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HOBBIUS
Heauton-timorumenos.

OR

A CONSIDERATION

OF

Mr *HOBBES* his

DIALOGVES

In An

EPISTOLARY DISCOURSE

Addreſſed,

To the Honourable

ROBERT BOYLE, Eſq.

By *JOHN WALLIS*. D. L.
Profeſſor of Geometry in *Oxford*.

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HOBBIUS
Heauton-timorumenos.
OR
A Consideration of Mr *HOBBES* his Dialogues.

In an Epistolary Discourse, Addressed

To the Honourable

ROBERT BOYLE, *Esq*;

SIR,

I Was told a while since, that Mr. *Hobs had written a Book against You, for being acquainted with D. W. and me.* And, upon view of it, I find that he hath done me the favour, to joyn me therein with so Honourable a person, by writing against us both. But, as (I presume) you doe not fear to Suffer much by that *Opposition*; so neither do I think

y self *Oblig'd* for this *Favour*: For, though the Hurt be
lesse, the Favour is more, than was intended.

The Piece you cannot suspect to be Spurious; bearing
such perfect lineaments of his Pen who is the reputed Fa-
ther; and so great conformity to those others of the same
brood.

———Facies non una sororum, Nec diversa tamen.———

The greatest difference is, that, He is much improved;
(& *factus indies* Ὀξύτερ©) I mean, He doth *proficere in pe-
jus*, and *expose* himself every day more than other; and more
indeed than I could reasonably have expected he would
have done. In so much that I cannot but professe some *Re-
lenting Thoughts*, (though I have formerly had occasion to
use him somewhat *coursely*,) to see an old man thus *fret and
torment himself*, as now he doth in his old Age, to no pur-
pose. And if you will give me leave to Apologize for your
Antagonist, I think there is much to be said why You should
also *pitty* him. (Not as if he did Deserve it, but because he
Needs it.) And, (as *Chremes* in *Terence*, of his ἑαυτὸν τι-
μωρούμεν© *Senex*, his *Self-tormenting* Menedemus.)

*———Cum videam miserum hunc tam excruciarier,
Miseret me ejus. Quod potero adjutabo senex.*

Indeed, if any *Danger* were like to ensue (upon this piece
of *Charity* so placed) to the prejudice of any part of real
Learning: I would not be so cruel to *Others*, as to perswade
You, with their Injury, to spare Him. But since that evil
is sufficiently provided for (by discoveries already made in
that kind,) that the world is not, for the future, likely to be
imposed upon by his Paralogisms, and ψευδογεάφημαία, (the
name of *Hobbes* not bearing now any great authority with
intelligent persons) it will be no dishonour for You, to *Con-
temn* an Enemy that cannot Hurt; or, to *give Quarter*,
though he scorn to Ask it.

And, being secure of this danger: You are in the next
place to consider the *Temper of the Man*, (which is one of
the first considerations that I am to propose to You, to

move pitty ;) A person extreamly *Passionate and Peevish*, and wholly *Impatient of Contradiction*. A Temper, which whether it be a greater *Fault*, or *Torment*, (to one who must so often meet with what he is so ill able to bear,) is hard to say.

And to this *Fretful* Humour, (Torment enough alone) You must adde Another, as bad, which feeds it. You are therefore next to consider him, as one highly *Opinionative and Magisterial*. *Fansiful* in his conceptions, and deeply *Enamoured with those Phantasmes*, without a Rival. He would be thought, of All that *are*, or ever *have been*, the onely *knowing* Man. And he doth not spare to professe, upon all occasions, How *incomparably* he thinks Himself to have *surpassed All*, Ancient, Modern, Schools, Academies, Persons, Societies, Philosophers, Divines, Heathens, Christians; How *Despicable* he thinks all Their writings, in comparison of His; and, What Hopes he hath, That, *by the soveraign command of some Absolute Prince, all other Doctrines being exploded, his new Dictates should be peremptorily imposed, to be alone taught in all Schools, and Pulpits, and universally submitted to.* Somewhat to this purpose you may see collected out of him, by my learned Colleague Dr. *Ward*, (in the first Chapter of his *Exercitation* on Mr. *Hobbes* his Philosophy,) as a *Specimen* onely of what you cannot misse to meet with, in Mr. *Hobb's*, at every turn : For, to recount All which he speaks, of Himself, *Magnificently* ; and, *Contemptuously*, of all Others ; would fill a Volume.

'Twas a motion made by one (whom I will not name) That some idle person should read over all his Books; and, collecting together his *Arrogant*, and *Supercilious* speeches, Applauding himself, and Despising all other men ; set them forth in one *Synopsis* ; with this Title, *Hobbius de Se.* What a pretty piece of Pageantry this would make, I shall leave to your own thoughts : Yet am not forward to second the motion, lest the person put to this penance, should be neither *Idle*, nor *well imployed*.

Now, where so much of *Gun-powder*, and *Tinder*, is laid in; do but consider, how much he lies at the mercy of every man; who, by one *Spark* of *Fire*, produced by the least *Collision*, may Blow him up. And think but, in what a Flame he must needs be, when he meets with others, of so much a different *Opinion*, from what he hath conceived of himself.

For though the admirable *Sweetnesse* of your own Nature, and *Obliging* Deportment, have not given Your Honour the *Experience* of such a Temper: yet Your *Contemplation* must have needs discern'd it, in those Symptomes which you have seen it work in others; (like the strange *Effervescence*, *Ebullition*, *Fumes*, and *Fetors*, which you have sometime given your self the content to observe, in some active *Acrimonious* Chymical *Spirits*, upon the injection of some contrariant *Salts*;) strangely Vexing, Fretting, and *Tormenting* it self; while it doth but administer *Sport* to the unconcerned *Spectatour*. Which Temper, being so eminent in the Person we have to deal with; Your generous Nature, which cannot but pity *Affliction*, (how much soever deserved,) must needs have some *Compassion* for him: Who besides those exquisite *Torments* wherewith he doth Afflict himself, (like that

> ———— quo *Siculi non invenere Tyranni*
> *Tormentum majus*,) ————

is unavoidably exposed to those two great *mischiefs*; an *Incapacity*, to be *Taught*, *what he doth not know*; or, to be *Advised*, *when he thinks amisse*: And moreover, to this *Inconvenience*, That he must *never hear his Faults*, *but from his Adversaries*; For those who are willing to be reputed *Friends*, must either, not Advertise what they see amisse, or, Incommode themselves.

But you will ask, What need he thus Torment himself? What need of pitty? *If he have hopes* to be admitted the sole *Dictator in Philosophy*; Civil, and Natural; in

Schools, and Pulpits ; and to be ovned as the only *Magi-ster Sententiarum* ; What would he have more !

True. *If he have.* But, What *if he have not ?* That he *had* some hopes of such an honour, he hath not been spa-ring to let us know : and was providing against the *Envy* that might attend it ; (*Nec Deprecabor Invidiam* ; *sed, Augendo, Ulciscar,* was his Resolution.) But I doubt those Hopes are at an end. He did not find (as he expected) that the *Fairies and Hobgoblins* (for such he reputes all that wrote before him) did *vanish* presently, without more ado, upon the first appearance of his *Sun-shine.* Whom though he thought, (*non Pugnando, sed*) *inferendo Diem,* to chase away ; yet he finds that (notwithstanding his new *Light,*) *certant viventes.* And (which is worse) while he was on the one side, *Guarding* himself against *Envy,* he is on the other side, unhappily *Surprised,* by a worse Enemy, called *Contempt,* and with which he is lesse able to grapple. On which account we find him now (with a *Frustra dum vivo,*) *Adjourning* his Hopes (of being *Dictator*) at left till he be *Dead.* (But what *Posterity* may do, who can tell ? For, though he be *Despised,* while he is *Alive* ; yet who knows but that, when he is *Dead,* he may be----forgotten.)

His great *Leviathan* (wherein he placed his main strength) is now somewhat out of season : Which, upon deserting his *Royal Master* in distresse, (for he *pretends* to have been the *Kings Tutor,* though yet, from those who have most reason to know it, I can find but little ground for such a pretense,) was written in Defense of *Olivers Title* (or whoever by whatsoever means can get to be upmost ;) pla-cing the whole *Right* of Government, meerly in *Strength*; and Absolving all his Majesties Subjects from their *Alle-giance,* when ever he is not in a present capacity to *forse Obedience.*

But (besides the *mis-adventure* of that piece) I do n find that, even while it might be thought in season, it

met with such Acceptation as he expected : Unlesse with such, as thought it *a piece of Wit* to pretend to *Atheism* ; Who would be content the rather to favour it, not for that any strength was produced to *Prove*, but because they should be now able to say, that some body durst *Affirm*, what they would be thought to *Wish*. For, one while they find him affirming , That, beside the Creation of the World, there is no *Argument* to prove a Deity : Another while, That it cannot be evinced by any ~~rgument~~, that the World had a beginning ; and, That, whether it had or no, is to be decided not by Argument, but by the Magistrates Authority : And, *Jeering* upon every turn at *Immaterial Substances* : But, no where proving either the *Impossibility*, or the *Non-existence* of them.

Another Disaster there is befallen him, which doth not a little trouble him. His *New-Divinity* was to be flanker'd by his *Philosophy* : and, if any *Divines* durst to quarrel at it, they were to be shook off with this Answer, *They understood it not, for want of Philosophy* : (For he would not have it thought, that a *Divine* can be a *Philosopher*, any more than that a *Substance* can be *Incorporeal*.) His *Philosophy* is to be Releeved by his *Mathematicks* : and therefore, if any who pretend to *Philosophy* (which some *Physitians* may be permitted to do) shall think his Proofs to come short ; his Answer's ready, *'Tis want of Geometry* that makes them think so ; and that he doth professedly *non omnibus omnia, sed aliqua Geometris solis scribere. Corp. Epist.* And lest they should think it possible to understand something without Geometry; he tells them plainly, That, *whoever doth Study, Write, or Talk of Natural Philosophy, without first beginning at Geometry, they do but loose their Labour, and Abuse those who Read or Hear them. Corp. c. 6. §. 6.*

But now 'tis so unhappily fallen out, that *Geometry*, which he thought his greatest Sanctuary, hath most failed him. Nor is there any Tribe of men whatever, who are lesse satisfied in what he writes, than those who understand

Geometry. Of whom, I suppose, you have not yet heard
of any one man, who is become his *Proselyte*, or will un
dertake to be his *Voucher in Geometry*. And doubtlesse
what ever else he is not, he is left of all found to be
Geometrician.

Now, Sir, 'Twould *grieve* a man, (if it were no more)
when he hath *built* such fine *Castles* (in the Air) to see the
Foundation sink; And his *Reputation*, which was to be
mounted on the top of those *Pinnacles*, tumble with them
His *Geometry* was to have given Credit to all the rest; and
is it not able to Support it self? A man *impatient of Contra
diction*, is not (it's like) very well *pleased* with a *Disap
pointment*.

But this is not all. To have fallen *silently*, and *in the dark*
undiscerned; and failed of *Reputation*, but without *R
proach*; had been but a bare *Disappointment*, and *losse*
labour; 'twere but *lucrum cessans*, not *damnum emergens*
(And, you know, many a man there is who lives well and
comfortably, with good Respect and Reputation, who
hath not yet the Fame of being a *Mathematician*; And
others, without pretending to *dance on the Ropes*, ma
walk on the Ground safely, without Reproach:) But, to fal
thus mounted, where all the World are invited to be *Specta
tors*; and, with so much *Ostentation*, become *Ridiculous*; i
an *Affliction* above the strength of such a Mortal to Bear
and may wel pretend a Right to share in that Compassion
lodged in your Noble Breast for persons in Distresse.

You'l ask perhaps, What made him, having so little,
think he had so much *Geometry*? If you will give me leav
to conjecture, I think 'tis this. He had, it's like, in h
younger daies gotten some small smattering in the Math
maticks: And, because he doth not remember, of all h
Acquaintance, any who did then know more than he, th
are now alive; (and it is not to be imagined, That an
who did *set out later*, should *over-run* him;) he thoug
he might safely conclude, Himself to b   st Math

matician alive. And then, what should hinder him from vaunting himself so to be?

And whereas you may suppose, That the reading of other mens Writings might disabuse him: 'Tis much otherwise. For, having once entertained that former notion, Of his own surpassing all others; He doth now professedly *study Nature, not Books*, (since that he knows already more than they can Teach; and what himself is not able to find in the Search of Nature, 'tis in vain to hope for in the Writings of men:) Or (as a great Person was pleased to phrase it) *He Thinks too much, and Converses too little*, either with Books, or Men.

And hence it comes to passe, That, Much of what he takes to be *New Discoveries*, (and thinks the World beholden for to him) are known by others to be but *Errours* long since laid aside, or *Triviall Truths*: And oft-mistakes, for *New* and *more Compendious Waies*, those *Bogs* and *Precipices*, which the Experience of wiser persons had taught them to decline. Yet (for want of *Converse*, or Indisposednesse to *Improve* it,) he can as hardly be induced to think other than That he is a *Great Mathematician*; as *Heraleon* (in *Argenis*) to believe that he was not *Poliarchus*.

I forbear to mention (lest I might seem to Reproach that Age which I Reverence) the *Disadvantages* which he may sustain by his Old Age. Which though Younger persons in good manners should sometimes Dissemble, and seem not to take notice of; yet in a serious Argument, if we will *Compute* aright, they ought to be considered; And 'tis Injustice not to make allowance for them. 'Tis possible that Time and Age, in a person somewhat *Morose*, may have Riveted faster that preconceived opinion of his own Worth and Excellency beyond others. 'Tis possible also, that he may have *Forgotten* much of what once he knew. He may perhaps be sometimes more *Secure*, than *Safe*, while trusting to what he thinks a firm Foundation, his Footing

failes him : Nor alwaies so Vigilant or Quick-sighted, as
to discern the *Incoherence* or *Inconsequence* of his own Dis-
courses ; unwilling notwithstanding to make use of the
Eyes of other men, lest he should seem thereby to dispa-
rage his own. But certainly (though his *Will* may be as
good as ever) his *Parts* are lesse Vegete and Nimble (as to
Invention at least) then in his Younger daies.

The *Old-mans* Motto , is ἡμεῖς ἡμῖν, not ἵσμεν :
Importing their Best daies to be then Past. And therefore,
as to those profound Speculations, of *Squaring Circles,
Doubling of Cubes* , &c. He should, in Prudence, have
thought fit, (or, been Advised by his Friends,) either
to *Attempt sooner*, or, at this Age, to *Let alone*, such In-
quiries ;

——————— *& quæ non Viribus istis*
Munera conveniunt. ———

What he may have been in his Younger years, we know
not : But certainly, at this Age, (though he may be wil-
ling to *Bite, or Nibble,*) his Teeth are too Old to *Crack
Nuts.* And is it not *Pity*, that, by *weak Attempts*, at these
years, he should forfeit that *little Reputation* which before
he had ? and which, perhaps, if he had forborn to *Write*, he
might have yet retained? (For there are, who, *while they
hold their peace*, are accounted *Wise.*)

While he had endeavoured only to *raise an Expectation,*
or put the World in Hopes of what great things he had
in hand, (*to render all Philosophy as Clear, and Certain, as*
Euclide's *Elements* ;) If he had then *Died* ; it might per-
haps have been thought by some, That the World had
been deprived of a *great Philosopher* ; and Learning su-
stained an unvaluable Losse by the Abortion of *so desired a
Piece* : But, since that *Partus Montis* is come to light ; and
found to be no more than what little Animals have brought
forth, and that, *Deformed* inough and *Unamiable* : I do not
find, but that he might have taken a time sooner to go off
the Stage, with more **Advantage**, than now he   e to

do. And tis (you know) no small Mis-fortune, for a man to *Out-live his Reputation.*

And by this time, perhaps, you may see cause to *Pitty him*, while you see him *falling*. But, if you consider him *tumbling headlong*, from so great a height; 'twill make some Addition to that *Compassion*, which doth already begin to work. You are therefore next to consider, that when, upon the account of *Geometry*, he was (unsafely) mounted to that Height (of Vanity;) he did, unhappily, fall into the hands of two *Mathematicians*: who have used him so unmercifully, as would have put a person of greater *Patience*, into *Passion*: And, meeting with such a Temper, have so discomposed him, that he hath ever since *talk'd idly.* And, to augment the grief, these *Mathematicians* were both *Divines* ; A sort of men whom he doth left of all Admire, and had rather have fallen by any other hand. These *Mathematical Divines* (a term which he had thought Incompossible) begin to Unravel at the wrong End ; and, while he thought they should have first *until'd the Roof*, and by degrees gone down-ward ; they strike at the *Foundation*, and make the Building tumble all at once ; and that in such Confusion, that, by Dashing one Part against another, they make Each help to destroy the Whole. They first fall upon his *last Reserve* ; and Rout his *Mathematicks* : (beyond a possibility of *Rallying.*) And, by *Firing his Magazine* upon the first Assault, make his own Weapons *Fight against him.* Not contented herewith, they Enter the *Breach*, and pursue the *Rout* through his Logicks, Physicks, Metaphysicks, Theology : where they find all in such Confusion, that no part answers other. They find as little sound in his *Philosophy* ; (Natural, or Civil;) as in his *Mathematicks* : and, in his *Religion*, left of all. And, because he talks so much of Accurate *Method*, Legitimate *Demonstrations*, and other the like fine words, (which what they signifie with Geometricians, is understood ;) they expect, that, for such *New and Daring*

Assertions, at left, as those against the *Existence,* or *Possibility,* of *Incorporeal Substances,* (whether God, Angels, or the Souls of men ;) against all *Obligation of Laws,* (Humane, or Divine,) further then Strength doth Enforce Obedience; against the *Authority of the Holy Scriptures,* or Word of God, further than the Magistrate gives them that Authority ; That it is lawful to *Say,* or *Swear,* or *Do, Any thing that is commanded,* (Right or Wrong, Just or Unjust,) there being no other Rule of *Just,* or *Honest,* but the Magistrates command ; But withall, that he is *no longer a Magistrate,* or hath *Right to Command ,* than he hath *Strength to Compell* ; and consequently, that 'tis *Lawfull,* to *Rebell* or *Disobey,* when ever we be *Able* ; (with others of a like import;) He should have produced some Cogent Argument, or at left some very Plausible Reason : whereas, upon Inquiry, there is no such thing to be found ; As if *Saying,* or *Jeering,* were proof enough for such petty things. And (supposing him to be of the number of those, who *ought to have a good Memory,*) as if it had been incumbent on Him, at these Years, to *Remember* at one time what he writes at Another, or, when he turns over a new leaf to remember what had been delivered in the precedent Page ; they do, by Confronting places Inconsistent, make him *strike out his own Teeth.*

And, by this time, His *Bold Assertions,* without attempt of *Proof,* are found unable to stand alone : His *Slender Arguments,* where he attempts any ; the woful *Inconsequence* of those things he calls *Demonstrations* ; the *Inconsistence,* and *Contradiction,* of his whole Discourse ; have made his whole Fabrick to fall with them ;

     ------Longíq; perit labor irritus ævi.

I need not tell you, with what Passion he must needs receive this Affront. You may well believe that he could not without Regret see his Labour lost, his Hopes dash't, and all his Expectation of future Re... ... ome to nothing.

'Tis true, that after this, he did, a first and a second time,(imprudently,) attempt to *Re-assert* his lapst *Geometry*: But with such Successe, as Birds taken with Lime-twigs,the more they Flutter,the more they are entangled. And he would not have done it, had he not been as unable to Understand, as to Make, a Demonstration. For *who is so stupid,* (they are his own words,) *as both to Mistake in Geometry,and also to Persist in it, when another detects his Errour to him?*

And with as little successe hath he since endeavoured, when he did at length Dispair of making good his *Own,* to be Revenged on *my Geometry:* And (for my sake)on all that durst to speak well of me. (For your Honour is not the first on whom he hath bestowed Complements upon this account.) Notwithstanding which, I am not so *unmerciful,* but that I can both pity him my self, and likewise be-speak You to the same purpose (in his own words, *Less.* p. 26. 35. 49.) That, *When you consider the opinion that men will have of him and his Geometry; When you think, how Dejected he is, and will be for the future; and, how the Grief of so much time irrecoverably lost, and the Consideration of how much his friends will be Ashamed of him, will accompany him for the rest of his life; You would have more Compassion for him, than he hath deserved.* For, *A man of a tender forehead, after so much Insolence, and so much Contumelious language, grounded upon Arrogance and Ignorance, would hardly indure to Out-live it.* And *they that have Applauded his Geometry,* (I mean, if any such be; for I have not yet heard of any;) *have reason by this time to doubt of all; and, if they can, to Dissemble the Opinion they had be-fore.* And lest you should think me lesse serious, while I move for *Pity;* I do seriously professe,that I am in earnest: For, in earnest, I pitty him; and, I think also, that you have reason so to do. Especially if you consider, that (according to the Temper before described) he looks upon his *own Worth,* and on *these Affronts,* through the same

Glasse; which *Magnifies* both beyond their just dimensions.

Nor doth it at all abate this ground of Pity, that what Opinion he had of his own Worth was but a Mistake: For, as on the one hand, even that Mistake deserves Pity; so, on the other hand, the Affliction is as great as if what he conceives were True. For, as to those things which do Afflict by working on the Fansy, What is *Beleeved*, hath the same effect as if it were *so indeed*:

> ————*pariter q̃ pungunt*
> *Credita Veris.*

'Tis, *To Deprive him* (he saies) *of the Honour he hath Merited; To Deprive him of the Friendship of all the World; and, No little Wickednesse.* It cannot then be but that *Heauton-timorumenos* upon these Considerations, must needs *Afflict himself* deeply, and need your *Pity*.

But (you'l ask perhaps) should a person, because himself is not well at ease, be therefore suffered to Rave, or Reproach all that come in his way, without Controll?

'Tis somewhat, I confesse, that is Objected. But, though I do not think a Licence of this nature Universally fit to be allowed: Yet I think there is somewhat to be said in the present case, why even this may in some measure be connived at in him. First, upon that general account, That *Loosers may have leave to speak*; For though he had not much perhaps (of Reputation) to Loose: Yet he hath lost much (so far as a man may be said to loose what he never had) of what he *Hoped* for. Next, for that it doth not appear, that his *Reproaches* are very Dangerous, because not *Infective*: (like as the Bitings of some Animals, though very Angry, are not Venomous.) For *our selves,* (on whom he hath bestowed, I think, as much of that kindnesse as he doth on most,) do not find that either our Friends do *Love* us much the lesse, for his *Revilings,* or Learned Men lesse *Esteem* us. And your self, (I am confident) will as little suffer on that account as We have done.

There is yet a further Consideration, ···· we are not always

alwaies to take a Rigorous Account of Mens Words. But I am loth to mention it, lest you should think I grow Severe my self, while I move You to Pitty. He tells *Us* sometimes of men *lesse awake*, of *unsteddy Braines*, whom *the Speculations of Motion have made Giddy*, and of some other things (*quæ dicere nolo*) which 'tis *Inhumane, not to pardon, because they are not Voluntary faults*. I shall make no other use of it, but to borrow a *Similitude*, which this puts me in mind of. 'Tis with some *Men*, as it is with some *Diseases* which affect the Brain. While the *Symptoms* do first appear, and the Distemper *begins* to work, (before the *Disease* is well discerned,) it may occasion severe Censures and sharp Rebukes, from injured By-standers, for those importune Impertinences or Provocations they meet with : But when the Distemper *works high*, and the Disease is manifest ; we think those Injuries better vindicated by a Neglect, than by a serious Defense, or Reprehension. In like manner, I think, it fares with Mr *Hobs* at this day : And, that there is not *Now*, the like need of a serious Reply, to what he Writes, as when he first *Began*. For, (as *operatio læsa* doth argue a Disease, so) those Symptomes *continuing*, and *increasing*, are certain Arguments of *some special cause of Intenebration* (as he speaks) which we are not further to struggle with. And upon this Account it was, that, when he published his first Six Dialogues the last year ; though fronted against my self ; I did not think my self obliged to make any Reply, because 'twas known sufficiently, by what Person, and how Affected, the Dialogues were so written ; Besides, that the Contents thereof were not worth a *Book*, much lesse *Two*. Of which notwithstanding, upon this Occasion, (because it may conduce somewhat towards the Enforcement of that Motion which I am now pressing)'twil possibly be not unseasonable to give you a (brief) Account.

And I am here first of all to take notice of a piece of

Prudence. He had in his former writings oft intimated what *Praises* he deserved, and how much he ought to be *commended* for what he wrote. But finding others not so forward, as he desired, in complying with this Intimation, and perceiving that it was resented as savouring somewhat of Vanity, too *grossely* to commend himself: He found out a middle course, by way of Dialogue, between A and B, (*Thomas* and *Hobs*;) Wherein *Thomas* commends *Hobs*, and *Hobs* commends *Thomas*, and both commend *Thomas Hobs* as a third Person; without being guilty of self-commendation. For this reason ; and, because, he hath found it difficult to discourse with *others* without being Contradicted, and (so) Provoked ; he might think it most convenient to *talk to himself*. Not but that he doth as oft *contradict himself* as any other, (even when he doth not sustain two persons,) but *these Contradictions* he can better bear ; and, being accustomed hereunto, he may perhaps in time endure to be contradicted by others also.

These Six Dialogues (that we may know the Contents of them) are Entituled, *An Examination and Emendation of* (Modern, or) *Hodiern Mathematick* : But with this *Exegesis*, (lest his *own*, being also *Modern*, might be thought to need Emendation,) *qualis explicatur in libris Johannis Wallisii.* Which yet you are not so strictly to understand, as if it were meant only of what is delivered by my self; but, to concern those others also that have been seduced by me, (such as *Euclide, Aristotle*, &c. which do very frequently, and severely, fall under the lash, in this *Emendation* of *Hodiern Wallisian Geometry*.)

His first Dialogue (and much of the rest) is mostly spent in Carping at Words, Ranting at Symbols, and Guirding sometime at *Aristotle*, sometime at *Euclide*, or what I am not at all peculiarly concerned in; that I believe you would think my time almost as ill spent as his, if I should employ it in giving you a particular account of all those

He is not pleased that I call that which doth directly
Influence all parts of Mathematicks, and is immediatly
subservient to them, by the name of *Mathesis Universalis;*
because he thinks it doth not contain All Mathematicks.
If I should tell him (as I may You) that *Totum Universale*
and *Totum Integrale* are not wont to be taken for the same;
Or that there is somewhat *Universally* common to All,
beside what is *Specifical* to each Part: He would tell me
(for that is one of his frequent Exceptions) that those are
Scholastick words, not *Latine.*

He thinks it of moment also to acquaint the World
(for 'tis better to do so, then not to be said to *write a Book*
against me) That I make use of *Quamvis* or *Quantumvis,*
where he thinks *Etsi* would do better; (*quantumvis non sim
prorsus nescius.*) That *suis* is put where he would have said
illius ; and *Instituat,* as he thinks, for *institueret.* That I say
What comes forth in publick (without the word *Book*) *useth
to be dedicated to some or other* (without saying. *Person* ;)
which is not Intelligible : For *whenever* Some *comes
without a Substantive, the word* Thing *must* ALWAIES
be understood. That for *prodeant* he would rather have said
prodeunt ; That *Proferre* he thinks to be a better word than
Efferre; And *Repetendis singulis* more *Elegant* than *Repetendo
Singula.* And *idem erit ac si,* is Barbarous. (with more of the
same Alloy.) Which though they be some of his more
choice (Mathematical) Emendations, I do not yet think so
much conducing to the *Mending,* or Marring, of *Modern
Mathematicks;* as that I need be solicitous about them: And,
though I am not either Converted or Instructed by what he
hath thus delivered, yet I do not think it fit to *make a Book*
against it, lest you should think I have as little to do
as he.

I shall only take occasion, to advertise You of some Ele-
gancies; which, though You are known to be a great Ma-
ster of Language, yet, I fear, you do not every where observe.
You must take heed of saying at any time hereafter , that

there be *some wiser* then Mr *Hobs* ; but rather (if You think so) that *some* Persons *be wiser* Persons *than* Mr *Hobs*. If You say, This needs not, because *every one knowes what Substantive is understood* ; You erre again, for You should have said *every one* Person *knowes what substantive* Word *is understood*. Otherwise (as Mr *Hobs* informs us) it will be thus supplyed, *some* Thing *is a Wiser* Thing *than* Mr *Hobs* ; and *Every one* Thing *knowes what substantive* Thing *is understood*. Again, in case at any time, in Arithmetick, you meet with this notion 0 + 0 = 0. 0 + 1 = 1. to be express'd in words; take heed of saying, *If to Nothing, you adde Nothing, the totall is Nothing ; but if to Nothing you Adde One, the totall is One*: For (*nihilo aliquid Apponere*) To *Adde* to *Nothing*, is not Elegantly said. Nor may You say, that a Man worth *Nothing*, may, by good *Addition to his Estate, come to be worth Something* : for the Estate of him that is worth nothing, is Nothing ; and an *Addition to Nothing* is very improper. Neither ought You to say, *However I am not Altogether of his opinion in all things, yet &c.* But *Although*. For *However Altogether* doe not well cohere. If you say that *However* is not to be construed with *Altogether*; but, *However*, with, *I am not* ; and, *Altogether*, with, *of his Opinion*: Or, that although *However* be originally an Adverb of Comparison, yet by use it is passed into a Conjunction Adversative (which are Barbarous words) and that it imports as much as this longer Periphrasis, *How true soever it be that I am not &c.* He tells You, No: But *However* is certainly to be construed with *Altogether*; and the sentence to be thus read, *However altogether I am not of his Opinion, yet &c,* which is not Elegant ; But if instead of *However*, you say *Although* ; it will thus run, very Elegantly, *Although altogether I am not of his opinion, &c.* Of which I do the rather advertise You; lest (in case that, notwithstanding my Motion, you shall yet think fit to say any thing to Mr *Hobs*) it might be thought in you as great an *Errour in*

Naturall Philosophy, as it is found in me an *Errour in Mathematicks*, to mistake in such an Elegancy.   We'l proceed.

I am then to be told ever and anon, That I am a *Presbyterian*: (Not because, he Knows 'tis *True*; but, because he thinks 'tis a *Reproach*.)   But I shall be so far from Reproaching him for his Religion, whatever it be, that I shall not so much as *Charge him to be of any*.

He hath a double Objection concerning the Reckoning by *Ones, Tens, Hundreds*, &c. The one against the *Antiquity*, the other against the *Vniversality*, of this manner of Numbring.

He doth not think, *p.* 2. That the most *Ancient Records* exstant, and of the most *Ancient times* (As that of *Gen.* 5. where the Ages of the first Patriarchs are recorded even *as high as Adam*) to be good evidence that Numbers were so reckoned in those *first Ages of the World*.   (For who knows but that the *Præ-Adamites* might reckon at another Rate.) And against the *Vniversality* of it he objects, *p.* 33, that the *Welch* doe say *un ar bumtheg*, (one and fifteen) instead of *sixteen*.

For the first; he hath a conceit, That the *Bookes of Moses might possibly not be written till the days of* Esra; Or that the Patriarchs Ages are not there reckoned, as in the Times wherein they lived. Of which fansies, when he doth produce more Authentick evidences, or more Ancient, than what we produce for the Antiquity of that Computation; 'twill be time to think of reinforcing our Argument: (As yet, there is no such occasion; nor any reason to think that *Moses* did otherwise *Record*, than they did *Reckon*.) And as for his *Welch Argument*, he knows (if he understand the language) that *un, deg, cant, mîl*; are words with them of the same import, as *one, ten, an hundred, a thousand*, are with us. And his *un ar bumtheg*, proves no more against Their, then *one dozain and four*, or *two stone*, against Our reception of that Computation. For though we have occasion to reckon sometimes by *scores*, or *dozains*,

it doth not follow, That therefore we do not admit the reckoning by *Tens, Hundreds,* and *Thousands.* Which both They and We are known to doe.

Another Objection in matter of History, is this.(*p.2,3.*) I had said *'Tis thought, that Mathematicks, after the Floud, did flourish, first, amongst the* Chaldeans ; *then, amongst the Ægyptians.* &c. Whereupon he doth (with some Majesty) call me to account, *How do I know that? Why is it so thought? What Historian ever said it? I Ought* (says *Thomas*) *to have Named my Author :* nor is it possible to reconcile it with *Diodorus Siculus.* But *Hobs* is a little more mild ; he thinks *tis credible* that I may *possibly* have seen it *in some Author.* And (upon condition he will excuse my fault in presuming that he might have known some Author of that opinion without my Information) I shall endevour to make Amends for that Fault, by letting him know that *Cicero* was of that opinion (*De Divinatione, lib.*1.) who tells us that *First of all, the Assyrians,* (*to begin first with the most Ancient*) *having the advantage of a Large and Plain Country, and a fair Prospect of Heaven every way, did Observe and Record the Motions of the Stars, and that hereupon Astrologers,* (*non ex artis, sed ex gentis vocabulo*) *were called* Chaldæans. And, awhile after, that the *Ægyptians also, by long experience, did learn the like.* And *Pliny* in his Natural History, (*lib.* 18. *cap.* 25.) was of the same opinion also ; recounting the four Periods of this knowledge, in this order, First the *Chaldæan,* next the *Ægyptian,* then the *Grecian,* and lastly the *Roman.* And *Vitruvius,* (*lib.*9. *cap.* 7.) refers the original of this knowledge, as *Peculiar* to them ; and by name to *Berosus* the *Chaldæan,* (the most ancient that he knew of ;) who upon this account (as *Pliny* tells us) had a *Statue erected,* at Athens, *with a Golden Tongue.* And *Berosus* himself (cited by *Josephus*) ascribes it to *Abraham,* (a *Chaldæan* also.) Consonant to all which, *Josephus* (a *Jewish* writer, and as much as any acquainted with the Antiquities of his own Nation)

Antiquit. lib. 1. *cap.* 3. tells us of *Seth*, and his Posterities great skill in these Arts; and of their *two Pillars,* (erected for the perpetuating of this knowledge) whereof one was yet extant in his daies: And of their care to transmit it to their Posterity. And the like of *Noah,* (*cap.* 4.) his *skill in Geometry and Astronomy,* and his care to transmit it to his Posterity. He tells us, (*cap.* 8.) that *Abraham* (descended from them in a direct line) was *Eminent in this knowledge*: And (*cap.* 9.) that, upon his going into *Ægypt,* he did (amongst other things) *teach the Ægyptians, Arithmetick and Astronomy, of which, till then, they where wholly Ignorant. Suidas* also (in the word Aβεαάμ) and *Philo Judæus,* cited by him, do both give Testimony to the same purpose. But I forbear, as needlesse, to cite their words. (So that 'twas well guessed, that 'tis *not incredible* that I might have found *some Author* of this Opinion.) To which we may adde out of *Diodorus Siculus* (his own Author) what is said (*lib.* 2.) of the *Chaldæans* skill herein *excelling all mortal men*; Of the Stately *Temple of Belus* erected by *Semiramis,* (about *Abrahams* time) for their *Astronomical Observations*; Of their care to transmit this knowledge from *father to son in the same line*; Of their Observations made and preserved for (a time to himself incredible) 473000 years before *Alexanders* time. Which incredible number of years, may be corrected by the *Chaldæans* Observations transmitted by *Calisthenes* to *Aristotle,* (upon the taking of *Babylon* by *Alexander*) for 1903 *years* backwards; (as *Simplicius,* out of *Porphyry,* informs us in his Commentary on *Aristotle* 2o *De Cælo.*) that is, from about 100 years after the floud, or lesse; about the time of *Pelegs Birth*: In whose daies *the Earth is said to be divided, Gen.* 10. 25. But, till then, the Family of *Noah,* (not being yet so numerous as to send out Colonies,) may very well be supposed to have taken up their habitations (not far asunder) in *Chaldæa,* (and the parts adjoyning) not far from the place where *the Ark*

rested, on the Mountains of *Ararat* : (And where afterwards we find *Abraham* placed; till, upon Gods command, he removed first into *Mesopotamia*, then to *Canaan*, and from thence made his journey to *Ægypt*, carrying with him, as *Josephus* tells us, the *knowledge of Mathematicks.*) But that *Ægypt*, a place so far off from *Armenia* where the Ark rested, should, before the birth of *Peleg*, be so well Peopled as to send out Colonies to inhabit *Chaldea*, (as Mr *Hobs* from what is said by *Diodorus Siculus*, would have us believe) is so incredible, and so unagreeing with *Holy Story*, with those aforecited, and with what *Diodorus* himself (*lib. 2.*) delivers, that it needs no other Refutation.

But the truth is, *Diodorus Siculus* (however Mr *Hobs* please to abuse his Reader) doth not himself Affirm, or Believe, what Mr *Hobs* would have Us believe from him. For see what he cites ? *Chaldæos (Dicunt) qui in Babilone sunt colonos Egyptiorum, propter Astrologiam celebrari, quam à sacerdotibus Ægyptiis didicerunt.* He doth not himself Affirm it; tis but *Dicunt* (the *Ægyptians* do so boast;) and, if you consult the place (*lib. 1.*) this *Dicunt*, is but *fabulantur,* (for so he had said but a little before;) and these *fables*, he tells us expressely, that *he doth not believe.* The summe of his Discourse is to this purpose. *The Ægyptians* (he tells us) do *fabulously affirm (though he doth not believe it to be true) that Ægypt, being fertile of Animals, did first breed Gods, and then Men, (as, now, Mice,) and consequently was the first peopled of all the World, and all the rest of the World Colonies from them ; That, about 23000 years before* Alexanders *time (or more) one* Hermes *found out Mathematicks there ; And that the* Chaldæans, *one of their Colonies, did from their Priests learn that Astrology for which they are so famed ; like as the Jews, another of their Colonies, did from them receive their Rite of Circumcision.* Now, upon supposition that these fables be true ; I grant that the *Chaldæan* Astronomy must be younger than the *Ægyptian* : But if not true, nor to be believed of

Now, (which *Diodorus* could not believe Then;) to what purpose doth Mr *Hobs* produce such a Testimony? And when he tells us, (*lib.* 1.) the *Ægyptians* pretend to have been Astronomers (before *Alexanders* time) for 23000 years: and the *Chaldæans* (*lib.*2.) for 473000 years: If the pretenses of each may passe for proof, which do you think must be the more Ancient? But, allowing both their pretenses to be (as they are) incredible; Yet if their *Hermes* were indeed *Moses*, or *Joseph*, and *Atlas* (ancienter then he) *Abraham*, or some others at left of a like antiquity; (and, that they could not be much ancienter, the History of the Flood doth plainly enforce:) We have found already, *Astronomy in Chaldæa* long before: And, to whether of the two, must we then give the precedence? But enough of this. I had said before, '*Twas Thought*; and I see no reason but that we may *think still*, that the *Chaldæan was the more* Ancient. But, what to think of Mr *Hobs*, I leave to you. I shall be briefer in the rest.

He hath a great displeasure at *Algebra* all along. He would not have it called *Analyticks*; (*Diophantus* should not have been so seduced by the *Hodiern Mathematicians*, as to give a *Greek* Name to a Thing so *Barbarous.*) He would not have it thought, p.3. that *any new Propositions have been found by it.* Or, that it is *a Method of Finding them out.* (If any shall think so, he can confute them in two words, *Falsum est.*) Yet tells us that, in *Pappus*, there be *many excellent Propositions found out* by Algebra. He doth believe, that the *Spots in the Sun*, the *Mountains in the Moon*, the *Attendants on Jupiter*, the *figure of Saturn*, &c. were not *found out by* Algebra, (very like;) but by an *Ignorant Dutch-man.* This *Thomas* Thinks; and *Hobs* tells him, It is certainly so.

He doth believe (pag. 5,6.) that *Vieta*, *Oughtred*, *Cartes*, &c. have not made any *Improvement* (in Mathematicks,) *none at all*; That *Symbols* are not *Shorter then Words*; That *Specious* Arithmetick was not *introduced by them*; but, was constantly practised by the *Ancients*; ('tis not therefore to

be condemned as Ho*diern* :) For *Words are Symbols* ; and, *the most ancient of all* : That *Algebra* is a matter of *Chance*, (not of *Art*;) the *Pest* of *Geometry*, &c. In all which, *Thomas* is of the same mind with *Hobs*, and doth approve what he hath said.

He doth not think *p.* 3, 4, 14. that *Geometry* is lesse litigious or more certain, than *Physicks*, *Ethicks*, and *Politicks*; but These are *Mathematicks*, as much as That; and may be as clearly *Demonstrated.* (He hath shewed us, How.)

He is of opinion, *pag.* 7. that *Arithmetick*, being derived from ἀϱιθμὸς, ought not to treat of any thing but *true Numbers*, (like as Geometry, being derived from γῆ, ought not to treat of any thing but Earth :) That *Numbers*, are all contained in a *series, beginning from One, and increasing by One, infinitely continued*, p. 8. And 1, 2, 3, 4. &c. are *numerorum cifra*, p. 31. Yet that *One is no number* (because not found in that series :) but $\frac{1}{4}$ *is* ; (because it is there to be seen, *numerus enim nullus est qui non est in progressionis hujus Arithmetica serie*, 1, 2, 3, &c. p. 97.) That there be *no numbers but Integers* ; and yet that *Fractions are Numbers properly so called*, p. 31. But *Surd Numbers* there are none, All are *Effable*, p. 7, 8, 97. That I take the *Original of Number*, to be from a *Composition of Unites*; But *it seems* (saies *Thomas*) nay 'tis *most certain* (saies *Hobs*) that *Euclide* contrarywise takes it to be from *Division of an Integer*; p. 7. 11. (For *Euclide* defines *Number* to be μονάδων πλῆθ℅, *a multitude of Unites.*) But, why so *Certain?* Because (he tels us p. 11.) *in the Diagrams of the first six Books of Euclide, Magnitudes are designed by Continued Lines, but, in the three next, Numbers by Prickt-Lines, that is Lines cut in pieces.* ('Tis well he made use of *Clavius* his Latine Edition; for had he consulted the Greek Edition of *Euclide*, this goodly Argument had been lost; for there *Numbers* are designed by *Continued* lines, as well as other Quantities.) But how should we have known (had not Mr *Hobs* told us) That ...... doth more represen

Line cut into Six pieces, than, *Six Points set in a Row?*

He is not pleased p. 28. &c. that I take *One,* to be a *Number.* (Had I said, it *were not;* it's like he would have said; *It is.*) But why not? Because *One* is not *Many.* (True. And *Two* is but a *Few.*) But *One,* may *tell, How many,* as well as *Two.* (And if by *Number,* we mean, What answers to *How Many:* as by *Quantity,* he saies, p. 10. is meant, What answers to *How Much: One* is as much *Number* as *Two.*) But *Euclide,* he saies, makes Number to be μονάδων πλῆθΘ, and πλῆθΘ signifies *plura;* (Sometimes it doth: but I think *Euclide* meant it of, *What tells, How many.*) But why doth he tell us of *Euclide?* For p. 30. he would not have us so Ignorant or Absurd, as to think that *it is the Mathematicians Work, to determine what they will call Number:* 'Tis the *Vulgar impose Names.* (It seems, he knows well the use of a Definition.) Why did he not tell us what his *Nurse,* (as p. 61.) not what *Euclide,* calls Number?

Nor doth he like (p. 7, 31, 66, 98, *et alibi*) that I deny *Fractions,* to be (in *Euclide's* sense) *True Numbers.* (It seems 1 is not a Number; but ½ is; because that is not, this is, μονάδων πλῆθΘ.) He thinks ½ is a *True Number,* yea an *Integer:* Because *Three Quarters* is as properly a Number as *Three Men;* (and why not also, what he denies, 3√2, that is √18: For *Three Roots,* is as much a Number also as *Three Men:*) True. *Three* is in each place an Integer Number; but *Quarters, Men, Roots,* are the *Numerated,* not the Numbers. Yes, he says; *Homines,* is a *Number.* (True: The *Plural.* And *Homo,* the *Singular.*) But is *Homines,* μονάδων πλῆθΘ? and *Homo* μονάς? Or doth he think (for I suppose he hath heard of that distinction) that *Euclide* was talking of *Numerus Numeratus,* and not of *Numerus Numerans?*

But when all's done; Mr *Hobs* is not so Ignorant (unless he be very much So) as not to know (what ever he list to say to the contrary) that *Euclide* under the Name of *Number,* doth (very oft) comprehend a *Unite;* but not a *Fracti-*

on. If he doubt it, let him consult *Lib.7. def.* 3, 16, 21, 22. *prop.* 18, 24, 35. *Lib.* 9. *prop.* 3, 16, 17, 18, 19. For in these places (and a multitude of others) if an *Unite* be not taken for a *Number*, and a *Fraction* for no *Number*; *Euclide*'s propositions will agree like some of Mr *Hobs*'s. Though it be as true, that, in some other places, *Unite* is contradistinguished to *Number*. For, the truth is, *Euclide*, in this, is not constant to himself; but under the word *Number* doth sometime include an *Unite*, sometimes he doth not. Like as other Mathematicians, some do, some do not, and sometimes they do, sometimes they do not. 'Twas therefore lawful, and convenient, for me, to define (saving the authority of Mr *Hobs*'s Nurse) in what sense I intended to use the word *Number*, so as to include an *Unite*.

I had taken notice, that of Quantities (the peculiar Subject of Mathematicks,) there were two Sorts; (*Continued*, and *Discrete*. The one saies How *Much*, the other How *Many*. That, to be *Measured*; This, to be *Numbred*. This, of *Arithmetical* consideration; That, of *Geometrical*; (and is exercised principally about *Lines*, *Superficies*, and *Solides*.) That *Time*, *Place*, *Motion*, *Weight*, &c. doth not fall under any Consideration Mathematical, other than those two; but did fall under this or that of them according as they were considered either capable of *Measure* (how Much,) or of *Number* (how Many.) That Geometry and Arithmetick (called *Pure Mathematicks*,) were *Sciences* properly so called, (according as the Word is used in the Schools,) That, of *Magnitude*; This, of *Number*; because there are *Subjectum*, *Principia*, & *Affectiones*, and these Affections *Demonstrated* of their Subjects. (Which, You know, are the Characters of *Science* as that word is used in the Schools: If Mr *Hobs* by *Science*, mean something else; we have nothing to do with it.) That other, whether *Arts* or *Sciences*, called *Mixt Mathematicks*, are so far *Mathematical*, as they doe contain somewhat either *Arithmetical* or *Geometrical*. What hath

He first saies that *I do not* (so pag. 10.) he then saies that *I do* (so pag. 11.) call *Speech, Discrete Quantity.* (One of them must needs be true ; either I do, or do not.) He finds fault (p. 10.) with *Geometers* (all at once) that *Never a one had yet defined Quantity.* With the *Barbarism of Schools,* even *those of the Ancients;* for calling *Quanta* what he would have called *Tanta.* (But why doth he not also, elegantly, say *Tantitas,* for their *Quantitas?*) With *Euclide,* for his *unskilfull* Definition of *One.* p. 27. 53. With *Aristotle,* for calling *Speech, Quantity,* and, *Discrete.* p. 11, 12, 13. What *Discrete* signifies, *Thomas* doth not know, till *Hobs* informs him that it signifies *broken* or *cut asunder;* but that *Cutting* or *Breaking* it, doth not *alter the Quantity.* And he *Wonders* that *Aristotle* should talk of Quantity *Discrete.* (It seems, with him, 'tis all one to say, that Two Mice are *as Much* as two Mountains ; and to say, They ate *as Many.*) He asks whether *Ration* (proportion) be a *Number,* or a *Line,* &c ? Whether *Continued,* or *Discrete* quantity ? (Neither. But, an *Affection* of either.) He believes that, *If Moral and Civil Doctrine had by the Ancients been Demonstrated* (as of late by Mr *Hobs*) *it would have been called* Mathematicks. He will not allow. p. 15. that we are taught in *Arithmetick,* that *twice two is four ;* or that it can be *Demonstrated.* Nor, that *Astronomy* teacheth us, the Inclination of the Zodiack and Æquator : Nor, that there can be any *Mixt Mathematicks;* (that a Tractate on any Subject, can handle, therein, somewhat that is Mathematical, and somewhat that is hot.)

When I give two Definitions of Geometry (one from the *Subject,* the other from the *End,*) he doth not like either. p. 18, 19. Nor the first (*Scientia Magnitudinis quatenus mensurabilis,*) for two Reasons, first, because *Magnitude* is not a *Proposition,* and therefore cannot be known : For *præter alicujus Dicti veritatem nihil Sciri dicitur* ; *itaque nisi Magnum sit Propositio, sciri non potest.* Next he takes *tenus Mensurabilis,* to be redundant : because *it is not*

possible, of a *Magnitude*, to consider any thing but this onely, *That it may be measured.* (You may think, perhaps, that I abuse him, in forming these Objections: But indeed I do not. The Objections are his own; and I have delivered them in their full strength.)

For, *it seems*, (when *Physiology* is defined *Scientia Corporis naturalis quatenus mobilis*,) that *Corpus naturale* is a Proposition: And when Geometry is by himself defined, *Scientia determinandi magnitudines*, and *Scientia per quam cognoscimus magnitudinum inter se rationes*; though *Magnitudo* be not a Proposition, yet *Determinatio magnitudinis*, and *Rationes Magnitudinis*, are Propositions, and may be *Known*. (But, now I remember my self, I should not have said, *It seems*; for in saying *videtur*, he saies, I do professe my *Ignorance*, that *I do not know whether it be so or no*.)

Nor doth the Other satisfy, where Geometry is defined *Scientia bene mensurandi.* For, (beside that *mensurandi*, is not a proposition) I should have said *Magnitudines determinandi* (as he doth p. 17.) which is not the same with *mensurandi*, (for then my definition had been good as well as his.) And yet (as we heard but now) *it is not possible, of Magnitude to consider any thing but this onely, That it may be measured*: Not so much as, Whether it have or have not a *Being*? or *Existence*? Whether it be *Ens*, or *Modus Entis*? Whether *Substance*, or *Accident*, or what else? Whether it have, or have not a *Subject*, and what that is? Whether it be *Really* distinct from Matter, and actually *separable* from it, as the Papists, or *be not*, as others hold? Whether it can, or cannot, be *Altered*, the Matter remaining the same, by Rarefaction or Condensation? (Of which he doth so often take upon him to tell me, though I do not remember that I have yet told him, What *my Opinion* is.) Whether Magnitude be peculiar to *Bodies*, or belong to *Spirits* also? With the like Inquiries. Which if they signifie any more than this, (Whether Magnitude may be measured?) they cannot *possibly* (by Mr *Hobs*) be *Considered*. Which is the Rea-

He is not pleased (p. 19, 20.) when I say , (and tell him, in what sense,) that *Punctum est Principium Magnitudinis.* He thinks I mean (at least he would have me,) that it is *Principium Geometriæ*; but, That such Principles should be *propositions.*(As if, in Naturall Philosophy, when *Materia, Forma, & Privatio,* are said to be *tria Principia*; the meaning were, that they are *three Propositions*; and that they are *Principia Physiologiæ*, not *Corporis Naturalis*: and the *Affections* there handled, *Motus, Calor, Color, &c.* are *affectiones Physiologiæ*, not *Corporis Naturalis.*)It seems, when 'tis said, that, in *Sciences*, there are *Subjectum, Principia, & Affectiones*, he thinks 'tis intended of *Principles and Affections* of the *Science*, not of the *Subject.* He may learn hereafter, that they who so speak, doe mean, *Subjectum, ejusq; Principia & Affectiones*, meaning that *Materia, Forma, & Privatio,* are *principia Corporis Naturalis* , not *Physiologiæ*; and that *Motus, Calor, &c.* are *affectiones Corporis*, not *Affectiones Physiologiæ* : And have been so understood hitherto, by All, but Mr. *Hobs.*

He is confirmed in his opinion (p. 21.) that *Punctum* is *Corpus* ; because it may be *Moved.* Now *Nothing can be moved but Body.*

He doth not allow that *Extension* , or *positio partium extra partes,* is the *formalis ratio magnitudinis,* or a *Principle* from whence the *Affections* proceed : Because these are *Scholastick Barbarous* words. As likewise that of *Primum quod sic,* and *Ultimum quod non.*

He allowes not (p. 22. 27) Mine, or *Aristotles*, Definitions of *Demonstration*; Nor, that some Demonstrations are *Ostensive*, (proving, directly, that *It is so*;) others *Deducing to an Absurdity*, (proving , the *contrary to be impossible* :) Or that some are τὸ ὅτι , (shewing *That* it is so;) others τὸ διότι, (shewing *Why* it is so.) But will have all to be *Ostensive,* and τὸ διότι : For, (*Nescimus* Quod res ita est, *nisi sciamus*, Propter quid *ita est*,) It is not possible to know *That* a thing is, unlesse we know *Why*, or *How it comes* to be so. (As if it were impossible to know, *That* Mr. *Hobs*
hath

hath made a Book, unlesse we know *Propter quid* : Or, That
there is such a thing as *London Bridge*, unlesse we know,
Who made it, and *How*.) And, That *All* good *Syllogismes*
are such ; For the *Assent* to the *Premises*, is the *Cause
Why*, we *Assent* to the Conclusion. (As if to say, the *Cause
of the Conclusion*, or of it's *Truth*, were the same as, the *cause
of our Assent* : And because our *Ocular Inspection* is the
Cause why we *Know* there is a Bridge, it were also the
Cause why *There is* such a Bridge at *London*.)

In summe, He would have *All Science* to be *Mathema-
ticks* ; All *Quantity*, *Magnitude*; All *Syllogismes* (or num-
ber of Syllogismes,) *Demonstrations* ; All *Demonstrations*,
to be τ͞υ διότι. Which whether it be to find fault with *Ma-
thematicks*, or *Modern*, or *Mine* ; or rather with *Logicks*,
and *Ancient*, and allowed by *All* (but Mr. *Hobs*;) I leave to
Your Judgement: and, whether it need a Refutation.

His second Dialogue (excepting the two first Pages;
where he tells us That he doth not like some Etymologies;
and, That I have skill in *Decyphering* ; for which, he saith,
Thuanus thought fit to commend *Vieta*;) is spent in *Cor-
recting* another peice of (Hodiern) *Mathematicks*, called
Euclide's Elements.   The Result of which amounts to this,
That *Thomas* and *Hobs* doe both agree, that *Thomas Hobs's*
Elements are more accurate then *Euclide's*. There is some
hopes therefore, that when Mr *Hobs* hath been *dead* as long
as *Euclide*, his Elements may be in as good request: though
in his *life time* (he tells us) he cannot hope to se it. But about
this I shall not trouble You here. What in it may concern
my self, it's like, we shall meet again. For he is not usually
so sparing of his Notions, as to let us hear them but once.

In his Third Dialogue, I find him somewhat at a
losse, for matter of discourse. He can hardly pick up
in *Twenty* Chapters or more of Mine, so much to carp at,
as will furnish discourse for One Dialogue. For besides
his generall Accusations, That 'tis little worth, (in his

Judgement ;) That something might have been left out, or was known before, or some what put in that is not ; (to which, I suppose, you do not expect I should make Answer :) Or, That, (where I undertake to give account of the *Ordinary* Waies of Operation,) this is *Ordinary*; or (where I tell what is Mr *Oughtreds* rule,) this is in *Oughtred*; (which are very *True*, but no *Faults* :) Tis little else he hath to say, and to as little purpose. Such as this.

He desires to know , p. 57, 58. Why I distinguish Numbers thus 2, 468, 013, 579, into *Periods* of *Three* places, (according to the Computation of the *Latines*, and of Modern Nations, who reckon by *Thousands* ;) and not thus 24, 6801, 3579. into Periods of *four* places, according to the *Greeks* Computation, who reckon by *Myriades*? (The Reason's plain ; Because I wrote in *Latine*, not in *Greek* : And 'tis *Hodiern Mathematicks*, not, for the daies of *Old*, that I was teaching.) And, *Why I write Decimal Fractions* thus 3579, 753. *like Mr Oughtred?* (for, I suppose he did not purposely falsify, when he left out the note of Separation to make his Reader believe I had written it 3579753.) And 'tis, because they be *Decimal Fractions*.

Then, *Thomas* cannot understand, till *Hobs* teach him, (p. 59.) That, *one quadruple quaternion, two single quaternions, and three Unites* ; or, *four times four, twice four, and three*, do make *twenty seven*. But he doth teach him moreover, p. 60. (what You and I cannot understand yet,) That 3 ad 27 *sunt in proportione* 3 ad 9 *duplicata*. But, *How is it possible that Analysis can be performed by Algebra ?* When *Thomas* saies, *He cannot imagine* ; *Hobs* Swears, *Nor he neither*. p. 65. (He doth not know that he who *Resolves an Æquation*, doth ᾽Αναλύειν.)

In the mean while, he would have it believed, p. 61. That I have somewhere said, That *All the Ancients were ignorant of Algebra*. But is much pleased, that I compare a *Point* in Geometry, with a *Ciphre* in Arithmetick (as

this hath *nihil Multitudinis* ; so that *nihil Magnitudinis*;)
For now he thinks 'tis Manifest, that *I say, A Point is no-
thing*. (For, since it is, with Mr *Hobs*, not conceivable for
any thing *to be*, which is not *Body* ; it must be as impossi-
ble, for a *Point to be*, if it be not *Great*. But, a Line or Body
may have a *Middle*, though that Middle have no *Bigness*.
Situm habet, Magnitudinem non habet. There may be *Ubi*,
where there is not *Quantum.*)

He doth not believe, that a *Geometer*, (to prove that *A
Line of Two foot, added to a Line of Two foot, makes a Line
of Four foot,*) doth, out of *Arithmetick*, make use of this,
Because Two and Two, make Four : For this, he saith *is no-
thing of Arithmetick* ; His *Nurse taught it him*. He be-
lieves (he tells it us here a second time, as a thing of great
moment, pag. 61. having told us once at least before p.15.)
that *An Arithmetician never Did, nor Ought to demonstrate,
That Two and Two, make Four;* For 'tis (he tels us p.15.) *not
Possible to be done.* (*Vide, quæso, hominis negligentiam, doceri
dicentis in Arithmetica, Bis Duo efficere Quatuor. Si doceatur
hoc in Arithmetica, etiam in Arithmetica demonstratur. Quis
hoc unquam demonstravit, aut demonstrare conatus est, aut ex
Principiis Arithmeticorum nunc positis demonstrare potest ?*)
We'l try. That 2 *is equal to* 1+1; and 4 equal to 1+1+1+1;
he allows to be *Definitions* (p.67.) Therefore say I, 2+2, is
equal to $\overline{1+1}$ + $\overline{1+1}$, (because *Æqualia æqualibus addita faci-
unt æqualia* ;) But, by his Definition 1+1+1+1, are equal to
4; therefore 2+2 are equal to 4; (because, *Quæ sunt eidem
æqualia, sunt & inter se æqualia.*) ὅσπερ ἔδει δεῖξαι. 'Tis
Possible therefore to *Demonstrate, That Two and Two, make
Four.* And, which is more, (though Mr *Hobs* cannot think
it possible) without the help of Geometry.

The use of *Species*, he tells us, (p. 62, 63.) is neither
Needful, nor is *Shorter* than Words at length, nor is it
Perspicuous : For when he meets with *Demonstrations so
written*, He hath not the *Patience* to Understand them. It
may be so.

Then, p. 65, 66. to enform *Thomas,* what is *Analysis,*
Hobs gives two Examples; one about *Angles;* the other
about *Numbers;* and then both conclude, That there is
indeed a going *forward and backward,* but what of it is
Analysis, they do not understand. Onely this they do both
understand, That *there are not Any, Arithmetical Pro-*
blems, which it is Possible (for Mr Hobs) *to find out, without*
making use of Geometry. There are Mistakes good store in the
process of those two Examples, but I do not think meet to
take particular notice of them; because it's possible divers
of them may be the Printers faults; and, because I would
not discourage any who may hope to learn from thence,
What is Analysis.

Only p. 66. lin. 1. I do not take it to be a good conse-
quence, that *Because* $AA + 16A = 128$, *therefore* $16 + AA$.
$\sqrt{128}$. A. *are in continual proportion.* (Any more than I
did before take it to be a truth, pag. 60, lin. 9, that *the pro-*
portion of 3 *to* 27 *is duplicate of* 3 *to* 9. Though it be the
foundation of what he calls there a *Demonstration.* Nor
pag. 67. lin. 4. that $2Q + 3R$ *is equivalent to* $\frac{1 R + \frac{1}{2}}{2R}$. (though
he would have it thought that I had said so as well as he;)
but rather $\frac{2Q + 3R}{2R}$ *aequivalent to* $R + \frac{1}{2}$. And p. 69. l. 15
To find a Number which, to the Number given 6, *shall bear*
proportion as 4 *to* 5; the Analogisme should not have been
thus ordered 4. 5 :: 6. 7½, (but thus rather 5. 4 :: 6. 4⅘.)
'Tis fond to think that 7½ (being greater than 6) can bear
to 6, the proportion of 4 to 5.

When I say, *To Multiply a number* (Integer or Fraction)
is to find another which shall be to it in a proportion given. He
asks, p. 69. *If the Number given be* 6, *and the proportion*
4 *to* 5; *by what must we multiplie the Number given?* I
answer; by $\frac{4}{5}$, (Not, as he doth, by $\frac{1}{2}$.)

He saies, *I suppose the Multiplier to be Given,* (Yes; the
Exponent of the Proportion.) *and, that it is the Multiple*
of

of an Unite. Not alwayes. 'Tis sometimes a Fraction: As in
the Case proposed.

He takes notice, *p.* 68. that, (amongst the operations of
Integers,) I do not teach to Adde, Subduct, Multiply, and
Divide *Surd Rootes.* (True. I did not think it there Proper.)
This defect Mr. *Hobs p.* 70. *&c.* will undertake to supply.
How good he is at this work, we may have occasion to con-
sider hereafter. But at present, wee'l take notice of a Rule
or two, to judge of his skill by.

Thomas desires, *pag.* 71. a solution of this Probleme.
Multiplica numerum Radicum per numerum Radicum. Ex-
empli causa. Sint 8 Rq. numeri 9, multiplicanda in 3 Rq.
numeri 4. Which when *Hobs* had resolved to his full sa-
tisfaction; *Thomas* proceeds *pag.* 72. to propose further.
Manifesta hæc sunt. Sed si plures radices quadraticæ, puta
6 Rad. numeri 4, ducendæ sunt in plures radices, puta in 4
Radices numeri 9. Quid faciendum ? And *Hobs* applyes
himself to give a Rule for the solving of this Problem also.
Now I should desire your Information, what is the Diffe-
rence between *Numerus radicum* in the former Problem,
and *Plures radices* in the latter. Or, (if these be the same)
what then is the Difference between these two Problems.
Mean while, wee'l consider another.

Divide a number of square Rootes, by a number of square
Rootes. As for example, 6 Rootes of the number 36, by
2 Rootes of the number 9.

The intended
processe is this, $\frac{6\sqrt{36}}{2\sqrt{9}} = \frac{\sqrt{1296}}{\sqrt{36}} = \sqrt{\left(\frac{1296}{36} = \right)36} := 6$

But he thus mistakes it.

The Rule is this. Let each Number of Rootes be multiplied
into that Root, and the Product be divided by the Product
(No; but, the *square* of the product by the *square* of the
Product:) *and the Root of the Quotient is the Quotient desired.*
Let's see the Application of this Rule. *Since therefore*
6 *Rootes of the number* 36, *is the Root of the number* 216.

C   (No

(Noe ; but , of the number 1296 ;) *and 2 Rootes of the number 9, is the Root of the number 36.* (True.) *Multiply 216, by 6, that is, by 2 Roots of the number 9, which makes 1296;* (True , it doth so make : But what direction is there in the Rule, for this Multiplication ? that the product of the Root multiplied into its number, should be multiplied into the other number of Rootes ? And, had the former multiplication been true, this would have spoiled the work : but that being false, this is brought in as a botch to make amends for it :) *Then dividing 1296 by 36,*

the Quotient is 36 ; whose Root is $6 = \dfrac{6\sqrt{36}}{2\sqrt{9}}.$

You see the Result is right ; (For this he knew before hand, that 6 must be the Number sought;)But how to come at this number 6 he knew not : For having first mistaken $\sqrt{216}$ (for $\sqrt{1296}$) as equall to $6\sqrt{36}$; if he should have gone on (as his Rule, corrected, doth require) to divide 216 by 36, the Quotient would be 6, (not 36 , as he expected,) and the Root of that Quotient (not 6, but) $\sqrt{6}$: which he saw was not right,(For $6\sqrt{36}$, that is 6 times 6; divided by $2\sqrt{9}$, that is 6 , must needs be equall to 6.) And therefore to help the matter; seeing that not 216, but 1296, must (by 36) be divided to make the quotient 36; and finding that by multiplying 216 by $2\sqrt{9}$, that is by 6., would make it 1296 ; he doth , without any scruple, take that, (though his rule say nothing of any such thing) that is, *Tinker-like* ('tis a Metaphor of his own ,) he makes two holes instead of stopping one.

But let's see his Demonstration (for that he undertakes also.) *It is thus Demonstrated. Suppose* AA = 36 ; *Therefore* $6\sqrt{AA} = 6A$. *Suppose also* 9 = BB ; *Therefore* $2\sqrt{BB} = 2B$. *And* $\dfrac{6A}{2B} = 6$. Whether he did intend by this to demonstrate his *Rule* ; or to Demonstrate his *Example* ; I will not inquire : Nor , How well he hath per-

formed either. I fhall only obferve, That he doth (where he thinks he can) endeavour to *Demonftrate by Symbolls.* (And therefore, That the Reafon why Mr. *Hobs* doth not *love Symbolls* ; is becaufe the *Fox did not love Grapes.*) But I doe not wonder (unleffe he knew how to ufe them better) that he thinks *Demonftrations by Symbolls*, not to be *Perfpicuous.*

Wee'l try one Rule more. *Thomas* asketh him, p. 73. *How is a Square Root of a non-quadrate number fubtracted from another fquare Root of a non-quadrat number?* And *Hobs* anfwers thus. *If thofe Roots be commenfurable* (but how we fhall know whether they be or no, he doth not tell us) *it is done,* faith he, *by this Rule. Divide each of the numbers by the greateft common meafure of both.* (Perhaps he thinks, that the two Numbers having a common meafure, is a fign fufficient that the Rootes are commenfurable; (for he doth not intimate any other:) But that is a great miftake: for √ 9, and √ 15 are not commenfurable, though 9, and 15, have a common meafure. But wee'l goe on.) *Then divide the Root of the greater number, in fuch proportion as the Root of the Quotient hath to the Root of the Quotient.* (But when it is thus divided, which of thefe parts, or whether any of them, be the Remainder fought, he doth not tell us. His Example perhaps may inform us better. Let's fee that.) *As for Example. Suppofe* √ 20 *to be fubducted from* √ 45. *Divide* 45 *and* 20 *by their greateft common meafure* 5: *the Quotients are* 9, *and* 4; *and their Roots* 3, *and* 2. (True.) *Divide therefore* √ 45 *according to the proportion of* 3 *to* 2, *and the leffer fegment will be* √ 20. (I doubt it. But what's next.) *and from Hence is Known, the Refidue to* √ 45. To whom is this Refidue known, by his Operation, more then it was at firft? To me I am fure it is not; nor, I fuppofe, to You: What fayes *Thomas*? doth He know it? No: For he thus objects, *But for as much as* √ 45 *is not a number,* it cannot be divided accurately according to the proportion of 3 to 2, (yes it may,) *I defire therefore,* faith he,

know, of what number, is that Residue a root? (He takes it for granted that an Apotome, muſt needes be at leſt the Root of a Number.) Well; But doth he ſatisfie this ſcruple of *Thomas*? Or tell him how he ſhall know what the Remainder is; or, of what Number it is a Root? Not a word. (Onely he tells him, that there is Another method, in *Oughtred*, which perhaps may inform him, what this Method of his cannot.)

This being all therefore that his Rule can doe, (for you have it *verbatim*,) let us ſee what that amounts to.

And, firſt, (ſuppoſing the whole to be true and accurate as it is delivered, yet) it amounts but to thus much, That if from $\sqrt{45}$ you would take $\sqrt{20}$, there is in $\sqrt{45}$ a part, equall to $\sqrt{20}$, which if you take away, the reſt is the Remainder: Or, *if from $\sqrt{45}$ you take $\sqrt{20}$, the Remainder is, $\sqrt{45}$ wanting $\sqrt{20}$.* (which he might as well have ſaid at firſt, without all this ceremony; and, which doth no more concern Rootes *Commenſurable*, to which he pretends to fit his Rule, than thoſe that are moſt of all *Incommenſurable*; for even of theſe it is as true, That, *if from One you take the Other, the Remainder is, All but what is taken away.*) But how that Apotome, $\sqrt{45}$ *wanting* $\sqrt{20}$, may be at once expreſſed, he doth not tell us; nor, of what one number it is a Root. That it is the root of ſome Number, he takes for granted; (And indeed in this caſe it is ſo, but it ſhould have been proved; For, of Apotomes properly ſo called, it is not true;) But he cannot tell, it ſeemes, of what number it is a Root.

Next, it was a Miſtake in *Thomas*'s Objection, (which *Hobs* ought to have Rectified,) that, *$\sqrt{45}$ cannot be accurately divided according to the Rate of 3 to 2.* For $\sqrt{45}$, being equall to $3\sqrt{5}$, if for the greater part be taken $\frac{9}{5}\sqrt{5}$ (or $\sqrt{\frac{81}{5}}$,) and for the leſſe part $\frac{6}{5}\sqrt{5}$ (or $\sqrt{\frac{36}{5}}$,) it is accurately divided at the rate of 3 to 2.

But, Thirdly, 'tis as great a miſtake of *Hobs* (yet *Thomas* ſwallows it) when he ſayes, that, *of $\sqrt{45}$ divided at the*

rate of 3 to 2, *the leſſer ſegment is* $\sqrt{20}$: whereas (beſide that $\sqrt{20}$ is more than half of $\sqrt{45}$, and ſo cannot be the leſſer ſegment,) the leſſer ſegment of $\sqrt{45}$, ſo divided, is $\sqrt{\frac{26}{4}}$, (as was ſaid before) not $\sqrt{20}$.

He ſhould rather have divided $\sqrt{45}$, that is $3\sqrt{5}$, at the rate of 2 to 1. And then $\sqrt{20}$, that is $2\sqrt{5}$, being the greater ſegment, the Remainder $1\sqrt{5}$, would be the leſſer.

I will not give You the trouble of examining more of his Rules. Onely, becauſe (as we ſaid) when his own Rule (which we laſt examined) did not ſucceed, he refers to another Method of Mr *Oughtred*, (who, from $\sqrt{147}$, *ſubducting* $\sqrt{12}$, finds the *remainder* to be $\sqrt{75}$; and to $\sqrt{147}$, adding $\sqrt{12}$, the *Summe* to be $\sqrt{243}$.) which Mr *Hobs* undertakes to demonſtrate for him, p. 74. I ſhall give you a little account of his demonſtration. (That you may ſee how much better he is at Demonſtrating a *good* Rule of *Oughtreds*, than a *bad* one of his own.) It begins thus. *Quod datum eſt ſumo, radices numerorum 147 & 12 eſſe commenſurabiles. Sunt ergo eædem radices numerorum quadratorū.*&c. Where I deſire You to conſider, firſt, Whether this be a good conſequence; *becauſe* $\sqrt{147}$ *and* $\sqrt{12}$ *are commenſurable, they are therefore the Roots of Quadrate numbers*; (as if no Quadratick Roots of non-quadratick Numbers could be commenſurable:) and then, Whether the thing inferred be true, that $\sqrt{147}$ & $\sqrt{12}$ *be the Roots of Quadrate Numbers*, that is, whether 147 and 12 (whoſe Roots they are) *be Square Numbers.* And then (if You think that a Demonſtration, which begins thus, be worth further examining) You may conſider another Conſequence, a little after, in theſe words, *Ut* 147 $+$ 12 *ad* 49 $+$ 4, *ita eſt* 243 *ad* 81. *Et proinde, ut Rq* 147 $+$ *Rq* 12 *ad Rq* 49 $+$ *Rq* 4, *ita eſt Rq* 243 *ad Rq* 81. (*Becauſe* the ſumme of the numbers 147 $+$ 12, to the ſumme of the numbers 49 $+$ 4, is as the number 243 to 81. *Therefore* as the ſumme of the Roots $\sqrt{147}$ $+$ $\sqrt{12}$, to the ſumme of the

the Roots $\sqrt{9}+\sqrt{4}$, so is the Root $\sqrt{243}$ to the Root $\sqrt{81}$.) For if that be a good consequence, Why might he not as well inferre, *Because* 149+10 *is to* 49+4, *as* 243 *to* 81, (for this is true) *Therefore also* $\sqrt{149}+\sqrt{10}$, *to* $\sqrt{49}+\sqrt{4}$, *is as* $\sqrt{243}$ *to* $\sqrt{81}$? And consequently, *Because* 147+12 = 149+10, *Therefore* $\sqrt{147}+\sqrt{12}=\sqrt{149}+\sqrt{10}$? (*Because the summes of the numbers be equal*, Therefore *the summes of the Roots are also equal*?) And is not Mr. *Oughtred*, think You, much obliged for this Demonstration? But I shall not trouble You further either with this Demonstration, or any more of Mr *Hobs*'s Rules about *Surd Roots*, A Tast is enough.

He thinks, p. 75. That *Geometria*, and *Geodæsia*, are words of the same signification; (and would not have them distinguished:) For *Etymology* is a great Argument with him, in Mathematicks.

He takes notice *pag.* 76. That I had said, *Quantities compared ought to be Homogeneous*. And he allows it. But he doth not allow me to say, that *To compare Heterogeneous quantities, would be the same as to ask, How much of Time would be equal to a Line?* Because he thinks himself concerned: (as being wont to compare Time and Line:) And therefore takes some pains to perswade *Thomas*, that, If *Time* and *Line* be not *Homogeneous Quantities*, yet at least their *Quantities are Homogeneous*. And therefore he thinks fit to give notice, (and he doth it ever and anon) How Absurdly the (Hodiern) Mathematicians, do (for want of *Concrete Substantives*)make use of (the Abstracts) *Quantity*, and *Magnitude*, (as *Euclide* doth μέγεθ⊕,) for *Concretes*. (He would have us say, *Quants* and *Greats*.)

And though You and I perhaps may think it is but a λογομαχία; and that it is not worth while to *contend for words when the meaning is understood*: You must take heed You say not so; For when any say thus, 'Tis, he tells us pag. 9, *a certain Argument , that they do not understand what they say*. And that 'tis a very great mistake, to think,

that

that *there is any Disputation other than* λογομαχία, *or, Any Truth other than the Truth of Words.* That it is *absolutely Necessary* to reprehend whatever is not *accuratissime dictum.* That 'tis all one, *non Accurate, & False dicere.* (Yet of *Euclide's* Definition, p. 42. he saies, 'tis *True, but not Accurate.*) And that, *De veritate rei, nisi Accuratissimis verbis constare non potest.* And *Thomas* doth often tell us, that *Hobs* speaks ἀκριβῶς.

Let us therefore learn (from this *most Accurate Speaker*) to *speak Accurate,* that is, (as he defines it, pag. 16.) *præfinite loqui,* that is *vocabulis uti prædefinitis;* but those Definitions, he tells us must be *accurate Definitions:* And to *define accurately* (that is, *præfinito Definire,* as we heard but now) *depends on the Understanding of Words;* (not, as others imagine, the Understanding of Words on the Definitions; and, that where Words are already sufficiently Understood, Definitions are needlesse; being intended by the Definer, onely to determine what he understands by those words :) And what by a Word is *Every where Understood,* is the *Accurate signification* of that Word, (For, That every Word, doth every where signifie, some one and the same thing, is not to be questioned.)

Now he doth not say, That *Time and Line are Homogeneous:* (for, *'tis absurd to say that a Line is equal to a Time,* pag. 77. though he have oft said it heretofore.) Nor that *they be Quantities,* (they are, he tells you, *Quanta,* but not, *Abstracte, Quantitas,* p. 76, 77.) But, *That their Quantities are Homogeneous.* And the like of *Line and Weight,* p. 80. That *Line and Weight are Heterogeneous, is true; But yet their Quantities may be Homogeneous.* What therefore is this *Quantity?*

To this purpose he had told us, in his *Philosophy of Bodies,* (cap. 12.) *There be three Dimensions, Line (or Length) Superficies, and Solide;* (but in *cap.* 8. to which he there refers, a *Solid* alone, one of the three, is said to have *three Dimensions;*) *That Every of these three,* if

deter-

determined, is *Quantity* : And therefore that *Quantity* cannot be otherwise defined than thus , *Dimension* determined.

But he doth not here speak Accurately ; for he had not, that I find, any where *predefined* what *Dimension* is. But you may perhaps guesse at his meaning, by a Definition he now gives us of a word in the same form, (*Dial. p. 21.*) where he tells us that *Extension, to speak Properly, is the Action of Stretching*, and that 'tis *Barbarous* for the Schools to use it in another sense ; (though *corp. cap. 8.* himself do so use it constantly.) And at that rate *Dimension*, must signifie the *Action of Measuring* : And *Quantity*, that is, *Determined Dimension*, must be, the *Determined Action of Measuring*. (But he is now to speak *Accurately*, not *Properly* ; and so it may here signifie somewhat else than that Action.)

Again, it was not Accurate, to define *Quantitie* by *Dimension*, and restrain Dimension to *those three*, (Line, Surface, and Solid ;) For (*Dial. p. 10.*) he affirms , *Tempus, Locum, Motum, Pondus, non minus proprie Quantitates dici, quam Linea, superficies, & Solidum* : (I would not change the construction, lest I should spoile his Latine : it is an *Elegance,* for *quam,* not to couple like cases :) And therefore at what rate these Three are called Quantities, those Four should be so called also.

Neither was it *Accurate*, to call the first of those three Dimensions, *Line, or Length*, (as if these words were Synonymous,) for he tells us now, pag. 77. *Accurate loquentes, Lineam dicemus esse Longam, potius quam Longitudinem.* (That, is a Concrete ; this, an Abstract : and therefore not *Line*, but *Length* onely, should there be called *Quantitie* ; for *Quantitie* is an Abstract.) And therefore, pag. 76. we are thus taught to speak Accurately : *Omnis Quantitas (si accurate loquendum est) aut Longitudo est, aut Superficies, aut Solidum :* (Instead of *Line,* he saith *Length*: for *Line* is a Concrete, and therefore not *Quantitie*:

but

but *Superficies*, and *Solide*, remain as before; for these, it seems, are Abstracts:) *Tempus autem, & Motus, & Vis, ceteraq̃, res de quibus quæri potest Quanta, sunt, Quantitates habent (quibus quantæ sunt determinantur,) aliquas vel aliquam ex illis tribus*, nimirum illas ipsas quibus mensurantur: And that you may not doubt, which of the three concerns *Time* in particular; He tells you, that, *Mensura Temporis est Linea* (for by this time *Line* is got in again, though but now thrust out to make room for *Length*.) Yet he had told us, p. 47. That, *What are Homogeneous, are measured* (eodem genere mensuræ) *by Homogeneous measures*; *But, what are Heterogeneous* (diverso genere mensuræ) *by Heterogeneous measures*: And therefore, since *Time* is confessedly Heterogeneous to *Line*, the measure of Time cannot be that of Line.

And, he had before this time thought fit to un-say, what was said, pag. 13. *Quantitas alia est Corporum, ut Longitudo Corporis; alia Temporis, ut Longitudo Temporis; alia Motûs, ut Velocitas & Pondus*: For now *Longitudo Temporis*, is not *alia*, but *eadem* with *Longitudo Corporis*. (The mistake was occasioned by the *Latines* distinguishing between *quam Longum*, and *quam Diu*: But when he considered, that, in English, they do both signifie *How Long*; he was delivered from that Error.)

And what he had said before (pag. 11.) that *Time, Place, &c.* are *Quantitates non minus propriè dictæ, quam Magnitudo*; is not now to take place: for though they be *Quantitates propriè dictæ*, yet they are not *Quantitates Accuratè loquendo*; For he saies (*si accuratè loquendum*) All quantity must be one of those three, *Length, Surface, or Solide*. Which doth also Accurately agree (or disagree) with what he had said pag. 10. *Non sunt ergo Longitudo, Superficies, & Solidum, Quantitates ipsæ, sed Quanta*; which *Thomas* there tells him, is also *Accuratè dictum*.

And by this time You understand what in *Accurate speech* is to be called Quantity. *Length, Surface, and Solide*.

(to speak *Accurately*,) either be, or be not, *Quantities*. Or rather They are, and they are not, *Quantities* in the *Abstract*, every one of them.

If all this satisfie not; He tells us further, (*Corp.cap.*12.) That, *All men, by Quantity, do understand, that which is fitly answered to that question, concerning any thing what ever, How Much is it?* As for Example, *How much*, or *How Great is such a Length? such a Journy? such a Field? such a Bulk?* Is not fitly answered by saying indefinitely, *A Length, A Surface, A solid*: But, *A Yard, A Mile, An Acre, A Bushel.* (And in like manner, *How much Time? How much Weight? An Hour, A pound.&c.*) And this he tells us (*Dial.* p. 10.) is the *Definition* of *Quantity: Quantitas est per quam, quærenti de qualibet re Quanta sit, apte respondetur.* I will not ask him, what is the Antecedent to *quam?* whether he mean *Quantitas est quantitas per quam*; or what other Antecedent is understood; (though he move a like question to *Euclide*, upon as little reason, p. 42.) Nor will I quarel at the word *Quanta* in the Definition of *Quantitas*; (though pag. 27. he saies 'twas *unskilfully* done of *Euclide* to make use of *Unum* in the Definition of *Unitas*; and comdemns the Definition for naught upon that account, because it is *cognata vox*; and, an *Abstract doth nothing at all confer to the understanding of its Concrete, nor the Concrete to the Understanding of its Abstract*: And yet, in truth, *Euclide*, had not so done, he onely made use of ἓν in the Definition, not of ἓνοτης, but of μὸνας.) Nor will I presse to know, whether that which thus Answers the Question, (A Mile, an Acre, &c.) be *Quantitas*, and not rather *Quantum*, or, as he would chuse to speak, *Tantum?* Whether an Abstract, or a Concrete? (for hitherto the great exception hath been, that *Concretes* have been called *Quantity*, when as *Quantity* is an *Abstract*.) But we'l take the Definition for better for worse, as we find it. And now you know the *Accurate signification* of the word *Quantity*; and what that *one thing* is which it doth *every where* signifie.

But

But what is meant by *Homogeneous* ? *Euclide* having in his *Definition* of λόγ⊙, *Ratio*, (*def. 3. lib. 5.*) told us it was (μεγεθῶν ὁμογενῶν) between *Homogeneous magnitudes*: That we may know what those are, he tells us (in a following *Definition*) that *Homogeneous Magnitudes*, or (which is all one) *magnitudes which have relation to one another*, are such as may *each of them be so multiplyed as to exceed the other.* (For *Euclides* intent was not, as *Meibomius* mistakes him, in his *Dialogue of Proportion*, pag. 85. To enform us by that *Definition*, What Homogeneous quantities have, and what have not, *Ration* one to another; as if some had, and others had not: But To tell us what are those quantities he calls *Homogeneous*. For that by *Homogeneous* was meant *such as had Ration one to another*, was said allready in the *Definition* of *Ration*: And what those are that *have such Ration*, he determines in that subsequent definition). And this *Definition* Mr. *Hobs* allows, pag. 47, to be *a good Definition of Homogeneous.* Yet pag. 77 and 80, he gives us another *Definition* of his own (perfectly his own, he borrowed it from no man) *Homogenea sunt quorum mensuræ* ἐφαρμόσασι *congruunt*; (Understanding by *Measure*, as he defines it, p. 11. *that, which being once or oftener taken, is coincident with the thing measured.*) Informing us, thereby, that *Homogeneous* is the same with *Commensurable.* And therefore 'twas vainly done of *Euclide*, to make such adoe in his tenth book, about *Incommensurable Lines*, (and 'tis no wonder therefore, that neither *Thomas* can understand, nor *Hobs* informe him, pag. 54. for what purpose *Euclide* wrot it:) For Mr. *Hobs* hath told us often, That *Linea lineis sunt Homogeneæ*; and, now, that *Homogenea sunt, quorum mensura congruunt.* 'Tis not possible therefore that *Lines* can be *Incommensurable.*

Being thus accurately informed, what is *Quantity*, and what is *Homogeneous*; That the *Quantities* of *Line* and *Time*, or of *Line* and *Weight*, are *Homogeneous*; he further proves by this Argument. p. 80, *Because, As the Ration of a Line to a Li*

Line, may be set forth by two Lines; so the Ration of Time to Time, or of Weight to Weight, may also be set forth by two Lines. (Yes, Or by two Plaines, or two Solids, or two other *Homogeneous quantities.* For Rations be Homogeneous; though one be of Lines, another of Solids, and a third of Weights.) But this, if it prove any thing, proves *All Quantities to be Homogeneous.* And therefore, that you may not doubt of his meaning, he tells you once for all, p. 81. *The Quantity of any thing, to the Quantity of any other thing whatsoever, is* Homogeneous; *And therefore the Quantities of Lines, Superficies, Solids, Time, Motion, Force, Weight, Strength, Resistance, are all Homogeneous, though themselves be* Heterogeneous. And *Thomas* doth here applaud him as having said *clare & accuratissime quod res est.* (And therefore of what was said *accurately* before, of *Three sorts* of Quantities, pag. 76. *All Quantity, to speak accurately, is either Length, or Surface, or Solide; Time, Motion, and every other Quant, having for its Quantity one of these Three; that of them by which it is measured:* The two latter must be blotted out; For now there is but *One* sort. *Surface* and *Solide* are no longer *Quantities,* but Heterogeneous things. *Linea lineæ, Superficies superficiei, Solidum solido, Homogenea sunt; sed, altera alteris, Heterogenea,* p. 81 and cannot therefore be *Quantities,* which are, All to All, Homogeneous. You must now read it, *Omnis Quantitas, si accurate loquendum est, Longitudo est.*) And therefore *Euclide* doth but trifle when he restrains *Ration* to Homogeneous *magnitudes,* (for there are no other;) and Defines those Homogeneous Magnitudes to be such, as that *each may be so multiplied as to become greater then the other;* (for All are Homogeneous, and therefore may so be multiplied.) And therefore since the *Quantity* of Time (an Hour) is Homogeneous to the *Quantity* of Line (a Yard) there must some *Number of Houres* be longer then a *Yard;* and, some *Number of Yards,* longer than an *Hour.* And therefore it is not improper to ask, *How many Hours long a Yard is?* Or, *How many Yards long*

long is an Hour? And (left you might think I abuse him, by making an odious Inference,) You shall have it in his own words, *p. 48. Habent rationem inter se Mensura Longitudinis, Temporis, & Motus, & possunt multiplicata se mutuo superare.*

And yet after all this, *pag. 110.* he tells us that the *Quantity* of the Angle of Contact is *Heterogeneous* to the *Quantity* of a Streight-lined Angle. And that upon this ground; Because the Measure or Quantity of the one, is *Arcus circuli*; But, of the other (he faith) *linea recta*; which cannot *congruere.* (Yet heretofore he had often told us that *Linea linea*, without considering whether Streight or Crooked, is *Homogenea*: And he must not yet deny it; because he is by and by to square the Circle, and give a Streight Line equall to a Circumference.) Nor doth he affirm only that *Line to line* may be Heterogeneous, but also *Number to number*: for thus he tells us, *Numerus numero, si qua numerantur sunt Homogenea, Homogeneus est: alioqui, Heterogeneus.* So then, The *Quantity* of two Lines may be Homogeneous, or equall, to the *Quantity* of two Plains, but the *Number* of two Lines, is neither Equall, nor Homogeneous, to the *Number* of two *Plaines*.

I should not have detained You so long upon this Subject, but that I thought it necessary to give an Instance of what I did before intimate, How possible it is for Mr *Hobs* to Forget, or not Consider, at One time, what he hath written at Another. And, that you may see how extreamly *Confused* his Notions are, even where he pretends to *speak Accurately.* Yet hath he that opinion of his own *Accurate speaking*; that in one Dialogue (the first of these six, containing but 32 Pages,) he doth about 37 times (and how often in the rest, I did not think it worth the while to number) either directly *Commend himself* for *speaking Accurately*; or Reprehend others, as *lesse Accurate* then he; (but with various cadencies, *Accurate, Accurata, Accuratissima, Accuratius, Accuratissime, ἀκριβὲς, ἀκριβῶς, ἀκρίβεια, &c.*) besides his other Commendat

Recte,

*omnino, certe, certissime, exquisite, perspicue, clare, clarissime, & nihil clarius,& quod res est, &c.*which up and down we meet with at every turn.

But if you ask me (as perhaps you may) How he should have spoken to speak Accurately as he pretends : I say first, he should have spoken *Consistently*, (for 'tis not at all accurate, so grossely to contradict himself.) Next, 'Tis confess'd, that a *Quantity*, and a *Magnitude*, are, as to the Grammaticall form, *Abstracts*; but, in common use, doe passe for *Concrets* (for want of Concrete Substantives:) Nor is it an *Hodiern* or Modern Innovation in Mathematicks so to speak : but Euclide and other ancient Greeks,did at the same rate use μέγεθος, as the Latines doe *Quantitas*, and *Magnitudo*, for Concrets. And *Verba valent ut Nummi*; whatsoever they were first Coined for, they must now pass at that value, which use hath put upon them. Next, his Notion of *Quantitas in Abstracto*, is Heterogeneous to this businesse,being a Metaphysicall,rather than a Mathematicall consideration of it. The ποσότης is not considered in Mathematicks,but the ποσὸν 'Tis Metaphysicks not Mathematicks that consider *Abstract Formalities* of things.That considers the Formality;This the Measure;and 'tis not ποσότης, but the ποσὸν,we measure. Then 'Twas farre from Accurate to thrust out *Linea* (because a Concrete) to make room for *Longitudo*; and, at the same time,to keep in *Superficies* and *Solidum*, (which are as much Concretes as *Linea* :) He should therefore,in accurate speech,have said, either *Lineá*, *Superficies, & Solidum*, or else *Longitudo, Amplitudo, & Granditas*, (either all Abstracts, or all Concrets ;) and not as now *Longitudo, Superficies, & Solidum*. Next, 'tis a very great Negligence, when he doth so much contend for Abstracts only to be called *Quantity*; to tell us, that not *Longitudo &c.* are *Quantities*, but somewhat else that answeres to the Question *Quantum*; which every one knows must be a *Concrete* : (and such, is that he gives for instance 10.*tanta quanta est ulna &c.*)For,not *Quantitas*,but *Tantitas*

anſwers to the Queſtion *Quantū.* And then, 'tis very unacu-
rate to define his *Abſtract* (Metaphyſicall) Quantity, p, 10.
*Quantitas eſt per quam quæreti de qualibet re Quanta ſit,
apte reſpondetur* ; (For Quantity is neither *per quam quæri-
tur* ; nor *per quam reſpondetur.*) He ſhould rather have
ſaid ; *Quantitas eſt illa Entis Affectio, ſecundum quam, quæ-
ritur Quantum eſt, & reſpondetur Tantum* ; or *quæritur
Quam, & reſpondetur Tam.* And in like manner, of the ſe-
verall kinds of Quantity; as *Longitudo, Amplitudo, Grandi-
tas, Duratio, &c. eſt illa entis Affectio, ſecundū quam quæritur,
Quam Longum, Quam Amplum, Quam Grande, Quam
Diu, &c. & reſpondetur Tam Longum, Tam Amplum, Tam
Grande, Tam Diu &c.* But whether or no, *Tam Longum,*
and *Tam Diu,* be Homogeneous, any more then *Tam Lon-
gum,* and *Tam Amplum,* &c. I think, needs no very pro-
found Intellect to determine. But if he leave his Meta-
phyſicall ποσότης , and ſpeak of the Mathematicall ποσόν :
Whether he mean thereby that which is *meaſured* or mea-
ſurable, (and call it *Line, Surface, Solide, Time &c,* or, which
will here be much the ſame, *Longitude, Amplitude, Gran-
dour, Duration, &c;*) Or mean, ſome *determined Portion*
thereof, (and call it the *Determinate Dimenſion,* the *So much,*
or that *which tells How much* ; as a *Yard,* an *Acre,* an
Howre, &c;) I will be either way equally Abſurd ; to ſay
that a *Line is Equall,* or *Homogeneous to Time;* or to ſay that *A
Yard is Equall or Homogeneous to an Hour.* But if (as ſinking
men are ready to catch at any thing) by *Quantity* he will
mean *Proportion* : and, in ſaying The *Quantity of a Line* is
Homogeneous to the *Quantity of time,* he mean, The *Propor-
tion between two Lines,* is Homogeneous to the *Proportion between
two Times* : He doth but trifle. For though it be true, that
Rations or *Proportions* be Homogeneous, how *Heterogeneous* ſo-
ever the Termes of the one are to the Termes of the other:
(And ſo are *Numbers* alſo, though the things Numbred be
Heterogeneous ; however Mr. *Hobs* tell us the contrary :
For *Two Mountaines,* are *as many, as Two Lines :*) Yet this

is not at all to the purpose. For we are now talking of the *Quantity of a Line* (which he tells us pag. 13, is *Quantitas Absoluta,*) not the *Ration of two Lines,* (which there he tells us is *Relativa.*) But he, by confounding the *Absolute* with the *Relative,* and the *Mathematical* notion of Quantity with the *Metaphysical,* (and skipping confusedly from one to the other, without a distinct apprehension of either,) is so bewildred, as that he knows not which way either to go back, or forward. And all this, out of a Pertinacy to defend a former mistake, in comparing *Line* and *Time* as Homogeneous Quantities.

I must now beg your pardon for having deteined You so long (for the Reason but now mentioned) about the busineß of *Homogeneous Quantities:* And at the same time crave leave (for the same reason) to do the like upon the busineße of *Ration,* which is the Subject of his Fourth Dialogue, (besides wh it is to be gathered up out of former or following Dialogues to that purpose.) And you must give me leave to use the word *Ration,* though leße English, to avoid an Inconvenience otherwise unavoidable. For though the word *Proportion,* You may think, would do as well: Yet since that, you know, this word is used, by some, for what *Euclide* calls λόγ☉, and, by others, for what he calls ἀναλογία; I must not use it in either sense. For if I should use it in the former sense, Mr *Hobs* (as his manner is) would be sure to take it in the latter, and dispute against it at that rate; if in the latter, he would take it in the former, and dispute accordingly: (For, that he knows of no other *Disputation* than λογομαχία, You heard but now.) Nor must I use the word *Reason;* for, That he would interpret either for *Cause,* or for *Understanding.* And yet, even thus, I am not secure. For were I writing to Mr *Hobs,* I must expect to be told that *Ration* is but a barbarous word (and nothing but *Reason* mis-spelled:) And, however, *Reason* and *Ration,* being words of the same Original, (as much as δίπλάσιος and διπλάσιον, or *double* and *duplicate,*)

duplicate,) cannot (in Grammar) but signifie every where the same thing. And therefore *Ration* must needs be interpreted of *Understanding*. (For, that *Reason* doth, sometimes, so signifie, I cannot well deny.) But that Person of Honour to whom I am now speaking, being Intelligent at another rate, makes me secure, that I shall be neither not-understood, nor mis-interpreted.

His Fourth Dialogue, therefore, being wholly spent about the businesse of *Rations*, I shall to this place refer what I meet with in him, scattered up and down, about that matter; that You may see with how little of Reason he manageth this whole affair.

I had said that *Homogeneous* Quantities may be compared each to other, either as to their *Difference*, or as to their *Ration* or Proportion. As 6 *exceeds* 3, by 3. Or, is the *double* of three: The former saies, *Quanto plus*; the latter *Quantuplum*. But this Mr *Hobs* (p. 77, 114, &c.) cannot Understand. *Quotuplum*, he knows; but he thinks *Quantuplum* and *Tantuplum* are not *Latine*; and he knows not how to put them into *English*. (If he had known the difference between *Aliquota pars*, and *Aliquanta pars*; He might have known, that as *Quotuplum* is the Correlative to *Quota pars*; so *Quantuplum*, to *Quanta pars*. But whether it be *Latine*; or, Mr *Hobs* know how to make it *English*, is that which I am to neglect.) The former, I said, is determined by the *Remainder* in Subduction; The latter, by the *Quotient* in Division. (And when Mr *Hobs* is in a good mood, he can say so too; as *Lesson.* p. 16. *As the Quotient gives us the measure of the Dividend to the Divisor in Geometrical Proportion; so the Remainder after Substraction is the measure of Proportion Arithmetical.*) Thus, if, the Antecedent being divided by the Consequent, the Quotient be *Two*; we call it *Double*; if *Three*, *Treble*; if *Four*, *Quadruple*, &c. The Proportion taking its Denomination from the Quotient. (And this also Mr *Hobs*, when he thinks fit, can allow too, as *Corp. cap.* 13. §. 16

2 ad 1 *vocatur Dupla*; & 3 *ad* 1, *Tripla*: Though at another time as *Less. p.* 21, and 42. he think it Absurd and not Intelligible, to say, the *Prop.* of 2, *to* 1; or of 6 *to* 3, *is Double.*)

I had said further, That as to the former comparison, the *Difference,* or *Remainder, was allways Homogeneous to the Qantities Compared;* (if these be Numbers; that, a Number; if these Lines; that a Line; &c.) But as to the latter *the Quotient was oft Heterogeneous;* (as being always a *Number,* or *Homogeneous to Number;*) For though the Quantities compared be Lines, Plaines, or the like; Yet still the Quotient *transit in genus Numerosum.* (Which what it means, because Mr. *Hobs* says he cannot understand; he may be informed that by *genus numerosum,* I mean, what is *ejusdem generis cum numero,* or, as I had said before, *Homogeneum Numero.* For so all Quotients are; if not *true Numbers,* yet at least such Quantities as may be so multiplied as to exceed Number.) And whether we ask How many times the Double Line, or the Double Number, containes the Single, the Quotient in both cases is 2. Whether Mr. *Hobs* (when he understands it) will allow this or not, I cannot tell. For though *Dial. p.* 80. he allow that *All Rations (Geometricall) be Homogeneous,* yet *pag.* 110. he will not allow that *all Numbers be so*; which seemes to unsay the former. For if the *Number* of two Yards, be not Homogeneous to the *Number* of two Acres; it may as well be doubted whether the *Proportion* 2 *to* 1 in Yards, be *Homogeneous* to the *Proportion* of 2 *to* 1 in Acres. Especially when he hath told us heretofore, *Corp. cap.* 11. § 5, *Consistit Ratio Antecedentis ad Consequens in Differentia, hoc est, in ea parte majoris, qua minus ab superatur; sive in majoris (dempto minore) Residuo, non autem simpliciter, sed ut comparato cum altero relatorum: ut Rubinarii ad quinarium est ternarius, quo quinarius binarium superat, non simpliciter sed quatenus cum binario, vel quinario comparatus.* Now if *Proportion* consist, as he saith, *in the Remainder,* or *that Part of the Greater whereby it exceeds the Lesser*; then the Proportion of *Number to number*

be a *Number*, (as he there tells us, the proportion of the number 5 to the number 2, is the number 3, whereby 5, exceeds 2 :) and the proportion of *Line to line*, must be a *Line*, (as follows there *Chap.* 12, § 8. *The proportion of the unequall Lines* E F, IG, *consists in the difference* GF, *&c.* which is a Line :) therefore the *Proportion of number to number* (being a number) cannot be Homogeneous to the *Proportion of Line to line* (which is a Line,) unlesse that *Number* and this *Line* be Homogeneous. which whether Mr. *Hobs* will affirm, or not, I am not sollicitous.

But Mr. *Hobs* being thus ingaged, as you see, in making Geometricall Proportion, not only to *depend on*, or be *estimated by*, but to *consist in*, the *Residue*, or that part of the greater *whereby it exceeds the lesser Quantity*: Thinks himself obliged to reproach me, (though himself, as you heard but now, can say so when he please) for saying, that *Proportion is to be estimated by the Quotient*, and that therefore *Equall Quotients doe argue equall Proportions*. For in thus doing, he sayes, I make *Proportion*, to be a *Quotient*, a *Number*, an *absolute Quantity*. *&c.* (Forgetting that all the while he doth but reproach himself, who says, it *consists in a part of the greater quantity*, that is in a *Line*, a *Number*, a *Solide*, or whatever that *Absolute quantity* is that is compared.) No, I doe not make *Proportion*, a *Quotient*, or an *absolute Quantity* (that's but his inference, and a weak one.) I say indeed that Proportion *depends upon the Quotient*, is *determined* by the Quotient, *estimated by the Quotient*, and *denominated* by the Quotient; not that it *is* the Quotient. My words are full and clear, (had not he a mind, as his manner, is to pervert them.) *Ratio dividendo investigatur. Divisionis nempe quotiens Ostendit rationem Dividui ad Divisorem.* (Sic si 12 per 6 dividantur, prodibit Quotiens 2: cui congruus, ratio Dupla, illa est quam habet numerus 12 ad 6 *Item Quadripondium est Bipondii Duplum: quia si 4 pondo per 2 pondo dividantur, prodibit Quotiens 2: quippe toties hoc illo pondus continetur.) Et propterea, Ubi Quotientes in vicem*

D 2

Æquantur, ibi & quantitates, in Eadem Ratione constitutæ intelliguntur. *Quippe Ratio ex Quoto æstimatur; adeoq; & ex horum æqualitate, æqualitas illarum. Cap. 25.* Of which Mr. *Hobs* can make no other sense, but this, *Proportion, is a Quotient.* And when I say, *Cap. 35. Nobis (qui Rationes superius docuimus Quoto æstimandas) ad Rationum sive æqualitatem sive indentitatem probandam sufficere videtur, si fuerit æqualitas sive identitas Quotorum:* Mr. *Hobs* (according to his wonted ingenuity) *pag.* 93. cites my words thus, *Æqualitas sive Idemtitas Rationis, est Æqualitas sive Idemtitas Quotorū.* But such Falsifications are so frequent with him (as if *Hobbiana fides*, were the same with *Punica*) that 'twere endlesse to note them all; 'Tis enough to intimate; That You are not always to take for my words, what Mr. *Hobs* cites as such. Whether it be therefore I, or he, that make *Ration* to be an *Absolute Quantity*; it is not hard to judge.

And (besides that he thus makes *Proportions* to be Heterogeneous) when he says, *It consists in the Difference, as compared with one of the Relatives;* As thus (*Dial. p.* 78) *The difference between 4 and 2, is half the Antecedent; and the difference between 2 and 1, is half the difference,* (No, but the whole difference) *between the Antecedent and the Consequent:* The Result will be but this, *The Proportion of the Antecedent to the Consequent, consists in this, that the difference of the Antecedent and the Consequent, doth bear such a Proportion to this or that of them:* (as that it is half, or a thirdpart, or the double, &c.) which is a *Ludicrous Definition.* For the *Proportion of the Difference to either Antecedent or Consequent,* must be supposed to be as little understood, as the *Proportion of the Antecedent to the Consequent; which was to be defined.*

And then whether it be more naturall to expresse the Proportion of 6 to 3, (as Mr *Hobs* would have us) thus; *That the Antecedent exceeds the Consequent by a Number equal to half it self, or, by a Number equal to the Consequent;* And that of 9 to 3, thus; that *the Antecedent exceeds the Consequent by a Number equall to two third parts of it self; or, by a Number*

ber which *is equall to the double of the* Consequent , (which is the beſt of what Mr. *Hobs* his Notion can reach to :) Or to ſay , 6 *containes* 3, *Twice* ; and 9 *containes* 3, *Thrice.* I leave to any, that is but well awake, to judge.

But I have ſaid formerly ; That *Quotients, Fractions,* and *Rations,* are oft deſigned in the ſame manner : And $\frac{2}{3}$ may either ſignifie, The *Quotient* of 2 Integers divided by 3 : Or, 2 *parts* of One divided into 3 *parts* : Or, that *Part* of One which is in *Proportion* to the whole , as 2 to 3. And which ſoever of the three wayes it be underſtood; $\frac{2}{3}$ will ſignify the ſame quantity. But this, ſaith Mr. *Hobs*, is to make *Quotient, Fraction, and Ration*, the ſame thing. No, not *preciſely the ſame*, but of very great *Affinity* (I ſuppoſe you will give me leave to uſe that word though Mr. *Hobs* p. 98. will not) one to another. The *Quotient*, is the Denominator or Exponent of the *Proportion* ; (as 2, of the Duple ; $\frac{1}{2}$, of the ſubduple ; $\frac{1}{2}$ or $1\frac{1}{2}$, of the ſeſquialter. *&c.*) even of that proportion which the *Fraction* beares to an Integer. And if one of theſe be called by the name of the other; 'tis no greater fault then to put the Abſtract a *Quantity*, for the Concrete a *Quant.* (Which Mr *Hobs* doth as frequently as other men, even when he thinks he ſpeaks Accurately, and tells us *Leſſ.* p. 15, 'tis *common ſpeech, as well amongſt Mathematicians, as amongſt common people; and though improper, cannot be altered, nor needeth to be altered, to Intelligent men* ; and p. 19, that *all Intelligent men, are contented with that expreſſion* ; though He be not.) And, whether we ſay *Two Yards* (which is an Abſolute quantity) or , *The double of a Yard* (which is a Relative;) 'tis the ſame thing in reality, though in formality of ſpeech different ; And the like of *Half a Yard*, or an *Half-Yard*: (This a *Fraction* ; that , a *Ration* :) Which Identity of ſignification, under the Different formality of ſpeech, is the meaning of that which Mr. *Hobs* makes ſo much of (as having found a great purchaſe) pag. 83. *Fractiones nihil aliud ſunt quam Rationes.* (Which is as much as to ſay *Triens* is the ſame with *Subtr....*; and

Dimidium or *Semis* , the same with *Subduplum* ; that an
Half-Yard and Half a Yard , is the same.)

And he observes(pag. 82.)that I say *Duplum, triplum, &c.*
are taken to be Names *of Ration* (and the like of *Subduplum,*
Subtriplum, &c. their Correlates ; which, I said but now,
are the same for substance with *Semis* , *Triens, &c.*) He
would fain carp at it, but knows not which way to form his
Objection. Somewhat he suspects there is , not Accurate ;
but is not himself so Accurate as to find what it is. There-
fore I shall a little help him out. When I say *Duplum est*
Nomen Rationis ; 'tis at the same rate , that we say *Father,*
is a Name of Relation ; whereas (according to Mr. *Hobs* his
ἀριϑμον, or as he doth constantly write it, ἀριϑμεϑαι,) not
Father, but *Paternity,* is the *Relation* ; and *Father* is but
the *Relata* which hath this *Relation.* And in like manner
Duplum is not precisely the *Ratio,* but *Rationem habens* ;
not the *Rate,* but the *Rated* : (Σιϑνομς is the *Ratio.*) But
for want of a *Concrete* (for had I said *Rationatum* or *Propor-*
tionatum , he would have called it *Barbarous*) I made bold
with the *Abstract.* Which had he discerned ; he would
doubtlesse have rebuked me as severely, as he hath done my
betters, for saying a *Quantity* instead of *Quant.*

But, why may not *Duplum,* be *Ratio* ? Because (he tells
us pag. 13. 98.) *Ratio* is not *Quantitas Absoluta,* but *Re-*
lativa or *Comparativa.* Well : And is not *Duplum, Rela-*
tivum ? Is not *Duplum,* *Dimidii duplum* ; and *Dimidium,*
Dupli dimidium ? Doth not himself tel us (*Lesss. pag.* 81)
that, *halfs,* and *thirds, &c.* are *names* of *Quantity Compared* ?
But, by *quantitas Relativa,* he means, *Relatio.* Very good :
He should then have said , 'Tis *Relatio quantitatis* , not
Quantitas Relativa. For *Relativa* is as much a *Concrete* , as
Duplum. And therefore This as much a *Ration* , as That.

I have detained You, I doubt, too long, in tracing Mr *Hobs*
while he is picking *Strawes* : But being thus farre ingaged,
ther's one *Straw* more lyes in his way, weh I must remove.
The *Quotient* of the Antecedent Divided by the Conse-

quent (which gives Denomination to the *Ration* or *Proportion,*) what to call at present, so as to satisfie Mr. *Hobs,* doe not well know. If I should call it the *Quantity* of the Proportion, as some have done : Mr. *Hobs* tells us, p. 86. *He doth not believe I ever saw any Authour who did so call it,* (it seemes he hath not.) If I call it a *Quotient;* he will tell me , *Quotient there is none but in Aliquote pars. Less. p.* 2 c (Yet *Dial.* p. 52. he sayes ; *If* 15 *be divided by* 4, *the Quotient is* 3¾.) If I should call it the *Denominator* of the *Proportion;* he would pervert my words, and take it presently for the *Denominator* of a *Fraction;* and aske , whether of the *Denominator* be Four. I shall call it at present the *Exponent* of the *Ration ;* as 2 is the Exponent of *Duple ;* 3, of *Triple ;* 1½, of *Sesquialter &c.* (nor shall I much concern my self whether Mr *Hobs* understand it not; I write to You who doe.) Now I doe sometimes (as others have done before me) to this *Exponent* give the name of *Ration ;* (as *Ratio* ⅔, for the *Ration of* 2 *to* 3, or the *Ration* whose Exponent is ⅔.) And this is that which Mr. *Hobs* can not understand. But, that I am not the first who have thus used to speak, Mr.*Hobs* will be my Compurgator : For finding that Mr *Oughtred* is wont so to speak ; (in the Latine, as well as the English ; though this Mr. *Hobs* would fain dissemble:) he would have it thought *pag.* 82. that *I translated his Clavis into English.* (Whereas, the truth is, when that Book was first made English, I understood as little of Specious Arithmetick as Mr. *Hobs* doth now : so farre was I from being the Authour of that Translation.)

But, (if it were worth while) I could *mince* words as finely as Mr. *Hobs,* and *split a Haire* as nicely as he. And tell him, that even what we commonly call the *Quotient* in Division ; is capable of more formalities than one, according as we suppose the Question to be variously put. For example. Because 2) 6 (3. That is, if 2 divide 6, the Quotient is 3. If the question be put, according to *Euclide's* style By what *Number doth the Number* 2 *divide the Number* 6; or,

2 *pound*

pound, divide 6 *pound*; (which is as much as, what Number Multiplied into 2 *pound*, will produce 6 *pound*:) the Quotient will be *Three*, (a number *Cardinall*.) But if we put it (as usually we doe; and from whence *Quotient* takes its name) *Quoties*, or *How often, is* 2 *contained in* 6, (or 2 *pound* in 6 *pound*;) the Quotient is *Twice*, (a numerall *Adverb*.) But if we put it thus, *Quota pars* is 2 of 6 : the Answer is *Tertia*; the part denominated by 3; (and hence the Quotient is called as well *Numerus Quotus*.) But if thus, *Quotuplum* is 6 of 3. The Answere is *Triplum*. So that 3 may be interpreted (according to the severall notions in which we conceive division) to signify, *Tria*, *Ter*, *Tertia*, or *Triplum*; which you please. Though usually we take it to be a *Cardinall number* (from whence the rest are denominated) or what is Homogeneous to it; which multiplied into the *Divisor*, doth produce the *Dividend*. And if so taken, The *Fraction* (proper, or improper) is *Ratio in Concreto*: The Quotient, is *Denominator Rationis*, or *Exponens Rationis*, or *Quantitas Rationis*, (for that 'tis so called, we shall hear anon :) And the *Relation*, is properly *Ratio in abstracto*. Thus because 5 divides 10 by 2; *Duplum* (the Double) is *Ratio in concreto*: *Dimidium* (the Double-nesse) *Ratio in abstracto*: And *Duo* (the Quotient, or number *Two*) is *Rationis Exponens*. So (if 10 divide 5, by ½,) the like is to be said of *Dimidium* (the Half;) *Medietas* (the Halfnesse;) *semis quod sic* (Half One.) But enough of this. If Mr. *Hobs* can distinguish more accurately, I shall be willing to learn.

I shall trouble you but with one word more about the name *Ration*. These Numbers (or Quantities proportionall to them) 1, 2, 3, &c. being proposed as *Rationals*; You have heard, I suppose, (though it seemes Mr. *Hobs* have not,) √ 2, √ 3, √ 4, &c. called *Irrationall*. But, this (I said) was but what *Euclide* calls *Incommensurable* (to those exposed *Rationalls*) not *Irrationall* : And that by *Irrationall* he intended only such as were not so much as *potentia*

commensurabiles; that is, whose *Squares* are not commensurable to the *Squares* of the Exposed Rationalls. Thus 2 being exposed as *Rationall*, √2 will be *Incommensurable*, but not (in *Euclides* sense) *Irrationall*, (because 4 the square of 2, and 2 the square of √2, be commensurable:) but 1 + √2, will be *Irrationall*, because its square 3 + 2√2, is not commensurable with 4 the square of 2. If you never heard or met with the word *Irrationall* used in that former sense; You may think this Intimation, of *Euclides* using it in the latter sense, superfluous: But if You have; You may think Mr. *Hobs* his cavill *pag.* 83. may very well become him, but not another man.

I have now insisted so long upon the Name of *Ratio*, that You may possibly think 'tis more than it deserves. But I have the rather done it, because, though Mr. *Hobs*'s Objections were not worth half the while; Yet *Ration*, well understood, being the Life of Mathematicks, (as being of such Vniversall influence into every part of it, upon all occasions,) You will think, though the Objections do not, the Subject may deserve a little time to be spent in the Clearing of it. And I would willingly write something, (since I am a writing) that may be more *Considerable*, than, shewing that what Mr. *Hobs* hath said, *is not*.

I shall therefore next consider *Euclide*'s *Definition of Ratio*. Which hath fared the worse with Mr. *Hobs*, because I have formerly explained it, so as to make it intelligible, and significant at a better rate than as Mr. *Hobs* expounds it (*Less.* p.8.) *A what-shall-I-call-it As-nesse or So-nesse of two Magnitudes.* or (as p. 16.) *a Whatshicalt habitude of two Quantities:* Reproching it upon all occasions, (*Less.* p.7, 8, 16, 20. *Dial.* p. 44, 45, 82, 88, 100,) as, that 'tis *Intolerable, Insignificant, Inept, Ridiculous, As bad as any thing was ever said in Geometry, by* Orontius *or my self, That* Euclide *was confounded; did but* Tussire, (as not knowing what to say) *did not well understand the nature of Proportion. &c.* The Definition is (3 *def.* 5.) Λόγος ἐστὶ δύο μεγεθῶν ὁμογενῶν

χ̀ι πηλικότητι πρὸς ἄλληλα ποιὰ ϗέσις. Which Mr. *Hobs*, (*Dial.* p. 44.) renders thus, *Ratio est duarum magnitudinum ejusdem generis mutua quadam habitudo.* So that, χ̀ι πηλικότητα signifies nothing: ποιὰ, *quedam*: and ϗέσις, *habitudo.* But what *habitudo* means, he *cannot understand*, p. 82. He thinks p. 45. it signifies a kind of *having*, or *being had*: And the best he can make of it (p. 45. & *Less.* p. 8.) is but this, that it signifies a certain *asnesse* or *somesse*: And blames me *Dial.* p. 101. for taking *Habitudo*, to signifie *Relatio.* For he thinks, p. 100. that *habitudo* (being derived from *habeo*) must signifie the same with *habitus*, which is *facilitas agendi consuetudine acquisita.* (And if I should tell him that *Habitudo* and *Habitus* differ as much as ϗέσις and ἕξις, I suppose he would say; That's nothing at all; no more than ϗήσω and ἕξω, the two *Futures* of ἔχω.) And a Phansy he hath (which because he thinks it of moment, he gives us more than once, *Less.* p. 8. *Dial.* p. 45.) that *Euclid*, in the word ϗέσις, did *onely respect* that *Form of Speech amongst the Greeks,* ὕτως ἔχει (*ita se habet:*) and that, *if they had expressed Proportion by* ὕας ϗ̀ι, *Euclide would have defined it by* ποιὰ ἰσία, *as now he doth by* ποιὰ ϗέσις. (But, I perceive, Mr *Hobs*, is not very good at Guessing: nor doth he take his Aime right: For *Euclide's* constant phrase is ὕας ϗ̀ι, not as Mr *Hobs* supposeth ὕτος ἔχει· And yet he doth not define Proportion by ποιὰ ἰσία, but ποιὰ ϗέσις. And had Mr *Hobs* consulted *Euclide's* Greek, he would have found no footing for that Phansie. But, 'tis like the Diligence which he is wont to use in his Observations.)

But, (though Mr. *Hobs* be of another Opinion) with You, I suppose, it will not be absurd to say that *Habitudo* is a *Relation* (not a *Habit*) and that ὕτος ἔχει πρὸς τὸ, (*ita se habet ad,*) if it had been *Euclides* phrase, might well enough referre to what *Aristotle* calls τὸ πρὸς τι *Relation.*

And that ποιὰ, may be somewhat more than πὲ *quedam*, I believe you may be apt to grant also: and, that it may imply

imply τὸ ποιὸν, *Quality.* For though Mr *Hobs* p. 45, 82 &c. may despise *Aristotles Prædicaments*, (because he thinks his own Prædicaments better,) Yet that *Aristotles* Prædicaments, may give light as to the use of Words in *Euclide* (and somewhat more than those of Mr *Hobs*) You will think it more than possible. For they did not live either so long, or so far, asunder; but that they might well enough conform one to the others language; or both to the common language of that Time and Place. And therefore that ποιά ἔχσις, may be a *Qualitative Relation,* or such a Relation as may appertain to *Quality.* And, ἡ κατὰ πληθότητα ποιά ἔχσις, such a *Relation* as appertaines to the *Quality,* but ariseth from the Respective *Quantity* of those Magnitudes.

For though to Mr *Hobs,* p. 101, it seems very strange, that *Figures should be otherwise compared in Geometry than as to their Quantity,* (How Great:)Yet to You it will not be strange at all, That, beside the *Area* of a Figure, *Quanta sit*; a Geometer may consider also the *Species* of it, *Qualis sit.* (*What kind* of Figure, or of *What Fashion*; as well as *How Great.*) And that a Figure may be *Specie data,* when it is not *Magnitudine data.* To say, It is *Talis,* Such a Figure, and, *Tanta,* So Big; are two things. To say that such a Field contaînes an *Acre,* determines the *Quantity*; but to say, 'Tis *Round, Square, Triangular, Æquilater, Æquicrural,* &c. determines, *Qualis,* What kind of Figure 'tis: and is thought by *Aristotle* to belong not to his τὸ ποσὸν, the Prædicament of *Quantity*; but to his τὸ ποιὸν, the Prædicament of *Quality.* And though *Superficies* be a Species of *Quantity*; yet *Figura* (as *Triangulum, Quadratum, Circulus,* &c.) is with *Aristotle* (though perhaps not with Mr *Hobs*) the fourth Species of *Quality.* (Which is indeed a *Modus* of *Quantity,* but a *Species* of *Quality.*) And I believe that *Euclide* (in using the Word ποιά) did rather respect that which *Aristotle,* than that which Mr *Hobs,* calls ποιὸν.

Now I need not tell you, that determining the *Species*
or *kind* of Figures depends upon the *Proportion*, and the
Position, of its Parts, or Bounds, each to other. And
according as both those, in two Figures, be or be not the
same; those Figures are called *Like* or *Unlike*. Which
Words, I said, are used to denote an agreement or disagree-
ment in *Quality*; like as, *Equal* and *Unequal*, in *Quantity*.
And if Mr *Hobs*, p. 45, 82. take it to be a κατηγορεμα
thus to argue; *Proclus*, it seems, was κατηγορεμανης as well
as I. For he tells us (upon that of *Euclide*, *All Right
Angles are equal*.) Οἱ μὲν τὸ Ποσὸν ὁρῶντες τ̄ γωνιῶν, τ̄
ὀρθὴν Ἴσην τῇ ὀρθῇ λέγουσι· οἱ δ τὸ Ποιὸν, Ὁμοίως, (lege
Ὁμοίαν.) Ὅσον γὰρ ἐσὶ ἐν Ποσοῖς, ἡ Ἰσότης. σῦτο ἐν τῷ
Ποσοῖς, ἡ Ὁμοιότης. *Right Angles*, *as to the Quantity*, are
said to be *Equal*; *but*, *as to their* (Fashion, or) *Qualitie*,
Like. *Equality*, *in Quantities*, *being the same that Likeness
is in Qualities*.

And both of those Respects (that of *Proportion*, and
that of *Position*) are τοιαὶ χέσεις, *Qualitative Respects*, (as
determining the *Figure*, a Species of Quality:) but this
of *Position*, χτὶ τὸ κεῖδαι, as to the *Situation* of the Parts;
that of *Proportion*, χτὶ τὰν πηλικότητα, as to their *Respective
Greatnesse*. In *Numbers*, (which have nothing of *Local
Position*,) that of *Proportion* hath only place; and doth
therefore (without that other) determine *Similitude*. As
two Numbers (suppose 6 = 2×3, and 24 = 4×6,) are said
to be *plani Similes*, if their *Factores* be proportional. As
on the other hand, in *Angles*, where the *Length* or *Pro-
portion* of the *Crura* is not at all considered, there
Position alone determines their *Likenesse* or *Unlikenesse*, (as
well as *Equalitie* or *Inequality*) as you heard but now out
of *Proclus*. But in *Figures*, we consider both.

I have insisted the more on this, because I find that
others, as well as Mr *Hobs*, are apt, through inadvertency,
(and because we are not now wont, in ordinary Speech, to
call *Figure* a *Quality*,) not to consider, that *Proportion* is

one of those two things which do determine ποσὸν χ̅ημα, and is therefore ποσὰ χ̅ησις. (Nor are we to consider what it is now a daies called in ordinary speech by Us, or how it now stands in Mr *Hobs*'s Prædicaments; but how the *Greeks* did Then call it, and how it stood in Their Prædicaments; if we would know what ποσὰ signifies in *Euclide*.) And this Inadvertency, may be the reason, why most Interpreters, neglecting the Emphasis of ποσὰ have rendred it by *quædam habitudo*, as if it were in *Greek* χ̅ησις τὶς, not ποσὰ χ̅ησις.

And therefore I should chuse, as heretofore (notwithstanding Mr *Hobs*'s cavill, that *qualitativa* is not Latine,) to render it thus, *Ratio est duarum Magnitudinum homogenearum, quæ secundum quantitatem est, ad invicem habitudo qualitativa.* (Where *qualitativa* distinguisheth *Ration*, from that *Relation* which concerns the *Difference* or *Excesse*, Or, as the Scholiast calls it, that ἄλλη χ̅ησις, which is ἐν τῷ ὑπερέχειν ἢ ἐλλείπειν, which is *Quantitative*; And, *secundum quantitatem*, distinguisheth it from that other Qualitative *Relation* which concerns the *Position*; as that wherein a *Rhombus* differs from a *Square*.)

And this I take to be the true Emphasis of *Euclide's* Definition: Save that I am to adde further, as to that χ̅ πηλικότητα, (what I know Mr *Hobs* will not allow me) that the πηλικότης or *Quantity* which here is meant, is that which we call *Quotient*, (in the largest sense;) which is the Result of Division, (whether a true Number, as in some cases, or Homogeneous to it, as in all cases.) I know that Mr *Hobs* would with great disdain resent this Assertion: As having, p. 86. allready declared his sense to the contrary. For though, as to the Antiquity of the *Chaldean* Astrology, when *Hobs* thought I could not, *Thomas* was of opinion, 'twas possible I might have seen some Author of my judgment: Yet here they both agree, that I did but play the Mountebank, in saying *Some*, when I did not know *Any* of that opinion; For so 'tis concluded, pag. 86.

He

He doth not believe that I ever saw any Author who did interpret the Quantitie of Proportion in this manner. For either he was himself, or did think me, so ignorant, as not to be able to assigne any. But of this (because you see there is no dealing with Mr *Hobs,* but *signatis tabulis,*) I shall give you an account by and by, (that by πηλικότης he means what we call the *Quotient.*) At present I shall only tell you, out of the Scholiast, why he doth use the word πηλικότης the *Quantity;* rather than ποσότης, the *Quotity.* And 'tis the same with that for which I say *Quantuplum,* rather than *Quotuplum;* because, of a more large extent. For so his Scholiast tells us, ὅτι μὲν τῶν δεδομένων τᾶς λόγῷ μετὰ ἔχει ποσότητα· ἀλλ᾽ ὁ τῶν μεγεθῶν ὅτι τις λόγῷ, ὁ ὑσατις μηδένας καλεῖται. —— χ᾽ διὰ τοῦτο θεωρέσθαι τῷ δευτέρῳ τᾶ λόγῳ τῶν μεγεθῶν, τὸ χατὰ πηλικότητα. Ὁ μὲν ρητὸς, χ χατὰ πηλικότητα ἢ χατὰ ποσότητα ἐστὶν ὁ πάντως γ χατὰ πηλικότητα, ᾶ ὅλως. He tells us that, *In Numbers, any Ration hath an Effable Quotitie* or *Quotuplicity, (a Quorient explicable in numbers, which determines Quotuplum:) but in Magnitudes, there may be Ration, which cannot be explicable by Number. And that for this cause Euclide in his definition of the Ration of Magnitudes, saies* (χατὰ πηλικότητα) *as to the Quantity, or Quantuplicitie, (which determines the Quantuplum, not the Quotity which sies Quotuplum:)* *For though the Effable, have not only a Quantuplicity, but also a Quotuplicity; yet there is not alwaies an Effable Quotuplicity, where there is a Quantuplicity.* Where though he do extend the *Quantuplum* (larger than perhaps Mr *Hobs* would allow) to all proportions explicable in true numbers; yet his *Quantuplum* he extends further.

And I hope, by this time, *Euclide's* Definition, is Intelligible, and significant. By χέσις, *habitudo,* is meant what we call *Relation* or *Respect;* and by ποιὰ χέσις, a *Qualitative Respect,* or *Respective Quality;* and by *Quantitie* (not the τὸ ποσὸν, but the πηλικότης) the *Quotient,* or *Quantitie,* from whence the *Quantuplum* is denominated. And so the whole

whole definition amounts to this, that *Ration* or *Proportion,* is the *Respective Qualitie,* of two *Homogeneous Quantities,* or *Magnitudes,* as to the *Quotient.* Which I take to be somewhat more significant, than Mr *Hobs's* A*snesse,* or *Sonesse.*

We shall next consider what is meant by *Rationis Compositio.* And I have said formerly, that there is a Twofold Composition of Proportion. The one by *Multiplication* of the Exponents; the other by the *Addition* of them (as when we say, *the Double of the Treble* is equal to the *Sextuple;* but *the Double and the Treble* is equal to the *Quintuple.*) And both these are (not only in the *Hodiern* Mathematicks) but in *Euclide's* Elements, called *Composition.* The former in the last definition of the sixth Book; and the latter, in the fourth definition of the fifth book. (And this Mr *Hobs,* when he pleaseth, can acknowledge, as *Less.* p. 8. where he tells us, that the *Compositio Rationis, which Euclide defines in* 14 *def.* 5. is not the *same which he defineth before the sixth Element.*)

That last Definition of his sixth book is this, λόγΘ εκ λόγων συγκεῖσθαι λέγεται, ὅταν, αἱ τῶν λόγων πηλικότητες ἐφ᾽ ἑαυτὰς πολλαπλασιασθεῖσαι, ποιῶσί τινά. (For though some Copies have τινάς, yet I take τινά, to be the better reading; and Mr *Hobs* allows it : only whereas Mr *Hobs* thinks it to be thus supplied, τινά λόγον, I think that *Euclide* doth rather mean τινά πηλικότητα, notwithstanding the authority of Mr *Hobs's* Anonymous Book of an hundred years old, which, citing the Proposition, saith τινά λόγον.) As of 2 to 3, and 4 to 5, the *Compound Proportion* is that of 8 to 15.

What is meant by πηλικότητες, (which is the only thing in question in this definition) I said, Interpreters do not all agree. Some take πηλικότητες λόγων, the *Quantities* of the Proportions, here meant, (and Mr *Hobs* with them) to be the *Antecedent* and *Consequent* of each Proportion. And then their meaning is, that the Antece____t of the first,

multiplied into the Antecedent of the second, produceth the Antecedent of the third, (as $2 \times 4 = 8$.) And the Consequent of the first, into the Consequent of the second, produceth a third Consequent, (as $3 \times 5 = 15$.) And there is no great inconvenience if the words be so taken; the sense, even thus, being sound. (But then we must read it τινὰς, not τινὰ, for if πηλικότητες be the *Terms* of the Proportion, then is the new Antecedent one πηλικότης, and the new Consequent another. But Mr *Hobs*, though he embrace that Notion, will not allow that reading. And if he think to salve it with his τινὰ λόγον, as if the two new Terms, did ποιῶν τινὰ λόγον; he must consider that ποιῶν is here a Technical word, and that which πηλικότης πολλαπλασιάσεσι ποιεῖ, is the *Factum*, or *Product* of a Multiplication; and he must not allow that the *Terms* of the Proportions, that is, the *Absolute-Quantities*, do by Multiplication Produce a *Ration*, which, he saith, is not an *Absolute* but *Relative* quantity.)

Others (though Mr *Hobs* cannot believe it) do by πηλικότης understand the *Quotient*, (or the *Exponent* of the Proportion:) And so (in the case proposed) $\frac{2}{3}$ and $\frac{4}{5}$ (the Exponents of the two *Component* Proportions, 2 to 3, and 4 to 5) do by multiplication produce ($\frac{8}{15} = \frac{2}{3} \times \frac{4}{5}$) the new *Exponent* of the Compound Proportion. (And then we must read it τινὰ, as some Copies, and most Expositers do agree: for the new Exponent is but one, though the Terms of that new Proportion be two. Yet not τινὰ λόγον, but τινὰ πηλικότητα λόγου (and so *Theon* supplies it; as *Meibomius* acknowledges *Dial. Prop. p.* 25, 79. And *pag.* 96. himself so supplies it as to this opinion.) For the two *Exponents*, by Multiplication, produce, not a Proportion, but an *Exponent* of a new Proportion.)

Now though I said that, either way, the Result of the Definition amounts to the same issue (whether we say $\frac{2 \times 4 = 8}{2 \times 5 = 15}$ or $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$) Yet (to justifie my assertion) for

Mr

Mr *Hobs* doth not believe, that ever any but my self did take μηλικότης to be meant in the latter sense) I shall out of *Eutocius*, (in his Comment on the fourth prop. of the second book of Archimedes, *de Sphera & Cylindro*; and cited by *Meibomius. p. 15.*) tell you what in his daies, and those before him, was thought to be meant by it, (for should I produce any *Modern* Interpreters, they might be condemned for *Hodiern* as well as I :) who, in order to prove, that, *If between two Numbers, or Magnitudes, we interpose a Middle term; the Proportion of the first to the third, is compounded of the Proportion of the first to the Middle, and of the Middle to the third*; He thus proceeds.

Ἡμικύκλιον δὴ φανερὸν, πῶς λέγεται λόγος ἐκ λόγων συγκεῖσθαι. ὡς γὰρ ἐν τῇ στοιχειώσει, ὅταν αἱ τῶν λόγων μηλικότητες, ἐφ᾽ ἑαυτὰς πολλαπλασιασθεῖσαι, ποιῶσί τινα. μηλικότης δηλουότι λεγομένης τοῦ ἀριθμοῦ, ὃ παρωνυμός ἐστιν ὁ λόγος, ὡς φασιν ἄλλοι τε, καὶ Νικόμαχος ἐν τῷ πρώτω περὶ Μουσικῆς, καὶ Ἡρωνᾶς ἐν τῷ ὑπομνήματι τῷ εἰς τὴν ἀριθμητικὴν εἰσαγωγήν. ταυτὸν δὲ εἰπεῖν, καὶ τὸν ἀριθμὸν τὸν πολλαπλασιαζόμενον ἐπὶ τὸ ἑπόμενον ὅρον τοῦ λόγου καὶ ποιεῖν τὸν ἡγούμενον, &c. We are first (saith he) *to consider how, of Proportions, a Proportion is said to be Compounded. That is, (saith the Elements) when the Quantities (μηλικότητες) of the Proportions, multiplied into each other, do produce a new one. Where, by the Quantitie (μηλικότης) is meant, that Number from which the Proportion takes its Denomination. (And so say, as others, so particularly Nicomachus in his first book of Musick; and Heronas in his Commentarie on the Arithmetical Introduction.) that is to say, that Number, which, multiplied into the Consequent Term of the Proportion, produceth the Antecedent. And this Quantitie* (saith he) *is most properly assigned in Multiple proportions. But in the Superparticular and Superpartient, it is not to be assigned without dividing an Unite. So that in these an Unite is to be divided; (which is not properly Arithmetical, but Logistical;) and this to be divided according to such part or parts, as the*

proportion is denominated by. So that (to speak yet more plainly,) the Quantity of the Sesqualter proportion, is one Unite and an half, $1\frac{1}{2}$. That of the Sesquitertian, one Unite and a third part, $1\frac{1}{3}$. So that (as was said before) the Quantity of the Proportion, multiplied into the Consequent term, produceth the Antecedent. For of 9 to 6, which is Sesqualter, the Quantity $1\frac{1}{2}$ multiplied into 6, produceth 9. And in like manner, in other proportions. And these things thus premised, Let the two numbers given be A B, and a third taken at pleasure C. We are to shew, that the Proportion of A to B is compounded of that of A to C, and of C to B. Let the Quantitie of the Proportion of A to C, be D; and of C to B, E. And let E into D, make F. I say that F is the Quantity of the proportion of A to B: that is, if F multiply B, it will make A. For, let B multiplied by F, make G. Forasmuch then as B into F, makes G; and B into E, makes C: therefore as F to E, so is G to C. Again, forasmuch as D into E, makes F; and D into C makes A: therefore, as E to C, so is F to A. And (alternately) as E to F, so C to A: And (inversely) as F to E, so A to C. But we have shewed, that as F to E, so is G to C. Therefore, as G to C, so is A to C. And therefore A is equal to G. But B into F makes G, therefore B into F makes A. F therefore is the quantitie ($\pi\lambda\eta\kappa\acute{o}\tau\eta\varsigma$) of the Proportion of A to B. But F is the product of D multiplied into E; that is, of the Quantitie of the Proportion of A to C, into the Quantitie of the Proportion of C to E. The proportion therefore of A to B, is compounded of that of A to C, and of C to B. Which was to be demonstrated.

But to the end that, by an Example, I may farther make clear what hath been said. Let, between the numbers 12 and 2, a middle number be 4. I say, that the proportion of 12 to 2, that is, the sextuple, ($\lambda o\gamma o\varsigma$ $\dot{o}$ $\dot{\epsilon}\xi\alpha\pi\lambda\acute{\alpha}\sigma\iota o\varsigma$,) is compounded of the triple, ($\tau\tilde{\upsilon}$ $\tau\rho\iota\pi\lambda\alpha\sigma\acute{\iota}\upsilon$,) 12 to 4, and of the duple ($\tau\tilde{\upsilon}$ $\delta\iota$

πλασὶα) 4 to 2. For if the Quantities of these Proportions be multiplied one into the other, that is 3 into 2, it makes 6, which is the Quantitie of the Proportion of 12 to 2, (which is sextuple;) as was proposed to be shewed.

But in case that middle term interposed, happen not to be lesse than the greater, and greater than the lesser (of the two given terms,) but contrariewise, greater than either, or lesser than either; yet even thus the foresaid composition will follow. Between 9 and 6, let a middle term interposed, greater than either, be 12. I say, that, Of the subsupertertian (τῦ ὑπερτριτς) that of 9 to 12, and of the duple, that of 12 to 6, is composed the sesquialter, that of 9 to 6. For the Quantitie of the Proportion of 9 to 12, is $\frac{1}{4}$, that is, $\frac{1}{4}$ and $\frac{1}{4}$; and the Quantity of that of 12 to 6, is 2. If therefore we multiplie 2 into $\frac{1}{4}$ and $\frac{1}{4}$, the product is $1\frac{1}{2}$, which is the Quantitie of the Sesquialter Proportion, which 9 bears to 6.

In like manner, if between 9 and 6, the middle term interposed be 4: Of the proportions of 9 to 4, which is duplesesquiquartan; and of 4 to 6, which is subsesquialter, is compounded the Sesquialter proportion. For if again we multiply the Quantitie of the Duple-sesquiquartan, which is $2\frac{1}{4}$ into the Quantity of the subsesquialter proportion that is $\frac{2}{3}$; we shall have $1\frac{1}{2}$ the Quantity of the sesquialter proportion, as was said before. And in like manner 'twill hold in all cases what ever.

From what is said, 'tis also manifest, that if between two Numbers, or two Magnitudes given, there be interposed, not one but more intermediate terms; the proportion of the Extreams is compounded of all the proportions which each terms hath with his immediate subsequent, beginning at the first, and ending at the last, according as they follow in order. For between two terms A, B, ten more than one be interposed, C, D. I say that the proportion of A to B, is compounded of that of A to C, and of C to D, and of D to B. For seeing that of A to B is compounded

of that of A to D, and of D to B, as was said above ; and that of A to D, compounded of that of A to C, and of C to D: Therefore that of A to B is compounded of that of A to C, and of C to D, and of D to B. And the same will in like manner be shewed in all other cases. Thus far *Eutocius.*

I forbear, as needlesse, to cite *Theon* and others to the same purpose. (This alone, is enough to make *Credible,* what Mr *Hobs,* could not believe, That some other beside my self did understand πηλικότητες, the *Quantities* here spoken of, in this sense.) But this out of *Eutocius* I have the rather produced at large, as well because of that clear account he gives us of *Compounded Proportion,* and of *Euclide's Definition* thereof, as himself and the Antients did understand it ; As also because I find that Mr *Hobs* is not the onely person, who, looking no further than the *Latine* Translations, is apt to understand *Quantitas,* as if here used in such a sense, as when we call *a Quantitie* that which Mr *Hobs* would have us call a *Quant* ; and so to take the πηλικότητες λόγων for the *Terms of the Proportion,* (the Antecedent and Consequent,) or the *Quantities Compared,* which *Euclide* useth to call μεγέθη, the *Magnitudes* ; not πηλικότητες ; (Which mistake is the more advanced, because *Euclide* speaking here of more Proportions than one, saith πηλικότητες λόγων, whereas had he spoken but of one, and said in the singular πηλικότης λόγυ, the mistake had not been so easie :) Not attending that *Euclide* (who doth not take a pride in needlesse varying Words and Phrases, but is rather rigidly tenacious of his forms of Speech) doth by πηλικότης *Quantitie* (which is in such manner different from ποσότης *Quotitie,* or *Quotient* strictly so called, though Homogeneous to it, as *Quantuplum* from *Quotuplum,*) mean that *Quantitie* (rather than *Quotitie*) effable or uneffable, which denominates the *Quantuplum*; or which multiplying the Divisor doth produce the Dividend, or multiplying the Consequent doth produce the Antecedent n of the Proportion. (Which rightly understood,

addeth a great light to those two Definitions of *Euclide*, where that Word is used; that of *Ration* or *Proportion*, 3 d 5. and that of *Compounded Proportion*, 5 d 6.)

Thus if $\frac{A}{B}$ and $\frac{C}{D}$ (the *Quantities* or *Exponents* of the two Proportions, that of A to B, and of C to D,) be multiplied the one into the other; the product $\frac{A}{B}\frac{C}{D} = \frac{A}{B} \times \frac{C}{D}$ is the Exponent of a Ration, which by this Definition is to be called, the *Compound of those two*. And what *Eutocius* doth demonstrate; That *of any three Magnitudes* A, B, C, *the Proportion of the first to the third, is compounded of that of the first to the second, and that of the second to the third*: is evident; because $\frac{A}{B} \times \frac{B}{C} = \frac{AB}{BC} = \frac{A}{C}$. And, were there never so many, yet still $\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D} \times \frac{D}{E} = \frac{A}{E}$. For the intermediate terms, being first Denominators, and then Numerators, of the Exponent Fractions, do still destroy themselves, how many soever they be.

And when *Euclide* defines, 10 d 5, If A, B, C, D, &c. *be in continual Proportion*, (that is, if that of A to B, be the same with that of B to C, and of C to D, &c.) *the Proportion of A to C is Duplicate, and that of A to D Triplicate*, &c. of that of A to B. 'Tis as much as to say that a Proportion thus compounded of Equal Proportions, two, three, or more, is said to be Duplicate, Triplicate, &c. of each of them (διπλασίαν, τριπλασίαν, &c. not διπλάσιⲟν, τριπλάσιⲟν, &c. For that λόγⲟν διπλάσιⲟν, &c. signifies another thing we heard but now :) For then $\frac{A}{C}$, that is, $\frac{A}{B} \times \frac{B}{C}$, that is, $\frac{A}{B} \times \frac{A}{B}$, or $\frac{AA}{BB}$, is the Exponent of the Duplicate, and $\frac{A}{D}$,

that is, $\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D}$, that is, $\frac{A}{B} \times \frac{A}{B} \times \frac{A}{B}$, or $\frac{AAA}{BBB}$, of the Tripli-

cate, of $\frac{A}{B}$ or that of A to B. Thus the Double of the Double, the Treble of the Treble, the Quadruple of the Quadruple, &c. and the Half of the Half, the Quarter of the Quarter, &c. are in Duplicate proportion, to the Double, Treble, Quadruple, &c. the Half, the Quarter, &c. And the Double of the Double of the Double, is Triplicate of the Double. And so of the rest.

But here Mr *Hobs* can neither agree with *Me*, with *Euclide*, nor with *himself*. He had told us, in his *Latine* Edition (*Corp. cap. 13. §. 16.*) that (of quantities in continual proportion) *If the Proportion be of the Greater to the Lesse, the proportion of the First to the Third is Double of that of the First to the Second; and that of the First to the Fourth, Treble; meaning (as he tells us) by Double and Treble, that which is commonly called Duplicate and Triplicate. But if the proportion be of the Lesse to the Greater; the proportion is not properly said to be Multiplied, but Submultiplied; (for Submultiplicari was not then a Barbarous word; though now Dial. p. 50, 51. Supduplum be) and that of the First to the Third is the Half; and that of the First to the Fourth is the Third part, of that of the First to the Second; meaning by the Half, the Third part, &c. that which is commonly called the Subduplicate, Subtriplicate, &c.* (And yet he there presently addeth; that *a Proportion is Divided, by interposing Mean proportionals between the Quantities compared:* As if it were one thing to *Submultiply* by 2, another thing to *Divide* by 2: And, of the proportion of 1 to 9, the *Half* (by *Submultiplication*) were that of 1 to 81; and yet the *Half* (by *Division*) were that of 1 to 3: And *Euclide* mistaken when he tells us that *ejusdem dimidia sunt inter se aqualia.*)

But when I had told him in my *Elenchus*, That to *Submultiplie* was all one as to *Divide*; And, that whether

the continued Proportion were of the Greater to the Lesse, or of the Lesse to the Greater, yet still that of the First to the Third was Duplicate (not Subduplicate) of that of the First to the Second. He mends it, in the English, thus; *If the Proportion be of the Greater to the Lesser, as* 4, 2, 1, *That of* 4 *to* 1 *is not onely the Duplicate, but also twice as Great, as that of* 4 *to* 2. (Which yet doth not alwaies hold: For that of $\frac{2}{4}$ to 1 is *duplicate*, but not *twice as great*, as that of $\frac{2}{4}$ to $\frac{1}{2}$; though $\frac{2}{4}$, $\frac{1}{2}$, 1, are in continual Proportion of the greater to the lesse: and that of 9 to 1, is not onely *duplicate*, and at lest *twice* as great, but *thrice as great*, as that of 9 to 3.) *But when the Proportion is of the Lesse to the Greater, as* 1, 2, 4, *that of* 1, *to* 4. (he sayes) is *duplicate, yet not Twice as Great; but contrarily the Half,* of that of 1 to 2. (For, Now, *Duplicate* is not the same with *Double*, or *twice as great*; Yet is to be, again, by and by. For he tells us, Dial. p. 88. *Quicquid duplicatur, fit non minus Duplum quam Duplicatum, &, ut ratio* 1 *ad* 4 *est Duplicata rationis* 1 *ad* 2, *ita etiam Dupla est.* And yet again p. 178. *Rationem* 1 *ad* 4 *Duplicatam esse rationis* 1 *ad* 2; *rationem tamen* 1 *ad* 2 *majorem esse quam Ratio* 1 *ad* 4; *Paradoxa non sunt, Absurda sunt.*)

When he had thus, in his English Edition, mended that of the Latine: He doth yet in his *Lessons* (published at the same time with the English) p. 23. resume what he had laid aside, (that 1 to 4 is not *Duplicate* but *Subduplicate* of 1 to 2;) *Because* 1 *to* 4 *is Lesse than* 1 *to* 2; *and it is Absurd to say, that the taking the same Quantitie Twice, should make it Lesse.* (And yet affirms, Dial. p. 51. *Ex duplicatione aliquid fieri posse aliquando minus.*)

So that the proportion of 1 to 4, to that of 1 to 2, he tells us sometimes, is not Duplicate but Subduplicate; Sometimes, 'tis Duplicate, but not Double; Sometimes, 'tis both Duplicate, and Double; Sometimes 'tis neither Duplicate, nor Double: That, to say, it's Duplicate, and yet Lesse, is sometimes Absurd; sometimes, 'tis very True.

Which

Which minds me of a late Treatise of Yours, that You
were pleased to favour the World withal, concern-
ing *Fluiditie* and *Consistence* : For if, by *Fluent*, You mean
that which is opposite to *Consistent* ; You must needs ac-
knowledge Mr *Hobs* to be one of the most *Fluent* Writers
You have yet met with.

But, what ever become of the Proportion of 1 to 4, in
reference to that of 1 to 2 ; whether it be *Double*, or *Du-
plicate*, or *both*, or *neither* ; Yet, that *Double and Duplicate*
are every where the *same*, he doth oft tells us : That *Euclide*
never useth but one word διπλάσιον for both, (for τὸ διπλά-
σιον is the Neuter both to ὁ διπλάσιος and ἡ διπλασίων :)
That they differ, in what subject so ever, he never yet heard :
That inter διπλάσιον & διπλασίονα *differentiam nullam ob-
servant, neq; Grammatici neq; Mathematici Græci* : nor the
Latines, between Duplum and Duplicatum : That *Euclide
doth use* διπλάσιος *and* διπλασίων (though he never use but
one word) *promiscuously for the same thing* : That by λόγος
διπλασίων (10. def. 5.) *Euclide meant nothing else but*
λόγος διπλάσιος, &c. Less. p. 21, 22, 42, Dial. p. 50,
51, 88. & *alibi*.

And yet, after all this confidence, he doth allow Dial.
p. 101, *That I have deservedly reprehended* Meibomius *for
emending some places of the Ancients by* διπλάσιος *which
should have been emended by* διπλασίων. And, upon confe-
rence, pag. 101. *Thomas* and *Hobs* do both believe, *harum
vocum alium sensum esse apud Mathematicos, etsi non semper,
sæpissime tamen.* And, as we have heard before, he can
sometimes tell us of things *not onely Duplicate, but also
Double* ; others *Duplicate, yet but the Half, not the Double,
or twice as great.*

For his contrary opinion ; he allegeth two things : First,
their *Etymology* (an Argument on which he doth often
lay great stresse in Mathematicks ;) διπλάσιος *and* διπλα-
σίων, (as also *dupla* and *duplicata*) being of a like original,
must needs *signifie the same thing every where* (It seems he
doth

doth not think that a word of an Ambiguous or Lax signification as to Grammar, may, by a Definition, be restrained in Mathematicks to a Particular Determinate sense: x, that τετράγωνον in *Euclide*, however he please to define t, is to be taken for a *Square*, rather than a *Rhombe* or *Rhomboside*; for these have *four corners* as much as that: And in like manner, To *Induct*, and *Induce*; *Conduct*, and *Conduce*; *Refund*, and *Refuse*; *Confounded*, and *Confused*; to *Compound*, and *Compose*, &c. because they are of like Originals, and may in some cases be promiscuously used, may therefore be so used every where, and *do every where signifie one and the same thing without any ambiguity*.) And it doth not beseem a Geometer, (he tells us) *Theorematum veritatem ex Usu Verborum, aestimare*; but *ex rebus ipsis recte conceptis*. Dial. p. 178. (For he hath now forgotten, that *there is no Truth, but the truth of Words*.) But till I shall find others *Inducted* or *Induced* to believe, that 'tis as well said, to *Compound* as to *Compose*, a Verse, &c. I must *Refund* or *Refuse* to be of his opinion; and shall think it *Conducting* or *Conducing* to right speaking and understanding, to observe the *Use* of Words as well as their Originals.

The other is, that in one place of *Euclide*, διπλασίονι is used for διπλασία: And because he thinks it of very great moment, we are told it, at left, four times over, (perhaps oftener) *Less*. p. 21. & 43. *Dial*. p. 50. & 88. 'Tis prop. ult. 9. Euclidis; 'Εὰν ᾖ μετάλϕ ὁποσισῦν ἀριθμοὶ ἐξῆς ἀνάλϕθῶσιν ἐκ τῇ διπλασίονι ἀναλογίᾳ (1, 2, 4, 8, 16, &c.) ὡς ᶆ ὁ σύμπας παρῇ τῷ χρονίᾳ, κỳ ὁ σύμπας δαὶ τ ἐϕεξῆϛ πολλαπλασιασϑεῖς ποιῇ τινα, ὁ γινόμενϕ τέλειϕ ἔται; which doth prove (and 'tis one of the most considerable Observations, if his own, that Mr *Hobs* hath made) that *Euclide* (according to our present printed Copies) doth, in one place, in the ninth book, mention ἀναλογίαν διπλασίονα, in a different sense from what he had, in the fifth book, defined λόγον διπλασίονα. But it doth not prove (what he would have

have it) that λόγος διπλασίων as it is defined in the fifth book, is the same thing with what is called λόγος διπλάσιος, (which what it is, you heard but now out of *Eutocius*, and may, when you please, see the like in *Theon*, *Ptolemy*, and others of the Ancients;) Nor can Mr *Hobs* be so ignorant, as to think, that ἀναλογία διπλασίων in the latter place; is the same with λόγος διπλασίων in the former. (And, left of all will it prove what Mr *Hobs* infers p. 50. that *nulla potest esse ambiguitas in vocibus* διπλάσιος *&* διπλασίων, *quæ idem significant ubique*.)

But the truth is; though, I do not deny but that *Euclide* himself may possibly, some one time, in the use of a Word, Vary from his own definition; yet 'tis so very rare for him so to do, that I do rather believe, that *Euclide* wrote, neither διπλασίους, as we now read it, nor διπλασία, but rather διπλασίων : and that διπλασίους crept in either by the *Negligence*, or the *Over-diligence*, of some transcribers; I mean, that 'twas either unawares mis-written (and such faults in manuscripts, are but too frequent, especially when the transcribers understand little of what they write;) or, which is the more likely, that some person, who knew no more of the difference between ὁ διπλάσιος & ὁ διπλασίων than Mr. *Hobs*, mistaking διπλασίων, which was there the Genitive Plurall of διπλάσιος, for διπλασίων the Nominative Singular of διπλασίους, did instead of ἐν τῇ διπλασίᾳ ἀναλογίᾳ write ἐν τῇ διπλασίων ἀναλογίᾳ, to mend the Syntax, as he thought, when he did indeed marre the sense.

And a like mistake we may very well suppose possible, in *prop.* 20. *El.* 3. (and some other places which Mr. *Hobs* hath not observed;) where we meet with γωνία διπλασίων, perhaps mis-written for γωνία διπλασία : the rather, because this proposition is antecedent to that definition 10 *d* 5 ; and it is not *Euclides* usuall manner first to *make use* of a Technicall word in a former book, and then to define it two books after.

'Tis

'Tis true, that *Euclide* sometimes doth first make use of a word in a vulgar acceptation, which when he comes afterwards to use in a peculiar determinate sense he doth then define. As, having used μέρος *a part*, in the vulgar acceptation, in his ninth Axiome (*The Whole is greater than its Part*,) and afterwards very frequently in the same sense : he doth yet, when he comes to use it for an *Aliquote Part*, give us a Definition to that purpose, *Def. 1. lib. 5.* In like manner, having, in his tenth Axiome, told us, that *Two streight lines* ἠ περιέχουσι, *do not Comprehend a space* (taking the word περιέχειν *Comprehend*, or *Encompasse*, in such a sense as Mr. *Hobs*'s Nurse would have done ;) when he was to use the same word in another peculiar sense, he doth *Def. 1. lib. 2,* so define it ; *A streight-lined Parallelogram is sayd to be Comprehended,* περιέχεσθαι, *by the two streight lines which comprehend the Angle.* And in his tenth Book, prop. 22, 40, 77, being to use the words *Media, Major, Minor,* in a peculiar sense, different from the vulgar acception, he doth there Define them ; though, in the vulgar acceptation, they had been often made use of before. But in a following Book, to Define a Word, which had, *in the same sense,* been often used in the books foregoing, is a thing so unusuall with *Euclide,* as that I beleeve Mr *Hobs* will not be able to produce any one Instance. (For 'tis his constant practise, when ever he takes a word to be of so unknown, or uncertain, a signification, as to need a Definition, he doth never, in that sense, make use of it, till he hath first defined it.) And therefore if he had taken ἀναλογίαν in *Def. 10. lib. 5.* in no other sense, then as he had before used διπλασίω so often, (and διπλασίαν at lest once, if our present Printed books deceive us not,) he would either not have defined it at all, or not so late.

What ever therefore become of the *Word* διπλασίαν ; yet the *Notion* intended by it in that Definition of the fifth Book, (though Mr *Hobs* would have us think otherwise,) is quite another thing from that of διπλασίω in the books fore-

fore-going. And as for the Two *Words*, though he tell us, p. 50, 51, that *they do every where signify the Same thing*, and that *Mathematicians do Never observe any difference between them*; yet I cannot beleeve him; because he tells us p. 101. that *most times they do*, if not allways, observe a difference.

But we have not yet done with λόγος διπλάσιος, *ratio dupla*. That the proportion of 2 to 1, or 6 to 3, is wont to be so called (as well by *Ancient*, as *Hodiern* Geometers, Greek and Latine,) is so notorious, that no man (who reads Books) can doubt it. (And Mr *Hobs*, *Corp*. p. 100. says the same, *ratio 2 ad 1 vocatur dupla; & 3 ad 1, tripla*.) But (*Less*. p. 21. *and Dial*. p. 50. and elsewhere) he cannot understand, how it can be *ratio dupla, double Proportion*. But why not? *Because, Double Proportion must needs be the Double of some Proportion*; now, *of what is 6 to 3 the Double? Is it the double of a Number? or, the double of a Proportion?* 'Tis the Double of a Proportion; of that of 3 to 3, or 1 to 1; as this is the Treble of 1 to 3. For so *Theon* tells us, ἐὰν τριπλάσιόν τινος διπλασιάσωμεν, γίνεται αὐτοῦ ἑξαπλάσιον; (at which *Meibomius* is so much offended,) *If we Double the Treble, we have the Sextuple*, (But the *Duplicate* of the Treble is the Noncuple.) Mr *Hobs*, it seems, did not understand, that, as in *Numbers*, when we say *Two* (indefinitely) we are by common use understood to mean *Two Unites*; but, if we mean twice any other Number, we must expresse it, (as *two Fours*, that is 8; &c;) So, in *Proportions*, when we say indefinitely the *Double*, we are understood to mean, the *Double of the Single*; but if we would be understood of the Double of any other Proportion, we must expresse it, (as the Double of the Quadruple, that is, the Octuple, &c.) Would you have thought that so great a *Mathematician* as Mr *Hobs* (would be thought to be) should need a Commentary, to understand a thing so plain?

Another thing wherein his understanding is *Deficient* is, about the Proportion of Equality, or Single Proportion.

Corp. p. 89. *Leß.* p. 16, 17, 18, 19, 20. *Dial.* p. 45, 46, 47, 102, &c. *The Proportion of Unequalls,* he says, *is a Quantity; but the Proportion of Equalls, is not a Quantity.* Had he sayd the *Difference* of Equalls is not a *Quantity* I could have beeleved him; because they Differ not, or, have no Difference: But why not the *Proportion of E-qualls?*) *Because one Proportion of Equality is not greater than another Proportion of Equality.* (True. Nor one Proportion of *Duplicity* greater then another Proportion of *Duplicity.*) *And 'tis absurd to aske, Quanta est Æqualitas?* (As much as, *quanta est Duplicitas?*) *The Proportion of Equality, as of 5 to 5, is Greater,* he says, *than that of 5 to 6; and leße than that of 5 to 3; yet, these are Quantities, but that is not.* (But why not?) *Because* (he tells us) *Ratio Defectus est defectus Rationis.* (The Reason of Deficiency, in his Apprehension, is the Defect of Reason) And he beleeves, that I cannot design the Ration of Equality, by other than o a Cipher: (Yes; by 1, an Unite: For as 3 is the Exponent of the Triple proportion; and 2, of the Duple; so is 1, of the Single, which is the proportion of Equals; and $\frac{1}{2}$, of the Subduple, &c.: because the Antecedents do accordingly contain their respective Consequents, Thrice, Twice, Once, and *ἡμιόλιος*, Half-once, &c.) And, he says, *Proportions of the Leße to the Greater must needs be Negative Quantities, or leße than nothing, Because of two Proportions, of the Lesser to the Greater, the Proportion Compounded is leße than either;* (Just as when two Fractions, $\frac{1}{2}$ and $\frac{1}{3}$, are multiplied, the Product $\frac{1}{6}$, is leße than either of them: and yet, both those, and this, are Positive Quantities, not Negatives.)

That which hath confounded him in this whole businesse, is that Fundamentall mistake, in deriving *Proportion* from the *Difference,* and not from the *Quotient* of the Quantities compared. For, having so done, because, in Equals, the difference is nothing, he concludes the Proportion to be so too; and consequently, comparing that of

Equality to o, he muſt needs compare thoſe of *Minority*, to leſſe than nothing. Whereas had he aright apprehended the nature of *Proportion*, and derived it from the *Quotient*, not the Remainder ; he would have found that though the *difference* of Equals be *Nothing*, becauſe A — A = o ; yet their *Proportion* is *Single* (not *Nullecuple*) becauſe A) A (1. And, of the Leſſe to the Greater, though the Exceſſe be Negative or leſſe than nothing, becauſe 1 — 2 = — 1 ; yet the Proportion is Poſitive, and denominated by a Poſitive quantity, but leſſe then 1 ; Not, a Negative : Becauſe 2) 1 (½. Which *Merſennus*, and he, not well obſerving, take the proportion of *Equality*, for *No-quantity* ; and *Minority*, for a *Negative*, or *Privative* quantity. As if, the *double*, were indeed *ſomething* ; but the *Equal*, *Nothing* ; and the *Half*, *Leſſe than nothing.*

Nor doth it at all help the matter, to tell us, that by *Ration* he doth not mean a *Concrete*, (the Double, the Equall, the Half;) but the *Abſtract*, or (as he calls it) the *Act of differing.* For (beſide that his words will not bear this Evaſion ; *Ratio conſiſtit in Differentiâ, hoc eſt in ea parte majoris quâ minus ab eo ſuperatur*; where *ea pars majoris*, cannot be *the Act of differing*, but the abſolute quantity by which they differ ;) if this Evaſion be allowed him, it amounts to no more but this, That *to be the double*, is ſomething, (a Poſitive Ration or Relation :) *to be equall*, is Nothing, (No Relation;) *to be Half*, is ſo far from being *ſomething*, that it is not So-much as *Nothing* ; Which I am content to admit for *Half* an Anſwer ; and Mr. *Hobs* for *Half* a Geometrician.

Another Scruple I meet with *pag.* 91. where I am to give a Reaſon why I do (in Geometrical Progreſſion) make uſe of the Letter *R*, to deſign the Exponent of the common *Ration*; Which Mr. *Hobs* thinks ſhould rather be deſigned by *M*, the firſt Letter of *Multiple*. (A profound Inquiry ! Like that of ſome, Why *Homer* choſe to begin his *Iliades*

with M.) I might tell you (were it fit to detain you upon
trifles) That (as himself tels us, *pag.* 90.) this exponent,
which he calls *M*, is *Radix* (of which the severall Powers
come successively to be considered) and might , upon that
account, be fitly designed by *R*, the first letter of *Radix*, as
well as by *M*, the first letter of *Multiplier*.   Next , that
Geometricall Progression , is defined , not by a *Common*
Multiplicator, but, by a *Continued Ration* : and therefore
R, a fitter Letter then *M*, to design the exponent of that
Ration.   That Geometricall Progression may be carried
on, according to any *Ration* whatsoever , as well as the
Multiple ; and therefore fitter to be designed by *R*, than
M; (and it was not fit to *seduce* my Reader, as he speakes,
or, by the letter *M*, to make him think there can be no o-
ther Geometricall Progression , but in *Multiple* proporti-
on.)   And had I (as he would now have me) designed it by
M; I should then have been thus taxed on another account;
What ? Is there no Progression Geometricall, but only in
Multiple Proportion ? Are not 8, 4, 2, 1, and 8, 12,18,
27, in Geometrical Progression ? Yet the Proportion is in
that, *Submultiple.* ; in this , *Sesquialter* ; not *Multiple* in
either.   Next, that this Common Ration , may as well be
continued by Division, as Multiplication ; (and 8, 4, 2,1,
as properly said to proceed by a continued Division by 2,
as by a continued Multiplication by $\frac{1}{2}$;) and therefore
R more proper than either M or D. Next , that I was at
the same time to make use of *M*, (upon another account)
for a *Middle proportionall* ; and D, for Distance ; and
therefore *R* was more at leisure, to designe the *Exponent*, of
the Common *Ration* ; (And I chose that rather than *E*, be-
cause *E* is made use of for the Common *Excesse* , in Arith-
meticall Progression, which I was not willing to confound
with the Common *Ration*, in Geometricall Progression,
though Mr. *Hobs* think, they both consist in the Diffe-
rence.) But, (because I doe not think my self obliged to as-
signe a Reason, why I make use of this or that Symbol, more

than *Euclide* or Mr. *Hobs*, why this or that Line or Point, in a Scheme, is designed by this or that Letter,) *I* shall not insist on any of those Reasons. And, that *I* be not charged with *Double Pleading*, (a fault in Law, though not in Mathematicks,) *I* shall assigne but this one; That, being at liberty to use what Symbol *I* pleased, *I* chose to make use of *R*: And Mr. *Hobs* hath the same liberty to make use of *M*, or *H*, or what he please.

But as *I* did not assigne a Reason why *I* made use of *R*, so, neither hath Mr. *Hobs* assigned *All* the Reasons why he might make choise of *M*, to design the Exponent of this Common Ration. For, (besides what he intimates,) there be some other weighty Reasons, why it was fit he should change my *R* into his *M*.

First, because *pag. 90.* we are thus taught to find this *M*: *Divide the Second term by the First, and the Quotient is M*; which therefore he must not call, the Exponent of the Common *Ration*; (lest it might be thought that *Ration* depended on the *Quotient*;) but, the *Common Multiplier*; which doth a little better disguise the businesse, than if he had designed it by *R*, and told us in expresse words, that *the Ratios was to be found by Division.*

Secondly, because he undertakes (in the same place) to give a *New* way (from what *I* had given) for finding out any term in the Progression; suppose, the Fifth; which is (he tells us) *M M M M A*: (supposing *A* to be the first term, and *M* the Common Multiplier, or the Exponent of the Common Ration.) Now because *I* had said it was *AR⁵* that is *A R R R R*; if he should have retained the letter *R*, it might have been thought his Rule was but the same with mine; (for the transposing of *A* to the last place, which I see first, should scarce have made it passe for a new Invention:) But, transposing of A, and changing the Symbol R into M, makes the Invention perfectly New.

Lastly, because he is by and by (p. 93, 94.) to furnish a discourse of two Pages, between *Thomas* and *Hobs*, about what

may be the meaning of A R⁴, and , *in fine* , not to be abl
to understand it: where as if (without substituting M for R
he had himself designed the same quantity by k R R R A
that is R⁴A, it would have been thought so much the sam
with my A R⁴, that he might have been suspected not t
have been so much an Ignorant, as he would be though
to be.

'Twas Prudence therefore, for these Reasons , to mak
that Change, but (because, *Artificis est , celare artem,*) no
to tell us the Reasons.

But whether it be Prudence to design the *Hundredt*
place by *Ninety-nine* M's with A at the end, (as he direct
pag. 90.) rather by M⁹⁹ A or A R⁹⁹, (a designation com
mon enough, though he will pretend not to understand it
I cannot tell ; unlesse it be to make good what he tells u
pag. 62, that *Symbols are not shorter than words at length.*

Another difficulty *Thomas* meets with, *pag. 86*, which
Hobs cannot resolve, because he is *Artis Musica imperitus*
(And had not both been Ἄμουσοι, it had been no difficulty.)
That, in Proportions, *the Double is compounded of the Ses*
quialter and Sesquitertian, Thomas doth understand, (saving
that he cannot tell how, by *Double*, to understand that of
2 to 1.) And, That *the compound of Diapente and Diatessa*
ron is Diapason, Hobs doth inform him : (that a *Fifth* and
a *Fourth,* in Musick, do make an *Eight*.) But , how Thi
Composition, doth agree with That, they can neither of them
understand.

I must not send him *ad Lyram,* (because he professeth to
e ἄμουσῷ) else the Division of a Chord, might have taught
him the truth of it. I shall only direct him to what his
Friend *Meibomius* (though against himself) in his Dialogue
of *Proportions,* pag. 190. cites out of *Ptolomy's* Harmo-
nicks; τὸ δὲ δὶς διὰ πασῶν ὅπως ἔχει πρὸς τὸ διὰ πέντε ᾗ διὰ
πασῶν τετίσιν, ὁ τριπλασίῳ λόγῳ πρὸς τὸν ἡμιπλασίον
ὃς μεῖζον τὸ διὰ πασῶν πρὸς μεῖζον τὸ διὰ πέντε τετίσιν, ὁ δι-

πλάσιος

πλάσιος λόγ^Θ πρὸς ἡμιόλιον. Ἐὰν γὰρ ἑνὸς ἀριθμῶ ληφθῶσι
τειωπλάσιός τε κỳ τετραπλάσι^Θ· κỳ πάλιν ἡμιόλιός τε κỳ διαπλά-
σι^Θ· ἐπίτειται ποιῶν λόγον, ὅ τι τετραπλάσι^Θ πρὸς τ τρι-
πλάσιον, κỳ ὁ διπλάσιος πρὸς τ ἡμιόλιον· Ὡς τε ὅσῳ συμφωνότε-
ρόν ἐσι τὸ διὰ πασῶν τε διὰ πέντε, τοσέτῳ συμφωνότερόν γίνεται
κỳ τὸ δὶς διὰ πασῶν τε διὰ πασῶν κỳ διὰ πέντε. The Dis-
diapason (two Eights) *is in proportion to the Diapente and*
Diapason (*an Eight and a Fifth*) *that is, the Quadruple Pro-*
portion to the Triple; *as the Diapason (an Eight) to the Dia-*
pente (*a Fifth*:) *that is, as the Double Proportion to the Sesqui-*
alter. (*For if, of the same Number be taken the Triple and*
Quadruple; *and again, the Sesquialter and the Double*: *they*
make the Sesquitertian Proportion; *as well the Quadruple to*
the Triple, *as the Double to the Sesquialter*.) *So that by how*
much the Diapason (an Eight) is more Consonant then the
Diapente (aFifth) *by so much is the Disdiapason(two Eight's)*
more Consonant than the Diapason and Diapente, (*an Eight*
and a Fifth.) From whence he may understand, That
Ptolomy was so much infected with Hodiern Mathematicks,
as to call that of 2 to 1, λόγον διπλάσιον, Double proporti-
on; and that of 4 to 1, *Quadruple* proportion: That *Disdia-*
pason, in Musick, is Quadruple proportion; *Diapason*,
Double proportion; *Diapente*, Sesquialter; and, there-
fore, *Diatessaron*, Sesquitertian: That *the Diapason*, *com-*
pounded of the Diapente and Diatessaron, is the same with
the Duple compounded of the Sesquialter and the Sesquiterti-
an: That *Ptolomy* (as well as *Clavius* and I, with other
Hodiern Geometers) did account Proportions to be in the
same proportion with their Exponents; and, those Propor-
tions to be proportionall, whose Exponents are proportio-
nall; (though Mr. *Hobs*, and his friend *Meibomius* will not
allow it.) Like as but now you heard from Them, that the
Sextuple is Double to the Triple; because their Exponents
6 and 3, are as 2 to 1.

Which brings me to another Objection of Mr *Hobs*. I said
that

that, besides that *Composition of Proportion* already spoken of, by *Multiplication of the Exponents*, (as when the Compound of 2 to 1, and of 3 to 1, is that of 6 to 1; that is, the *Double of the Treble is the Sextuple* :) there is another *Composition*, by *Addition of the Exponents*, (as when we say, the *Double and the Treble* make the *Quintuple* :) Both which Compositions are very frequent both in Ancient and Modern Geometers, (though Mr. *Hobs* will not Believe it, and *Meibomius* doe not Like it :) And both, by *Euclide*, are called *Composition* ; (That, in *Def. 5. lib. 6.* This, in *14 Def. lib. 5.*) And Mr. *Hobs*, if he had not forgot his Lesson, would have said so too. For he tells us, *Lesson p. 8.* that the *Composition of Proportion defined in the 14 Definition of the 5th Book*; *is not the same Composition which he defineth in tht last definition of the Sixth book.* Thus *Euclide, Prop. 9. lib. 6.* Because, *One* part of a Right Line is *Double* to the *Other*; Concludes, That the *Whole* is *Treble.* And why so, but because the *Double and the Single*, make the *Treble* ? (like as their Exponents 2 + 1 = 3.) And, *Prop. 1. lib. 13.* having proved the *Gnomon* to be the *Quadruple* of the Exempt Square, he concludes the *Whole* to be the *Quintuple* of it. Why; but because the *Quadruple and the Simple* make the *Quintuple* ? (like as their Exponents 4 + 1 = 5.) And the like oft elsewhere. And 'tis that *Composition of Proportion,* σύνθεσις λόγε, which *Euclide* defines, in the 14. *Def.* of the 5 Book; but different from that defined in the 5th *Def.* of the 6th Book.

'Tis indeed an Inconvenience, that two so different Notions should, both, be called *Composition*; But 'tis very Ancient, and cannot be now helped. (For whatever remedy be applyed for the future, yet as to the Bookes already written, Ancient or Modern, that Ambiguity will remain.) But 'tis not hard (for one that is willing) to understand, in whether of the two senses the word is used by such or such an Author, in this or that Place. (And to remedy the Inconvenience, as much as might be, as to   wn use of the

Word; I call the one (that of the 6th Book) *Composition by Multiplication* of the Exponents; the other (that of the 5th Book) *Composition by Addition* of the Exponents.

But Mr. *Hobs* findes no Inconvenience in it at all; but makes a great Advantage of this Ambiguity, *Pag.* 51, 52, 53, 87, 88, 116, &c. For, by this meanes, whatever is said of the One, he will be sure to interpret of the Other: and thereby furnish matter of discourse for *Thomas* and *Hobs*, to shew, That it is not true in that sense wherein it was never intended. And whether I say, Composition *by Addition*, or Composition *by Multiplication*, (the termes whereby Modern Writers use to distinguish those two Compositions,) he takes no notice of that at all. For still *Composition* is *Composition*; And *Composition* (what ever it be defined in the 5th of *Euclide*) is in the 6th of *Euclide* defined to be, *by a Multiplication of the Quantities*; And this is also *Addition*; For all *Composition* is *Addition*; for *to Adde is to Put together*; (It seems he did not know that *Composition*, ούνθεσις, is a word common to *Addition*, and *Multiplication*; and that a Number made by the Multiplication of two Numbers, is *Numerus compositus*, and so defined by *Euclide*, 13 d. 7. And himself p. 52. and elsewhere, by *Quantitas composita*, doth mean the *Product of Multiplication*.) And to talk of any other *Addition* or *Composition* of Proportions, than that so defined, is *Wallisian* and *Hodiern*, (and had not *Euclide* been a *Wallisian*, he would not have mentioned any other.) *Clavius*, he confesseth p. 87. did so speak. But *he was a Jesuite*; and, *he took pains for it*: I ought not to *follow him*, and *so easily*. And by this Artifice he hopes at once to blow up, not onely what I had delivered about the two *Compositions* of Proportion (by *Addition* and by *Multiplication* of their Exponents) being the same with the *Addition* and *Multiplication of Fractions*; But my whole Doctrine of *Infinites*, because I there suppose that $\frac{1}{4}+\frac{1}{4}$ is equal to $\frac{1}{2}$ (a *Groat and Two-pence* equal to *Six-pence, or half a Shilling*;) whereas he thinks,

that the Compound of ½ and ⅓ must needs be ⅚. (Which furnishes difcourse for fix or seven pages, p. 116, 117, 118, 119, 120, 121, 122.) And he *Wonders* much, That, not onely *Hugenius, Schootenius,* &c. *fhould commend that Doctrine*; but, *Robervall lay claim to it* (as, he fayth, his manner is) *as an Invention of his, but never published.* (But if Mr *Hobs* had been but half fo good a Mathematician as the worft of them, he would have found as little fault with it as they did. Yet I fuppofe they do not *Wonder,* for us no Miracle, nor thing unufuall, to fee Mr *Hobs* argue at this rate.)

But his friend *Meibomius,* (who doth as little *Like* the Doctrine of *Exponents,* and this *Two-fold Compofition,* &c.) doth, as to the *Antiquity,* differ from him. For whereas Mr *Hobs* takes it to be *Wallifian* and *Hodiern*; *Meibomius* (though againft himfelf) cites to that purpofe, of the Greeks, *Nichomachus Gerafenus, Heronas, Ptolomy, Porphyrius, Theon Smyrnæus, Theon Alexandrinus, Eutocius,* &c. and, of the Latines, *Rodulphus Volumnius, Cardan, Clavius,* &c. (in his *Dialogue of Proportions,* pag. 16, 17, 22, 25, 30, 39, 79, 96, 99, 101, 127, 129, 130, 131, 161, 162, 165, 166, 167, 172, 186, 188, 190, *& alibi.*) and tells us p. 127, that thefe *modern errors* (fo *Coherent* they are with the doctrine of the Ancients) *cannot be refuted, without firft fhewing, That All Antiquity was ignorant,* of what Mr *Hobs* and He would have us take for Truths; (*viz.* Mr *Hobs,* for *Ancient* Truches which we *Hodierns* do not underftand; *Meibomius,* for *New Difcoveries,* which the *Ancients* never knew.) And whereas Mr *Hobs* tells us p. 87, that, *notwithftanding the authority of Clavius, the contrary opinion hath obtained*: *Meibomius* complains p. 167, that *Clavium fecuta eft tota Mathematicorum cohors ad noftra ufque tempora*; And p, 172, 173, *Tanta authoritatis fuit Clavii opinio, ut hanc deinde loquendi formulam omnes Mathematici ufurparint*; And p, 127, that, *Cum Theone, Juniores omnes,* were of the fame opinion. And p. 165.

F *Quod*

Quod Theo *vult &* Eutocius, *omniumque juniorum Mathe-*
maticorum filii. But 'tis very possible, that Mr *Hobs* (so
great an Enemy to *reading of Books*) might well be *Igno-*
rant of all this. But then he should (for the same reason)
have been more sparing in Condemning as *Hodiern* and
Singular, what others know to be so *Ancient*, and so *Univer-*
sally imbraced. (Unlesse he think it a credit, not to have
Read any of those Authors.)

I shall not undertake here, to reconcile *Meibomius* and
Mr *Hobs*, (either each to other, or to themselves.) But
leaving them to agree as they can, shall, before I leave this
discourse of *Proportions*, give You this Brief Account of
what hath been more at large discoursed.

That *Homogeneous* Quantities, (or *Quanta*; for I mean
it, with Mathematicians, of the *Concretes*; not, as in
Metaphysicks, of the *Abstracts*;) I call, (with *Euclide*)
Those which may, each of them, be so multiplied as to exceed
the other. Those which cannot, (as *Line*, and *Time*,) I
call *Heterogeneous* each to other.

That such *Homogeneous Quantities*, are wont to be *Com-*
pared; As to their *Difference*, which is found by *Subdu-*
ction; And, as to their *Ration* or Proportion, (Geome-
tricall, I mean; not that which is called Arithmeticall,)
which is found by *Division*. The *Quotient* of Division
(whether a *True Number*, or Homogeneous to it,) deter-
mining the *Quantity* of that Proportion; and giving *De-*
nomination to it. (As 2, to the *Double*; 3, to the *Triple*;
$\frac{1}{2}$, to the *Subduple*; and 1 (not o) to the *Simple*, or that
of *Equals*; $\frac{A}{B}$, to that of A to B. *&c.*) Which is there-
fore called the *Quantity*, the *Denominator*, or the *Expo-*
nent of the Proportion.

That *Ration* or Proportion, is the *Relation of two Homo-*
geneous Quantities, one to the other, considered as to the Quo-
tient of the Antecedent divided by the Consequent.

That, the *Double*, the *Half*, &c. are *Rations* in the *Con-*
crete;

crete; *Doublenesse, Half-nesse,* &c. *Rations* in the *Abstract,*
(and of Metaphysicall rather then Mathematicall considera-
ration ;) and 2 or $\frac{2}{1}$, $\frac{3}{1}$, &c. the Exponents of those *Ra-
tions.*

That, If the Quotient of one Antecedent divided by
its consequent, be Equall to the Quotient of another An-
tecedent divided by its Consequent ; the Proportion of
that first Antecedent to its Consequent, is Equall to the
Proportion of this other Antecedent to its Consequent :
If greater, greater ; If lesse, lesse.

That, *the Double and the Treble,* is the *Quintuple* ; be-
cause 2 + 3 = 5 : The *Double of the Treble,* is the *Sextu-
ple* ; because 2 × 3 = 6 : The *Duplicate of the Treble,* is
the *Noncuple* ; because 3 × 3 = 9. The first is a *Compo-
sition of Proportions by Addition of the Exponents* : The se-
cond, a *Composition of Proportions by Multiplication of the
Exponents* : The Third, a *Composition of Proportions whose
Exponents are Equall, by Multiplication of those Equall Ex-
ponents* ; (And differs from the second, as a Speciall, from
a Generall : *viz.* a *Composition of Two like proportions,* by
multiplication of their Exponents, is the *Duplicate* ; of
Three, the *Triplicate* ; of *Four,* the *Quadruplicate,* &c. to
one of those like Proportions.)

That the first of these is the same Operation with the *Ad-
dition of Fractions* ; The Second, the same with the *Mul-
tiplication* of Fractions ; And the Third, the same with the
Squaring, Cubing, &c. of Fractions. All *Fractions* (Pro-
per or Improper) being no other than the *Exponents* of
Proportions ; Or, the *Quotients* of the Antecedents divi-
ded by their Consequents.

And with this Account of my Doctrine of Proportions
(which I presume you will not take to be, either so much
Hodiern, or *Unintelligible,* as to Mr *Hobs* it seems,) I will
conclude what I have to say to his fourth Dialogue. For,
to my Treatise against *Meibomius,* which he would seem
there to consider, (that it might not be thought that any
piece

piece of mine passeth unanswered,) he hath nothing further to except, but, *That the Epistle is too long, and too full of Symbols for him to understand, and that I therein cite twelve Verses out of Homer.*

In his Fifth Dialogue he pretends to confute Three other pieces of mine: That of the *Angle of Contact*; Of *Conick Sections*; and my *Arithmetick of Infinites.*

The Result of his Confutation amounts to this. That, in the First, *I have demonstrated what was undertaken;* The Second, *is so full of Symbols that he cannot understand it,* (and therefore it may be true for ought he knows;) The Third might be true also, if $\frac{2}{3} + \frac{1}{2}$ *were equal to* $\frac{1}{2}$, (a *Groat and two-Pence*, equal to *Half* a Shilling;) but, this being absurd, *he Wonders that other good Mathematicians should commend that piece.*

The first of these concerns a Controversy between *Peletary* and *Clavius*, concerning the Angle of Contact.

Euclide had proved, 16 e 3. That the left Right-lined Angle possible, is Bigger than that which is called the Angle of Contact. (And it is allowed by all so to be.) But doth not expressly say whether the *Angle of Contact,* (as it is called) be indeed an *Angle* of any *Magnitude.*

Peletary is of opinion, That it is not; Nor, that it adds any thing to the Angle of a Semicircle. But, that the Angles of Semicircles, are all equall each to other, and to a streight-lined Right Angle. (That the Angles EAP, DAP, DAG, are all equall each to other, and to the Right Angle CAP.) And, that the Arch AE, and the Tangent AP, as to the Point A, are rather to be considered as *Parallels*, or *Coincidents*, than so *Inclined* as to make an Angle.

Clavius thinks otherwise. That the Angle of Contact is an Angle of some Magnitude, though lesse than any possible streight-lined Angle. That the Angle of the Semicircle CAE is not equall to the Right Angle CAP, but a

part thereof ; the other part being the Angle of Contact EAP. That CAD, CAE, Angles of Unequall Semi-circles, are unequall ; as also the Angles of Contact EAP, DAP, DAG.
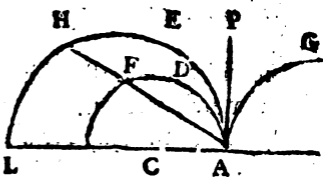
Now, in that Treatise, I take *Peletary's* part against *Clavius.*

And Mr *Hobs* grants the whole ; That *the Angle of a Semicircle* CAE *is not a Part,* but *the Whole,* of the *Right Angle* CAP. (And he had sayd as much heretofore, *Corp. c.* 14. §. 16. *An Angle of Contingence if compared with an Angle simply so called,* which is the present case, *hath such proportion to it, as a Point hath to a Line; that is,* he sayth, *no Proportion at all, nor any Quantity.* Though, since, he hath been much offended with me, for saying *A Point hath no Quantity.* And, *The Angle of Contact,* as it is called, *No magnitude.* 'Tis equall, he sayth ibidem, to an Angle at the Center, made by AB and the same AB : now where the *Crura* of a supposed Angle, come so near as to be coincident, that supposed Angle contained by them, must needs be of no magnitude. And 'Tis equall, he says there, *to an Angle whose Arch is the same point B* ; that is, I think, to an Angle of No-magnitude.) That the *Angle of Contact,* adds nothing to that of a *Semicircle* ; He allows also. And, that Angles of Semicircles are *All Equall,* each to other, and to that of a *Streight-lined Right Angle.* He allows pag. 106. That *I have sufficiently demonstrated,* that in the Angle of Contact there is no Inclination ; *Inclinationem in Angulo Contactûs nullam esse, satis quidem demonstrat:* (though, in the next page, p. 107, forgetting this concession, he affirmes the contrary; *Quin arcus & tangens ad se inclinentur, dubitari non debet.*) In summe ; He grants, that the *Angle of Contact is not an Angle simply so called,* that is, not such a thing as *Peletary* or *Clavius* meant by ^ ... 'e; nor, of any

Magnitude, as compared to such an Angle. (ὕπερ ἦσι Διἷξαι.)

But had Mr *Hobs* stayd here, it might have been thought, that somewhat of mine had not been confuted. And therefore, rather than *say Nothing*, he will say *Nothing to the purpose*.

He tells us, that Though it be not that which *Euclide* (and other Mathematicians after him,) nor what *Peletary* and *Clavius* in that Controversy, call an *Angle*; nor any thing *Homogeneous* thereunto: (But so *Heterogeneous*, that it is *not possible for one definition to comprehend both*, and that it is but an *Æquivocation* to call both by the name *Angle*, p. 40.) Yet, he says, it is *an Angle*, that is such a thing as *He* means by Angle, though not what others mean by that Word. (And he might as well have proved, that *A Horse is an Angle*: For, if he shall please first to *Define*, That, by *Angle* he doth not mean what *Euclide* calls *Angle*, but what others call *Animal*; he may well infer, That A Horse is an Angle, that is, *an Animal*, and of *some Magnitude*.) But was it not a great Errour, that none of us were able to prophecy, In what *New Equivocall sense*, Mr *Hobs* was afterwards to use the word *Angle*? and, apply our discourse in that Controversy accordingly?

Now, though it be no more to the purpose, in this Controversy, to talk of Mr *Hobs*'s *Angle*, than to talk of a *Fishing-hook* (for that also is called *an Angle*;) Yet, since he doth so importunely intrude it, (for we have it in his Book of *Body*, Latine and English; In his *Lessons* at lest twice or thrice; and as oft in his *Dialogues*;) wee'l consider a little, how he doth manage this his New Notion of Angle.

But first he finds fault with *Euclide*, p. 106. that in Defining an Angle, he speaks, *Vulgi more*; which he saies is *very Absurd*. (Yet, a while since he told us, 'twas very absurd *not to do so*, as you heard before: *because* 'tis not the Work of a Mathematician, to determine, *What shall be thus 'led: 'tis the work of the Vulgar to impose Names*.)

He thinks when *Euclide* saies that *Two streight line conteine an Angle*, that he takes *an Angle to be a Superficies* (For *Euclide* tells us, *Axiom* 10, that *Two streight line* Cannot *contain a Superficies.*) It seems when Mr *Hobs* doth so speak (and he doth so speak very often) he takes an Angle so to be.

He is then of opinion, That *two lines may make an Angle though they never meet* ; For fear lest, if he should say, (with *Euclide* and others,) that *an Angle is made by the concourse of two lines*, he must say also, that *two Points, that is, two Nothings make an Angle*: (For he had heretofore told us, that *A Point hath no Proportion to a Line, nor any Quantitie at all, Corp. cap.* 14. § 16. And again, *cap.* 15. § 20, as first printed, *Punctum inter Quantitates nihil est, ut inter Numeros Ciphra;* That, *As a Cipher in Numbers, so a Point in Quantities, is Nothing.* Though he will not allow me to say, that *A Point hath no Magnitude.*)

To the Argument, That, *If the Angle of Contact be a Lesser Quantitie, and the Right Angle a Bigger ; (That, a Part; This, the Whole :)* Then that *may be so multiplied a to exceed this*, (by 5 d 5, and 1 e 10.) When *Clavius* excepts that the Argument doth not hold, because *the Quantities are Heterogeneous* : 'Tis replyed, that *Clavius* making the *one to be a lesse Quantitie, the other Bigger ; and the one a Part, the other the Whole ;* he must, by 3 d 5. confesse them to be *Homogeneous* ; and this *Whole, if Homogeneous to one Part* (that of a Semicircle, as is confessed,) *must therefore be Homogeneous to the Rest,* (the Angle of Contact.) Mr *Hobs* allows all this to be *True*, but *not a good Argument against Clavius.*

To another mistake of *Clavius;* when I said 'twas *False:* Mr *Hobs* confutes me, *pag.* 109. for not having said, that *it was Absurd.* (You may think perhaps, that he blames me for having said too little, thinking that to say, *It is Absurd,* is somewhat more than to say, *It is False.* But that is Your mistake. He thinks it is too much. For *Scaliger's Quadrature*

Quadrature, which makes the 12 sides of a *Dodecagone*, greater than the Perimeter of the circumscribed *Circle*, he doth, in the same page, grant to be *Absurd*; yet he maintains it to be *True, pag.* 142.)

What he saies next, Of *Homogeneous*, making it the same with what others call *Commensurable*; Of *Numbers* not being *Homogeneous* save only when the *things Numbred* be so, &c. I say nothing now, because to this we have spoken already. But we'l come to his Explication of his New *Equivocal* notion (as he calls it) of an Angle. Which I promised but now, because of his importunity, to take some notice of. An *Angle of Contact*, he saies, is an *Angle*; and, an Angle of some *Quantitie*; but its Quantitie. *Heterogeneous* to the Quantity of a streight-lined Angle; this being measured by a Circular, that, by a Streight line; which are, he saies, *Incongruent*; and, therefore, the Quantities, *Heterogeneous*.

I shall not here mind You of what was before maintained by him, that the *Quantitie* of any thing whatever, to the *Quantitie* of any other whatever, is *Homogeneous*, not *Heterogeneous*, (which might make it seem strange, how, of these two *Quants*, the *Quantities* should be *Heterogeneous*:) Nor, that a *streight line* is by and by to be found *Equal* to a *Circular*, (and therefore not *Heterogeneous*:) But, supposing all this to be forgotten, let us see what it is he aimes at.

He first tells *Thomas* (and it is most true,) That *a Circular line is Crooked*. And *Thomas* doth confesse, It is so. He then tells him, that, of Crooked Lines, *some may be more Crooked than other*. Which *Thomas* also grants. He thence infers, *There be therefore certain Degrees of Crookedness*. And *Thomas* cannot deny it. He then observes out of *Galilee*, that *An Arch of a Lesser Circle is more crooked than an Arch equal thereunto in a Greater Circle*. Which when *Thomas* is content to grant, but, doth not understand, He concerns the Angle of Contact: He tells him, That

That *by the Quantitie of the Angle of Contact, he means the Quantitie of Crookednesse of the Circular line.* (Dic quantitatem Anguli Contactus, esse quantitatem Curvitatis peri metri quam consingit.)

So that, in saying *An Angle of Contact is an Angle of some Quantitie, or Greatnesse,* his meaning is no more, but that *A Circular Line is Crooked* : And in saying, *An Angle of Contact is of So-much Quantitie, or is So-Great,* his meaning is, that *A Circular Line is So Crooked.*

Now if this be all he means, I think we need not be difficult in granting, That *a Circular Line is Crooked,* and that it is *So-Crooked,* that is, that every Circular Line hath a certain degree of Crookednesse. But how this concerns the Controversie between *Peletary* and *Clavius,* I do not understand : For, I think, they did not differ about this point, *Whether a Circular Line be Crooked ?* or, *How Crooked ?*

But being, through his importunity, gone thus far out of the Way : wee'l stay a while to conlider, how well he states this *Crookednesse,* and the *Quantitie* of it.

How shall we know, how great is that *Crookednesse,* which he calls the *Angle of Contact,* as to this or that Circle ? Suppose, AHL ?

'Tis *measured,* he saies, *by a Streight-Line, as such,* (linea recta quatenus recta, p. 110.) And if we ask, by what streight-line ? He tells us, pag. 41. *Angulus contactus mensuratur per Lineam rectam ductam a Puncto Contactus ad Circumferentiam.* 'Tis measured, he saies, *by a streight-line drawn from the Point of Contact to* (some other Point of) *the Circumference,* (for so, I suppose, he would have it supplyed.) If you ask, To what other Point ? He means it, I suppose, indefinitely, *Any other Point.* (For he doth not determine any.) Such therefore is the line AH, or AL. (And of such lines 'tis manifest he means it, *pag.* 111. and elsewhere.)

But what, must we say then ? That the Croo'.nesse of

he Arch AH, is equal to the ſtreight line AH ? and, that
f the Arch AL to the ſtreight-line **AL** ? and, the Angle
f Contact EAP equal to this, or that, or any other
uch line ? Or, if not, What doth he mean in ſaying AH,
r AL, is the *Meaſure* or the *Quantitie*, of that *Crookedneſs,
r Angle* ?

If you ſay, He adds there, *The greatneſſe therefore, of two
Angles of Contact is meaſured by a ſtreight line drawn from
he Point of Contact through Both Circumferences* : (ſuch
uppoſe as AFH, or, ABL.) 'Tis true he doth ſo adde ;
But this doth not anſwer my Queſtion ; For I did not
sk, *How great are Two* ; but, *How great is One* Angle of
Contact ? Or, The Curvity of *One* Arch ? For he ſaith,
Angulus Contactus, &c. One Angle is ſo meaſured.

I am loth to think he
ſhould mean (and yet
there is no other meaning
obvious, at left as to one An-
gle of Contact alone con-
ſidered ;) I am loth, I ſay,
to think he ſhould mean,
That the *Angle of Contact*
EAP, is equal to the *ſtreight
line* AH ; For (beſides that it ſeems not congruous to ſay,
that *an Angle*, is equal to a *ſtreight-line* ; as the thing Mea-
ſured, is equal to its Meaſure ;) he muſt by the ſame rea-
ſon, ſay that the ſame Angle is equal alſo to the ſtreight
line AL, or to any other ſtreight line drawn from A to any
point of the Circumference ; and conſequently, that it is
Greater, and *Leſſe*, than it ſelf. (For, that the Archs HA,
and LA, do make the ſame Angle of Contact with AP,
I ſuppoſe he will not deny.) Nor, That *the crookedneſſe of
the Arch* AH, is equal to the *ſtreight-line* AH ; For (beſides
the ſeeming Solœciſm) he muſt, by the ſame Reaſon ſay,
that the Crookedneſſe of the Arch AL, is equal to the
ſtreight line AL, And, conſequently, that the *Crooked-*
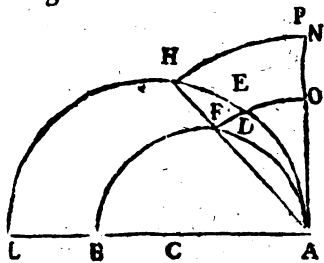
nesse of the Arch AH, to the *Crookednesse* of the Arch AL, is as the *streight-line* AH, to the *streight-line* AL, (as the Chord of that, to the Chord of this,) Which, I think, he cannot in any sense affirm. (Or, if he should, the contrary will easily be evinced, from what he grants, *p.111.* That, the *Curvitie of like Archs is Equal :* and, therefore, the Curvity of the *Unlike Archs,* in the same circle, Proportional to those *Archs,* not to their *Chords.*) If You can tell any other tolerable sense, in which the *Positive* (not the Relative) Quantity of *One Angle of Contact* can be properly said to be *Measured,* by *One Streight-line* ; You may oblige me by that discovery.

But, if You would have me lesse Severe as to this Demand ; and to excuse him as to the *Angulus Mensuratur,* (the Positive Magnitude of One Angle of Contact,) if he can but give a good account of his *Anguli Mensurantur,* (the Relative, or Comparative, Magnitude of two Angles :) I am content so to do.

Yet I must say withall, That it is a favour more than we owe him. For, though that which his discourse tendeth to, be indeed an account of the *Comparative* greatnesse, or *Proportion,* of Two Angles ; by two Proportional streight lines : Yet 'twas more than he was aware of. For he thought he had been determining the Positive Greatnesse of One Angle ; (and doth pretend to have done it.) And therefore in his *Lessons* (from whence he doth but transscribe his Dialogues) *pag. 3.* After he had given this account of the *Angle of Contact's* Positive greatnesse ; he proceeds to speak of the *How much Comparatively,* or the *Proportion of Two,* one to the other ; as quite another thing.

And when we have allowed him this favour, he is not very happy in the managing his Notion, even as to the Comparative greatnesse of two.

For suppose we, first, the Quantity of the Angle of Contact EAP, or of the Curvity of the Arch AH, to be

designed by the Chord AH (as he directs, *Dial. p. 41.*
Angulus contactus mensuratur per lineam rectam ductam
puncto contactus ad circumferentiam; and *Less. p. 4. The*
Measure by which an Angle of Contingence is measured, is the
streight-line intercepted between the point of Contact, and the
Circumference of The Circle; that is, I suppose, of the
Same Circle, not of another:) We are then (by the same
directions) to design the Quantity of the Angle of Con-
tact DAP, (whose comparative greatnesse to that other we
are to consider,) by such another line so drawn from the
Contact to the circumference; yet not drawn at pleasure
(as that first was,) but by AF, a portion of that first line
AH; (for so we are directed *Dial. p. 41.*) to the end
that the Archs AH, AF, may be like Archs.

Now You may expect per-
haps, that the Angle of Con-
tact EAP to the Angle of
Contact DAP; or the Curvity
of the Arch HA, to that of
the Arch FA; should be as
the Chord HA, to the Chord
FA, (the measure of that, to
the Measure of this:) But
'tis far otherwise. For EAP
which Mr *Hobs* will have to be the *Lesser* Angle; and the
Arch HA, which, he saies, is *lesse* Crooked; have the
Greater Measure: (The Chord HA being manifestly
greater, than the Chord FA, a part of it self.) And Mr
Hobs himself confesseth it, *Dial. p. 111.* and *Less. p. 3.* And
therefore he doth not say, As the *Chord to the Chord, so the
Curvitie to the Curvitie*, respectively, or the *Angle of Con-
tact, to the Angle of Contact*, (Which should have been
the Proportion, if those had been the Measures of these:)
But, As the *Chord of the Greater Arch*, to the *Chord of the
Lesser*: so (contrarywise) the *Curvity of the Lesser*, to the
Curvitie of the Greater; and the *Angle of Contact* made
by
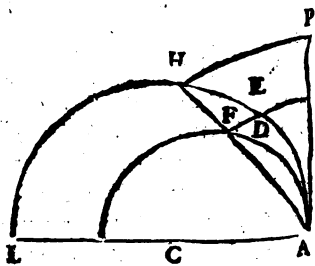
by that, to the Angle of Contact made by this.

Those *streight-lines* therefore are not the Measures (as he pretends) of the *Curvitie* of their Respective archs, as to their *Positive* Quantities ; Nor yet, as to their *Comparative* Quantities, the Proportion of Those, the Measure of the Proportion of These : (But the *Inverse* rather of that Proportion.)

So that, though there be a Truth in that Notion of *Galilee* (that Equal Archs are more Crooked in Lesser than in Greater Circles;) and none, that I know of, did ever doubt it : Yet Mr *Hobs* hath (unhappily) so mis-managed a good Notion, as not to Advantage, but rather Prejudice, himself by it.

But there is yet a greater Mischief: and that which strikes at the Foundation of what Mr *Hobs* would build upon it. The thing he aimes at, is to prove, That the *Angle of Contact*, hath a *Positive Quantitie*, but *Heterogeneous* to the Quantity of a *streight-lined Angle*. (For, unlesse Heterogeneous, he grants that it hath none at all.) But, why Heterogeneous ? *Because* (he tells us, pag. 110.) the *Measure of a Streight-lined Angle is Incongruent* with the *Measure of an Argle of Contact*. But why Incongruent ? Because *Angulus rectilineus non mensuratur per Lineam nisi Circularem , & quidem quatenus Circularem ; mensura autem Anguli Contactus est Linea Recta quatenus recta ;* That is, *No Line but a Circular can measure a streight-lined Angle ; and none but a streight line, the Angle of Contact.* And upon this foundation lies the whole weight of his Discourse. (For if either Both may be measured by Circular, or both by Streight Lines ; he hath then nothing to say, why, if Quantities , they are not Homogeneous.)

Now that *streight-lined Angles may be measured by Archs of Circles,* (that is, the Proportion of Angle to Angle, by the Proportion of Arch to Arch ;) I grant: (though not by these onely,) But *that the Angles of Contact* (as he

speaks

speaks) that is, *the Curvitie of Archs*, (as he explains himself,) *are measured by Streight-lines, as such, and by such onely*; I shall not grant him, nor can he evince. For if, as he affirms, *the (*Comparative)*Curvity of the Archs* HA, FA, (that is, the Proportion of those Curvities, or rather the Inverse of that Proportion,) *be measured by the (*Comparative)*Length of their Chords*, (that is, by the Proportion of those Lengths;) it will be as much measured *by their Own Lengths*. For, since that *like Archs* are proportional to *their Chords*; what ever Proportion is measured by that of their *Chords* will be as much measured by that of those *like Archs* themselves, (for 'tis the same.) They may therefore, as much, be measured by *Circular*, as by *Streight* Lines. Which *destroyes the Foundation of Mr Hobs's* Discourse. Again, If on the Center A, we suppose Two Archs drawn from the points H, F, cutting the Tangent A P, in N, O. Those Archs HN, FO, will, as much as HA, FA, their Semi-diameters (because proportional to them,) measure the Respective Angles of Contact EAP, DAP. They may therefore as much be measured by the length of Circular, as of Streight Lines: And, Mr *Hobs's* Hypothesis comes to nothing.

But (to distinguish what Mr *Hobs* would confound) the *Angle of Contact*, and the *Degree of Curvitie*, are not the same, but very different things.

'Tis very true, which Mr *Hobs* observes out of *Galilæ*, that *Archs of Lesse Circles are more Crooked.* For, as the *same Quantitie of Heat*, in a *Lesse Quantitie* of Matter, makes a *Greater Degree of Heat*; or, as we use to speak, makes the Matter *More Hot*: So the *Same Quantitie* of Crookedness in a *Shorter Line*, makes a *Greater Degree* of Crookedness as to each part of it; Or, as we use to speak, makes the Line *more crooked*. And therefore, there being in Like Archs, though Unequal, the *same Quantitie* of Crookednesse (as Mr *Hobs* acknowledgeth, p. 111.) there must be, in the *Shorter* of those Like Archs, a *Greater Degree* of Crooke dnesse:

Crookednesse : (And the *Degrees* of Crookednesse, Reciprocal to the *Lengths* of thoſe Like Archs.) But, whether we ſay, The Proportion of thoſe Degrees of Crookedneſs is Reciprocal to that of *their Own Length* ; or, to that of their *Chords* ; is all one (ſince the Proportion is the ſame of Both ;) and Mr *Hobs* his conceit, of being meaſured by *Streight*, but not by *Circular* lines, is but a Fanſy.

But the *Angle of Contact*, whether of Greater or Leſſer Circles, is ſtill the ſame ; that is, *of No Magnitude* in either. For, ſince that the *Angles of Semicircles*, CAD, and CAE, be, by Mr *Hobs's* own grant, Both equal ; and, equal to CAP ; the *Angles of Contact* DAP, and EAP, muſt be likewiſe *equal*, and, *of no Magnitude*.
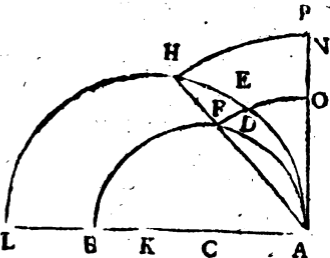
Or thus ; The two Mixt Triangles, HEAN and FDAO, are *Like Figures* ; For, all the ſides of the One, being Like, and Proportional, and in like Poſition, with thoſe of the Other ; the Figures muſt needs be Like: (and Mr *Hobs*, I ſuppoſe, will not deny them ſo to be ; or, if he ſhould, 'tis eaſily proved from his own grants, by drawing the Semidiameters HK, FC ; for then theſe Triangles will be the Remainders of Like Quadrilaters, abated by Like, Proportional, and Like-ſited Sectors ; and muſt therefore themſelves be Like, Proportional, and Like-ſited :) And therefore, (becauſe, in Like Figures, the Reſpective Angles are Equal,) the Angles of Contact EAO, DAO, though of Unequal Circles, are equal Angles.

Or thus. The four Angles of a Square, are equal to four Streight-lined Right Angles. Now, if in the Square ABCD, be inſcribed ABD the quadrant of a Circle; inſtead of thoſe Four, we have Six Angles (if thoſe of Contact

be reckoned for Angles,) equal to thofe Four; Thofe of the Quadrant at E and F, Mr *Hobs* grants to be equal to Two ftreight-lined Right Angles; and thofe at A and C, are two more: So that the Angles of Contact, at G and H, ftand for Nothing, or Angles of no Magnitude. (I mean; If, by *Angle*, Mr *Hobs* mean that which Others call an Angle; and, by *Magnitude*, what they call Magnitude. But if he lift to *Equivocate*, or to give Nick-names; they muft be what he

will pleafe to call them. And, if by *Angle*, he mean *an Arch*; and, by *Magnitude*, *Crookedneffe*; it is confeffed, That an *Arch* is *Crooked*.)
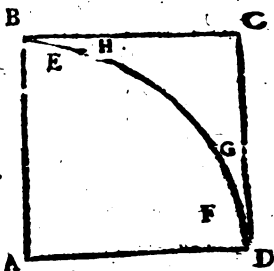
I have deteined You too long in this Digreffion concerning *Crookedneffe*; which, though not appertaining to the bufineffe in hand, the Importunity of Mr *Hobs* would needs put us upon. Otherwife, I need not have faid more to what he faies of my Treatife concerning the Angle of Contact; but, that he grants all that I undertook to prove.

To my Treatife of *Conick Sections*, 'tis very little he hath to fay, and will be fatisfied with as fhort an Anfwer.

When I fay that, according to the (now-received) Doctrine of *Indivifibles*; *A Plain Figure is fuppofed to confift of Infinite Parallels, or Parallelograms of Equal Altitude*; (and, in what fenfe, I had there fhewed plain enough, beyond a poffibility of miftake:) He will, by *Infinite*, underftand *Infinitely Great*: (For, fince that *Infinite*, in the Plural, doth fometime fignifie, *infinitely Many*; and fome time, *infinitely Great*; Becaufe he knew I meant the One, he thinks it a piece of Wit to interpret it of the Other.) Then inftead of *Æque-altis*, he thinks fit to read *Æqualibus*,

libu, and difcourfe upon it; (For want of Spectacles, I fuppofe; not, with a defign to Falfifie.) Then, he is not pleafed that I fhould fay, *An Aliquote part infinitely fmall*; For *Aliquot* fuppofeth a *Number*, which *Infinite* excludes. (Yet he had juft before blamed me for not faying *numero infinita*: And he had faid himfelf, in the page foregoing, p. 111. *in partes Totidem, quæ funt numero Infinita*: It feems that *infinita numero*, may be *totidem*, but not *totquot*, much lefse *aliquot*.) Then, he is of opinion, That if we fuppofe any Quantity, how big foever, to be divided into an Infinite number of parts infinitely fmall; the *Aggregate of all thofe parts* is Equall to *Nothing*. (He doth not know, it feems, that an Aggregate of all the parts, whether few or many, is equal to the Whole.)

Next, he thinks I fhould have proved here; And, *pag.* 155, 156, that I fhould have inferred elfe-where; That, the *Surface of a Cone, is, to the Surface of a Cylinder of the fame Bafe and Altitude; as* 1, *to* 2. But I am not of his opinion; For, the Propofition being Falfe, ought not to be Proved, or Inferred, in either place. And the Reafon why I did it not, is, becaufe I do not love to argue like Mr *Hobs*. Nor do I think with him, that the *Surface* of either Cone or Cylinder, (more than the *Perimeter* of a Triangle or Parallelogram,) is determined by the *Bafe and Altitude*; (though indeed the *Content* be both there and here fo determined:) For, the *Bafe and Altitude* remaining the fame, there may be yet infinite varieties of *Surface* there; and of *Perimeter*, here: (as none, but Mr *Hobs*, can be ignorant.) But, if, for *Altitude*, he put *Latus*; the Propofition will thus be true (and might have been affirmed in either place, though it were not neceffary fo to be,) *viz. The Surface of an (Erect) Cone, is, to the Surface of Any Cylinder of the fame Bafe and Latus, as* 1 *to* 2.

Then he fuggefts a *Limitation* to my tenth Propofition, as if it were not otherwife true. But 'tis his miftake. The

proposition needs it not. For the Section mentioned (without his limitation) can be no other but *Parabolical*. All Sections of a Parabolical Pyramidoeid, made by Plains lying in the Axis (though not passing by opposite angles of the Base) are Semi-parabola's, (whose common Vertex and Diameter, are the same with those of the Pyramidoeid,) but of different breadth according to their different positions.

He then tells me, (as though I had not known it,) That the *Cuneus* in my eleventh Proposition is (he thinks,) a *Prisme*. But 'tis no news, for I had first told it him at the same place. For it is there called *Cuneus sive Prisma*.

He then says, that *there may be taken* (and, doubtlesse, there may) *in the Diameter of a Parabola,* (yes, or in any other streight-line what-ever, if but long enough,) *a streight-line equall to the Parameter or Latus-rectum.* (But he should have shewed, That *it cannot be any where else* ; if he would have proved, what he aims at, That the *Position* of the Parameter is as much determined , as the *Length.*)

The rest he summs up, with this generall Confutation, *Tis full of Symbols* ; And, *He cannot understand it.* (Which I shall easily grant.)

I have repeated to you these particulars ; Not, because I think they deserved an Answer, (for whosoever consults the places to which they refer, will see them to be but Cavills ;) But, that You might thereby see, What kind of Discourse it is, which Mr *Hobs* accounts a *Confutation.*

To my next Treatise, *The Arithmetick of Infinites,* (though that must be confuted too,) He hath yet lesse to say. For beside that he *cannot Understand,* how $\frac{1}{2}$ can be equall to $+\frac{1}{6}$: of which we have spoken already ;) it is but this.

¬   rst Proposition, he saith, *is True.* The *Second,*

he sayth, *is the Same with the First* ; *and, Therefore, False.* (A good Consequence ! Yet *Less. p.* 46. he sayth, that *Both are True.*) But, to *prove* it false, he will take *another time.*

He is, next, of Opinion, that there cannot be supposed *an infinite number of terms continually increasing,* unlesse the *Greatest be Infinite.* (And yet he doth at the same time allow, That, in a Triangle, there are an infinite number of parallel lines so increasing, of which the Greatest is the Base.)

He then sayth, That *my Fifth Proposition,* (with its Consequents,) I do, at the thirteenth, *Confesse to be false.* But, if you consult the place, you will find no such Confession. The Proposition is true, with all its Consequents : so understood, as he knows it was intended. And his Cavils against it in his *Lessons,* have been abundantly answered ; *Due Correction, pag.* 44.

At length, He *Wonders ; Why Hugenius, Schooten, Robervall,* &c. should *commend my Mathematicks,* when as never any Mathematician commended His ? (The reason is, Because His, and Mine, are not alike.)

His *Universall Demonstration,* as he calls it, *p.* 123, is not worth the Confuting. Yet, because it doth not concern my self, I am content that Mr *Hobs* may believe it is a good one. Onely I have therein taken notice of one Advantage of Mr *Hobs* his writing Dialogue-wise, more than I did observe before. For, by this means, when *Hobs* hath occasion to *Assume* what he cannot *Prove, Thomas* can by a *Manifestum est,* save him the trouble of attempting a Demonstration. And when the Demonstration attempted doth not succeed, he can relieve him, with a *Claritudinem per se tantam habet, Fere, ut possit haberi pro Axiomate.*

I have now done with his Five first Dialogues. Which are but his *Lessons* put into a *new Dresse* : And therefore do not indeed need an Answer : But were Answered before they were written.

His *Sixth Dialogue* is indeed moſt of it New, but doth little concern me; (as not being directed againſt any thing of mine ;) But contains a new Effort, of his former Deſperate Adventure, of *Squaring the Circle*. (For, it ſeems, His own *Mathematicks*, need *Emendation*.)

How many Quadratures, firſt and laſt, Mr *Hobs* hath furniſht us with ; I cannot preſently tell You. But that they are all true, and all the ſame, I ſuppoſe he would have us beleeve. For though he have formerly confeſſed ſome of them to be miſtakes ; yet he hath now revoked thoſe confeſſions, and thinks them to be true. *pag.* 149, 150, 159, &c.

His *Firſt* Quadrature, *Corp. cap.* 20. p. 169, (as firſt printed,) or *p.* 170, (as afterwards) ſuppoſing the Radius 1.00000,00, makes the Perimeter 6.28385,11, *proxime.* (as I have computed it for him, *Elench.* p. 102. according to his Conſtruction.) Whereas its true greatneſſe is more than 6.28318,53, but leſſe than 6.28318,54. as hath, by divers, been demonſtrated.

His *Second* Quadrature (though he pretend it to be the ſame) *ibidem p.* 171. (as firſt printed) makes the Perimeter (as he computes it by the Table of Sines) to be 6.28317,60 ; or (more accurately) 6.28317,65, *fere.* The former made the Perimeter too big ; This, too little.

Inſtead of theſe Two (which he takes to be the ſame) we have *pag.* 170, (as reprinted) an *Epitome* of the Firſt, but confeſſed to be falſe : For which therefore he there ſubſtitutes a Third, pag. 171, &c.

This. *Third* Quadrature pretends not to an *Accurate*, but onely a *Quam-proxime.* (Nor is that, Truly performed ; as we have ſhewed *Elench. pag.* 119.) nor doth he there conclude of any certain Proportion.

A *Fourth* Quadrature he gives us, *ibid. p.* 174,175,176. But, in the Conſtruction, requires, as a neceſſary *Poſtula* That we firſt know how to take a *Streight-line* equal

to *a Sixth part of the Perimeter*: Without which, he can conclude nothing. And this also, *pag.* 181. is given for loſt, as well as the three former.

A *Fifth* we have in his *Engliſh Edition, p.* 214. The reſult of which (reduced to Numbers) makes the Perimeter to be more than 6.28384,93. which is too big.

A *Sixth, ibidem, p.* 221. Which, though with him it paſſe for one, You may call as many as You pleaſe. For the Proportion varies, according as the Arch varies to which he applies his Rule ; (which, he ſays, may be any Arch not exceeding a Quadrant.) As for example. If he apply his Rule to an Arch of 90 Degrees ; the Perimeter will be more than 6.54353,39. If, to an Arch of 60 Degrees ; it makes the Perimeter 6.42070,44, *proxime.* (Both very much too big.) And a like variety in other Arches.

A *Seventh* there is, at leſt attempted, *ibid. p.* 223. But it comes to no other iſſue, but this, *He thinks*, and, *is almoſt out of doubt*, but *cannot demonſtrate* ; that ſuch a ſtreight Line is equall to ſuch an Arch ; and *will therefore leave it to be further ſearched into.*

An *Eighth*, we have in his *Leſſons, p.* 52. Where, pretending to make good his Firſt, he gives us another inſtead of it. It differs from the firſt, in this, That the firſt, determining a particular Arch, (*viz.* BI an Arch of 30 Degrees,) did thereby at leſt determine ſome Proportion (though not the right, as was ſayd before:) But This, not determining the Arch BI otherwiſe than that it be *leſſe than* the *Radius* ; leaves us at liberty to chooſe any ſuch Arch : and ſo leaves the Proportion at as great uncertainty, as in the Sixth Quadrature. And ſo, inſtead of *One* Quadrature, it gives you (either *None* at all, or) as *Many* as You pleaſe. For, as the Arch varies, the Proportion varies too. As for example. If the Arch BI be 30 Degrees ; Suppoſing the *Radius* 1.00000; the *Perimeter* will be more than 6.28385 ; If the Arch BI, be 14 degree

degrees ; the *Perimeter*, will be 6.28329. *proxime.* Both, too big. And the like variety in other Archs.

The four first of these I have at large confuted *Elench.* p. 97. &c. the latter four I have answered Sufficiently (though not so Largely) *Correction*, p. 127, 128, and *Dispunct.* p. 11, 12. and shewed them to be all False. But Mr *Hobs* doth not think fit to take any notice of that at all : And therefore tells *Thomas, Dialog.* p. 149, 150. that *Tacent adversarii* ; and thence concludes, those Quadratures to be all *True*, and all the *Same*, with what he there delivers in his sixth Dialogue. But *I* shall not therefore think it necessary, to Confute them over again : Nor yet to spend much time on those that follow, in his Dialogues.

His *Ninth* Quadrature, *Dial.* p. 142. concludes (with *Joseph Scaliger*) that *Perimeter potest decem diametros*: Which, supposing the *Radius* 1.00000,00. makes the Perimeter, more than 6.32455,53 ; (which is, indeed, lesse than 6.28318,54.) 'Tis, he confesseth, inconsistent with what *Archimedes* pretends to demonstrate ; and, after him, *Clavius* against *Scaliger* : Yet would not have *Thomas*, thereupon, discouraged ; because he hopes to confute them all. And tells us, that, *if he do not clearly Demonstrate to him* (and 'tis a great attempt) *Arithmeticos Cyclometras omnes hac in re deceptos esse*, he will give him leave *to think as* Clavius *and others do* ; and, to *speak his pleasure.*

The grand mistake (for *I* do not intend to trouble you with all the lesser faults) in the long processe of this Quadrature, lyes in the *twenty fifth Proposition*, (which is it self *False*, and the three which follow it.) His *Quod est impossibile*, in the Demonstration, is a mistake. And his proof of it, is wholly inconsequent ; *viz, Nam, cum sit, ut arcus* εθ *ad rectam* ιμ, *id est, ad arcum* ηζ, *ita arcus* ηζ *ad rectam* στ ; *media proportionalis inter arcum* εθ *& rectam* στ, *erit ea ——— la qua media est inter* ιμ *& στ.* That is, *Because*

ϑ, is to ιμ == nζ, *as* nζ *to* στ ; *Therefore, the Mean-proportionall between* ϑ *and* στ *will be the same with the Mean-proportionall between* ιμ *and* στ. Which consequence is so grosse, that it needs no Confutation. He should rather have concluded, *therefore the Mean-proportionall between* ϑ *and* στ *is* nζ *or* ιμ ; which is no Inconvenience at all, and therefore doth not prove the Supposition *Impossible.*

You might think perhaps (to help salve the Consequence) that he might have, before, somewhere proved, that *nζ is a mean-proportionall between* ιμ *and* στ : But there is no such thing any where proved, or, so much as mentioned, save onely in the words cited.

Again in the Demonstration of *Prop.* 26. those words lin. 15. *Erit ergo ut* ½ *Radius ad arcum* ʃg *ita* ½ *Z ad, arcum* ξω ; are not proved at all (unlesse he suppose that they follow from the precedent proposition, which is it selfe false :) nor are they true. 'Tis true, that the streight-line χψ bears such proportion to the Arch ξω ; but, that χψ is the same with ½Z or equall to it, is not true ; nor, what depends upon this supposition.

And therefore this ninth Quadrature (*prop.* 27.) which depends upon the truth of those two, *prop.* 25, 26, is false also. Nor is it consistent with what *Archimedes* demonstrates, as himself confesseth.

He doth then, from this Quadrature, (how truly, *I* will not dispute) infer *prop.* 28. (which he thinks to be a *Confirmation* of it, *I* should rather call it a *Confutation,*) That, *the Radius together with the Tangent of* 30 *degrees, are equall to* BF ; (whose Square, he sayth, is equall to 10 Squares of the Semiradius.) Wee'l try.

Suppose the *Radius* to be	1 R
BF will then be	½ R √10.
The sine of 30 degrees	½ R
The sine of its Complement,	R √¼, or ½ R √3.
Therefore, As ½ √3, to ½ ; so is R to	$\begin{cases} \frac{1}{\sqrt{3}}R, \text{ or } \frac{1}{3}R\sqrt{3}. \end{cases}$
the Tangent of 30 degrees	

But this Tangent added to the Radius, (fayth Mr *Hobs*) is equal to BF ; that is $1R+\frac{1}{2}R\sqrt{3}=\frac{1}{2}R\sqrt{10}$. (An *Irrationall* line equal to a *Rationall*.) Which is the refult of his Quadrature. But whether it Confirm or Confute it, I fhall leave to you to judge.

His *Tenth* Quadrature, fuppofing the Radius to be 1,00000, makes the Perimeter more than 6,30940, (which is, in truth, leffe than 6,28319.) For fo much is the Quadruple of BF, a line which is to the Radius, as $\sqrt{3}+1$, to $\sqrt{3}$. For, by conftruction, as $XA=R\sqrt{3}$, to $AD=R$, fo is $XAB=R\sqrt{3}+R$, to BF : which Mr *Hobs* tells us, *prop.* 39, is equal to the Arch of a Quadrant.

The grand miftake of this Quadrature lyes in *Prop.* 34, 35. For having *prop.* 33. taken BL*a*, double to BL ; he doth *prop.* 34. take for granted (which he fhould have proved) that the Point *a* lyeth in the line XDF : whereas, indeed, it lyeth beyond that line ; and, confequently, the line *aa* lyeth not in the line XDF as he fuppofeth ; nor is XD a part of *aa*, but parallel to it ; therefore the point *a* falls not upon X, as he would prove, but fomewhat below it : nor doth the line *aa* come at all at D, nor the line DF come at all at *a*. So that his pretended Demonftration, which fuppofeth all thefe things, comes to nothing.

And that which follows, *prop.* 35. fhews onely how good Mr *Hobs* is at Adding Surd Numbers. For he there affirms that *Recta quæ poteft Tres Semiradios, affumpta quarta parte Diagonalis (five Subtenfa graduum 90,) poterit Sex Semiradios.* That is $\frac{1}{2}R\sqrt{3}+\frac{1}{4}R\sqrt{2}=\frac{1}{2}R\sqrt{6}$, (an Irrationall Line equal to a Rational ; as once we had before.) Yet this he undertakes to demonftrate too. But, in the Demonftration, his *Quod eft abfurdum*, is a miftake. And, what he brings to prove it, *For sh st cannot be parallell*, is very True, but is Nothing to the purpofe. He fhould have fayd (to prove what he intends) that sh rt *cannot be* But this he fays not, nor is it true ; and there-

fore no Abſurdity proved in the Suppoſition ; Nor doth the line *tr* in true conſtruction (however Mr *Hobs* have pleaſed to draw it) come at *s* at all ; but, is parallell to *bs*.

And, *prop.* 36. which depends on them, is falſe alſo. And what is brought for proof, *viz.* λ *b poteſt 24 Semiradios*, (that is R√3+R√½=½R√24.) is but like the reſt.

And *prop.* 38. is alſo falſe. The Demonſtration failes in that clauſe pag. 148. *lin.* 13. where 'tis ſayd that, *the two Archs deſcribed, one by the Radius* AB, *the other by the Radius* no, *cut each other* (in medio rectæ *lm*) *juſt in the midſt of the line lm* ; which is not ſo. They cut indeed each other, but not *juſt in* the middle, but *over* the middle of that line.

And conſequently his Quadrature *prop.* 39. built upon theſe Props, falls with them : (Notwithſtanding the Approbation which *Thomas* gives him, p. 149. *Abſque dubio ita eſt. Æqualis eſt exactiſſime.*) And therefore he needed not have taken the pains to Apologize p. 149, 150. for Retracting his Firſt Quadrature ; which both *Thomas* and *Hobs* do now beleeve to be *True*, and *the ſame with this* ; (though miſtaken in both ; 'Tis neither *True*, nor the *Same* ;) and that therefore 'twas unadviſedly done to remaẽt it. 'Twas his Modeſty, he tells us, to *ſuſpect his own Demonſtration, rather than Archimedes's*, when he ſaw that Both could not conſiſt. But, having now conquered that Modeſty, he doubts not to Aſſert his own for truth ; and, that *Archimedes*, with all that follow him, were miſtaken. And herein, he hath (he tells us) an advantage, even over *Joſeph Scaliger* himſelf ; For *Scaliger*, having once quitted his Quadrature, did never after reſume it ; but Mr *Hobs*, (a perſon of greater Courage) hath dared (*quam abjecerit reſumere*) to ſwallow a ſecond time, what he had once caſt up.

But having thus triumphed not over *Archimedes* onely, but *Joſeph Scaliger* ; he proceeds further to ſatisfy *Thomas*,

mas; Who, though *he do now no longer doubt but that Both are true*, yet is not satisfied that *the Ninth and Tenth Quadratures do both Agree* upon the same Proportion.

He therefore undertakes to prove, *Prop. 40.* that BF (which is to the *Radius* AD, as XA increased by the *Radius* AB, is to the same XA, whose square by construction is Triple to the Square of the *Radius*) *potest decem semiradios* (is equal in power to Ten squares of the *Semiradius* 5) that is, that $\frac{\sqrt{3}+1}{\sqrt{3}}R$, or $R + \frac{1}{2}R\sqrt{3}$, is Equal to $\frac{1}{2}R\sqrt{10}$. But in his first Demonstration of it, his *Dividit Ergo, &c. pag.* 150. *l. ult.* is no good consequence; and therefore 'tis not proved that *xqu, Bqξ*, are equal angles; nor, what he infers from it, that $X_B (= R\sqrt{3}+R)$ *potest* 30 *Semiradios*, or is equal to $\frac{1}{2}R\sqrt{30}$. In his second demonstration, his *Quare omnes anguli*, &c. is no good inference.

There be yet two Difficulties, *pag.* 151, 152. which make *Thomas* begin to question whether somewhat be not amisse in *Hobs*'s Demonstration; (till *Hobs* by a *Ne metue*, delivers him from that fear.) First he observes that *the Arithmetical Calculation doth not agree with his Geometrical processe.* For whereas he pretends to demonstrate that the Square of BX, that is, of $R\sqrt{3} + R$, or of $\frac{1}{2}R\sqrt{12} + \frac{1}{2}R\sqrt{4}$, is equal to 30 squares of $\frac{1}{2}R$ the *Semiradius*; 'tis yet confessed, that the Product of $\sqrt{12} + \sqrt{4}$ multiplied into it self produceth indeed somewhat more than 29, but lesse than 30. (And the like in some other calculations.) Next, he thinks it to be an inconvenience, that *the streight-line* $X \sigma \tau$, *should Cut at* σ, *and Touch at* τ, *the same Circle.*

Now because it is very possible that your self may doubt, as well as *Thomas*, that *Hobs*'s Demonstration (attended with these two Inconveniences) may not be every way Exact; I shall give you his own Answer; (For, I doubt, none but himself can answer those Objections.)

He

He tells him, therefore, It is but a γοη]εία, a *bewitching fanſy* that poſſeſſeth ſome men (who know not how to allow a Point or Line, bigneſſe and breadth enough) to think tha (Mr *Hobs's*) *Geometrical Demonſtrations*, ought to abide the Teſt of an *Arithmetical Calculation*. But he hath a δαυναλεψ]ημα before which this γοη]εία will never be able to ſtand. His *Lines*, he tells him, are not like the Lines of other men, (things of no Breadth or Thickneſs,) but carry *ſome Breadth* with them: So that while the *Inner-ſide* of his *Line Cuts* the *Circle* at σ, the *Outer-ſide* of it, *Touches the ſame Circle* at τ: For ſo he tells us, pag. 152, 154. *Eadem ergo recta tanget circulum eundem in* τ, & *ſecabit in* σ. Which would be Abſurd, he ſaith, had not the Line ſome Breadth. *Non eſt ergo recta* Xστ *ſine latitudine, per quam poſſit latus ejus exterius Circulum Tangere,* & *latus interius Secare eundem Circulum.* 'Tis, he confeſſeth, res *Mira, Stupenda, Prodigioſa,* Nay more; *Acutiſſima quidem ſed tamen Vera;* and 'tis a truth *quam Primus docuit nos Hobbius;* (he might have ſaid *Solus:*) the Ignorance of which *Prodigious Truth,* was the cauſe, he tells us, why *Hugenius, Schooten, Roberval,* &c. did not diſcern thoſe errors in my *Writings,* which Mr *Hobs* thinks he hath diſcovered.

I ſhall not detein You in reciting the Conſequences which He doth infer from it, That *the Tangent of a ſmall Arch, may be leſſe than the Arch it ſelf,* pag. 154, (and conſequently, The Perimeter of a Circumſcribed Polygon, Leſſe than the Circumference of the Inſcribed Circle:) That *Archimedes was miſtaken, in confining the Proportion of the Circumference to the Diameter, within the Limits by him aſſigned,* p. 155. That *Geometers have been all miſtaken in computing the Canon of Sines, Tangents, and Secants;* pag. 156. (With others of the like import.) Becauſe You will eaſily believe, that this Diſcovery muſt needs be attended with a Numerous train of ſuch Conſequences.

But

But I am now satisfied, that it was necessary for M. *Hobs*, whatever other men do, to allow his *Points* some *Bignesse*, and his *Lines* some *Breadth*; (Because, otherwise his Paralogisms would never passe for Demonstrations. For he that shoots at Random, if his Mark be not somewhat Large, is not like to Hit it. I shall onely desire him, by the Next, to tell me *How much* Breadth will serve his turn. For, if his *Lines* be not *Broader than Cheap-side*; I will undertake yet to demonstrate, that, notwithstanding this allowance, his Quadratures will not hold.

His *Eleventh* Quadrature (which yet remains) is indeed (though the Tenth be not) as to the Proportion of the *Radius* to the *Perimeter*, the same with the *Ninth*: (Which is a Wonder; for hitherto we have not had any Two agree upon the same Proportion.)But *prop.* 43. and 44. (on which it depends) are both false.

The Demonstration of the former, concludes *pag.* 157. *lin. ult. Quare arcus* op *& recta* AO *sunt inter se Æquales, ut & arcus* hi *& recta* BQ. (Which was indeed *to be proved*, but *doth not follow* from the premisses.) Whereas all that can be inferred is this, That, *The Arch* op *to the streight-line* AO, is (not *Equal*, but) *in the same Proportion, as the Arch* hi *to the streight-line* BQ.

In the Consectary hereof, he assumes *gratis*, That *the Right-line* uℶ *is equal to the Arch* op. Or, if he suppose this to follow from *prop.* 24. we have found that false already.

And *prop.* 44. depends on *prop.* 43. (for it assumes from thence, that *the streight-line* AO, *is equal to the Arch of a Quadrant whose Radius is* BQ:) and therefore falls with it.

If these Quadratures be not enough; he gives us (unawares) a *Twelfth* Quadrature (to make up the Dozain) *prop.* 45. (though he take it to be but a Confirmation of the Tenth.) His Tenth Quadrature, drawing XF by a certain Point D, did determine a *certain Proportion*, (which what

what it is, you have heard already) of the *Radius* to the *Perimeter.* but now, drawing Xβ by γ, any Point taken at pleasure in the Arch BL, he determines no proportion at all; but as the Point varies, so the Proportion varies too. I'le give but an instance or two.

First, suppose γ at L, and therefore δ at *b*. Then, As $XAb = R\sqrt{3} + R\sqrt{\frac{1}{2}}$, to $bL = R\sqrt{\frac{1}{2}}$, so is $XAB = R\sqrt{3} + R$, to $B\beta = \frac{\sqrt{2}+1}{\sqrt{6}+1}R$; which, he saith, is equal to Bγ, that is BL, the Semiquadrantal Arch; And therefore $\frac{\sqrt{3}+1}{\sqrt{6}+1}8R$, to the whole Perimeter.

Again, suppose γ at S, and therefore δ at *e*. Then, As $XAe = R\sqrt{3} + \frac{1}{4}R\sqrt{3} = \frac{1}{2}R\sqrt{3}$, to $eS = \frac{1}{2}R$, so is $XAB = R\sqrt{3} + R$, to $B\beta = \frac{\sqrt{3}+1}{3\sqrt{3}}R$, which, he saith is equal to Bγ, that is BS, an Arch of 30 degrees; And therefore $\frac{\sqrt{3}+1}{\sqrt{3}} + R$, to the whole Perimeter. (Which is the case of the Tenth Quadrature.)

Again, Suppose γ at *c*, and therefore δ at *l*. Then, As $XAl = R\sqrt{3} + \frac{1}{2}R\sqrt{:2 + \sqrt{3}}$: to $lc = \frac{1}{2}R\sqrt{:2 - \sqrt{3}}$: so is $XAB = R\sqrt{3} + R$, to $B\beta = \frac{\sqrt{3}+1}{2\sqrt{3} + \sqrt{:2 + \sqrt{3}}}R\sqrt{:2 - \sqrt{3}}$. Which, he saith, is equal to Bγ, that is B*c*, an Arch of 15 degrees; And therefore $\frac{\sqrt{3}+1}{2\sqrt{3} + \sqrt{:2 + \sqrt{3}}}24R\sqrt{:2 - \sqrt{3}}$: to the whole Perimeter. And the like variety in other cases.

Which if we reduce to Numbers; Supposing the Radius, 1,00000. The first makes the Perimeter, 6,33613, *fere.* The second, 6,30940+. The third, 6,29011, *fere.* (All, too big.) And every new Point gives a new Proportion.

You have now an account of his *Twelve* Quadratures at least, (though the Sixth, Eighth, and Twelfth, which may stand for as many as You please, passe but for One a piece; and; Howw ell they agree.

And Now (saith Thomas) *What will they say of Hobs, who have Reproached him hitherto?* I'le tell You what they say. They say, that *Mr Hobs is such another Geometrician as Joseph Scaliger.* And this, I hope, he will not take to be a *Reproach*; for *pag* 75, 76, he accounts it a credit to be joyned with such company.

If You would have me now to give You a Particular Confutation of each at large; You do not consider, First, How great a Task You put upon Your self: For You would be then obliged, in civility, at least to Read them over; which were to put You to expense of more Patience (in reading the Confutation of so many weak mistakes, as we must needs meet with) than the Demonstration of this Proposition, *That Mr Hobs is no Geometer,* would be worth: Nor, secondly, How hard a task You impose on me. For (beside the expense of more time than the Subject doth deserve) it were the same as to bid me hold an Eel by the Tayle. *Quo teneam nodo?*

If, by a *Confutation,* You mean such as All but Mr *Hobs,* would account a Confutation; the Task were easie; and, 'Tis done already. But, if such as might perswade Mr *Hobs* to think himself confuted, ὃς τῶ σῶ: You must first find me a Footing where to stand.

For if, first, I should say, 'Tis done already; while (*to save you the labour of examining all his numerous Propositions*) I have pointed to (some of) the most material and fundamental mistakes in the Demonstration of his several Quadratures; and, shewed you where he takes for granted what is neither Proved, nor True; (which most men would take to be a sufficient Confutation of a pretended Demonstration:) He would say, that 'Tis no Demonstration, *to Deny a Consequence, or Proposition, and Say, It is not Proved; Nor so much as any proof attempted.* I should *Prove* that it is not proved; as *Lesson. p.* 35. (else I do but *run on without an   ·ment. p.*41. &c. and *Dial.Phys.p.*35.) That is, I should
light·

light a Candle at midnight, to shew a blind man, that the Sun doth not shine.

Or, secondly, should I *Prove* that it is not proved, nor possible so to be, Because Inconsistent with what hath been demonstrated by *Archimedes* long ago, by *Clavius* against *Scaliger*, by *Snellius*, *Culen*, and others: (and was therefore confuted before 'twas written.) This would be no Confutation. For this he confesseth to be True; But *Archimedes* he tells us, was mistaken, and all that follow him, *Dial. pag.* 142, 149, 150, 155, 178, &c.

Or should I, thirdly, by a new Demonstration, prove again, what they had proved before; and which he grants to be inconsistent with what he affirms: He would say the same of this, as he doth of their Demonstrations; They are all mistaken, and so am I. (An easie way of answering demonstrations!) For, his Demonstrations being all good, what ever is or hath been, or shall for the future be said to the contrary, is not, he tells us, *Refutatio*, but *Refutatum*. *Dial. Phys. pag.* 35.

Or should I, fourthly, argue from what he grants, (in his *Philosophie of Bodies*, in English, pag. 213.) that *Archimedes* hath demonstrated the Perimeter of a Circle to be lesse than $3\frac{1}{7}$ of the Diameter, but more that $3\frac{10}{71}$; or that, *supposing the Radius to consist of* 1000 *equal parts, the Arch of a Quadrant will be more than* 1570, *but lesse than* 1572 *of those parts.* And that *Snellius* and others have *from true principles pronounced,* That, *supposing the Radius* 10000000, *the Arch of a Quadrant differs not one whole Unite from the number* 15707963. Whereas, according to his Quadratures, it must differ from it by many Thousands. His Answer's ready; *Who knows but that, though their Principles be true, there may have been some Errour in their Arithmetical Operations.* ibid. p. 214.

Or, fifthly, should I argue from the Canon of Sines, Tangents, and Secants, or the Foundations of that Canon. He tells us, that Geometers have been all mistaken in that

Canon

Canon; and did not in the Computation of it proceed upon right principles, or Geometrical Demonstrations. *Dial.* pag. 156.

If, sixthly, I should reply, That the *Foundations* of this Canon, are the same with those, which but now we heard him affirm to be *True Principles*, from whence *Snellius*, &c. demonstrate the Proportion mentioned. He will not stick to Answer, 'Tis true he Then thought them to be *True Principles*, but is Now of another mind. *They were all deceived.* pag. 142.

Or, seventhly, should I argue from what himself infers; That, by his doctrine, the Tangent is made lesse than the Arch; and, consequently, the Perimeter of a Circumscribed Polygon, lesse than that of the Inscribed Circle. He tells us, 'tis no Absurdity to Affirm, that the *Tangent of a small Arch may be lesse than the Arch it self.* pag. 154.

If, in the next place, I should say, That, if his Quadratures be right, 'tis very strange that *No one Mathematician* can be found who thinks so beside himself. He tells us, The Reason is, *Because He is alive.* Dial. Phys. Epist. (And it is not likely that *Two men* should be of that Opinion, *in One age.*)

If, ninthly, I should argue, from his own Authority; That *Scaliger's* Quadrature, he confesseth to be *False,* and a *great Errour, Less.* p. 39. and calls it *Absurd,* Dial. p. 109. which in the same book, *pag.* 142, he confesseth to be *the same with his,* and affirms to be *True.* And, that those of his own, which he now affirms for good, he did formerly confesse to be *False.* He tells us, pag. 149, 150. 'Tis true he did so: But 'twas his Modesty (*out of his respect to Archimedes,*) so to do; (as *Joseph Scaliger* had also done before him:) But, that he hath since *corrected that fault,* (which *Scaliger,* he tells us, *never did;*) and therefore is not now to be concluded by *Archimedes's* Numbers, *pag.* 142, 150, 155, 159.

Tenthly

Tenthly, If I should shew, That of all his Twelve Quadratures (the ninth and eleventh onely excepted) there are not any Two, agreed upon the same Verdict, He tells us, That, to dis-believe his own Quadratures, because of some small *insensible differences*, nay *though the differences were very sensible*, were to *dis-believe his own senses*; pag. 159.

If I should then argue, from what himself confesseth, *pag.* 151, 152, &c. That what he delivers is not agreeable to Arithmetical Calculation. As for instance; That $\frac{1}{1}\sqrt{3} + \frac{1}{4}\sqrt{2}$ is equal to $\frac{1}{2}\sqrt{6}$, *prop.* 34, 35. That $\sqrt{3} + \sqrt{\frac{1}{4}}$ is equal to $\frac{1}{2}\sqrt{24}$, *prop.* 36. That $1 + \frac{1}{3}\sqrt{3}$ is equal to $\frac{1}{2}\sqrt{10}$, *prop.* 40. That $\frac{1}{2}\sqrt{12} + \frac{1}{2}\sqrt{4}$, or $\sqrt{3} + 1$, is equal to $\frac{1}{2}\sqrt{30}$; and $\frac{1}{2}\sqrt{16} + \frac{1}{2}\sqrt{\frac{1}{3}}$, or $2 + 2\sqrt{\frac{1}{3}}$, is equal to $\frac{1}{2}\sqrt{40}$. (Which he demonstrates for me, *pag.* 152, 153. to be impossible.) His Answer is, That no man, *who is not bewitch'd*, will think it necessary that (his) *Geometrical* Demonstrations should agree with *Arithmetical Calculation*, pag. 151, 152, 153. And, *Dial. phys. pag.* 37. that *it is not meet, to examine Geometrical Problemes by Algebra, or Arithmetical Calculation.*

If therefore, in the twelfth place, I should wave Numbers, and betake my self to Lines: And shew how he doth, very absurdly, make the same streight-line, to *Touch* a Circle at one place, and at another to *Cut* it. He tells us, pag. 152, 154. That *'tis no Absurdity*, to say that the *same streight-line doth with its Out-side Touch at one place, and at another place Cut with its In-side the same Circle.*

If, then, I should urge *Euclide's* authority; who *prop.* 16. *lib.* 3. doth Demonstrate, That *the Tangent Line lies all without the Circle*, and therefore cannot *Cut* it. He will tell me, 'Twas a mistake in *Euclide*, not to allow his Lines Breadth enough, *prop.* 41. *The Ignorance of which Truth* (*quam primus docuit Hobbius*) was, he tells us, (in *Euclide*, as well as *Archimedes*,) the Mother *of many Absurd mistakes*, pag. 155. So that, You see, He will no more be

bound by *Euclide*'s (flender) *Lines*, than by *Archimedes* his
Numbers. (Nothing ████████ can hold him ; *a Line of
some Breadth and Thickneſſe*.)

If, after all this, I might hope to faſten on the 10th of
Euclide, a place yet unfoiled : (For, though he think, *it
was written to no purpose*, nor *can any uſe be made of it*;
yet he doth not deny but that *it is all Accurate*, *pag.*
53, 54.) I would ſhew him, that, if it will ſerve for
no other uſe, 'twill ſerve at leſt to confute his Quadra-
tures.

He affirms, *prop.* 40, 41. that XAB, (the Aggregate of
AB the Radius, and of XA equal in power to 3 Squares of
the Radius,) is equal in power to 10 Squares of the Semi-
radius: That is, $R\sqrt{3}+R=\frac{1}{2}R\sqrt{30}$. Againſt which I thus
argue. Let R be the *expoſed Rational*; Then (by *def.* 2, 3.
or *prop.* 8, 9. *lib.* 10. *Euclid.*) $R\sqrt{3}$, and $\frac{1}{2}R\sqrt{30}$, are *Ra-
tionals commenſurable in power onely*, to the expoſed rational
R, and each to other. And therefore (by *prop.* 36, in the
Greek Edition, or *prop.* 37, in *Clavius*,) $R\sqrt{3}+R$ is *Irra-
tional*. But, (ſaith Mr *Hobs*) $R\sqrt{3}+R$ is equal to $\frac{1}{2}R\sqrt{30}$.
(an Irrational, to a Rational;) Which is Abſurd. And in
like manner we may conclude againſt what he farther af-
firms, *prop.* 28, 34, 35, 40, 41, &c. viz. $R+\frac{1}{2}R\sqrt{3}=\frac{1}{2}R\sqrt{10}$.
$\frac{1}{2}R\sqrt{3}+\frac{1}{4}R\sqrt{2}=\frac{1}{2}R\sqrt{6}$. $R\sqrt{3}+R\sqrt{\frac{1}{4}}=\frac{1}{2}R\sqrt{24}$. $2R+2R\sqrt{\frac{1}{2}}$
$=\frac{1}{2}R\sqrt{40}$. and more to the ſame purpoſe. But to this he
would ſay, *'Tis ſo full of Symbols it cannot be underſtood* ;
And, *No man is bound to take my Symbols for Demonſtrations*.
As *Leſſon. p.* 22, 23, 28, 35, 49, 53, 54, &c. *Dial. p.* 100.
105, 115, and oft elſewhere.

If therefore, in the laſt place, (to avoid the Reproach
of *Symbology*) I ſhould, in the Margin draw ſo many
Lines, marked with ſuch *Letters*, (for then the *Letters* will
no more be *Symbols*, than ſo many Letters in *Euclide*,) and
proceed as before. As for the Example, Let the line R, or
AB, be an *Expoſed Rational* equal to the *Radius* ; and,
F $\sqrt{3}$, or XA, be equal in power to 3 Squares of Radius,

and therefore, by 8, 9, e 10. *a Rational commenſurable in power only*, to the expoſed Rational R or AB: and conſequently(by 37 e 10) XAB , or $R\sqrt{3}+R$; (the Aggregate of both) an *Irrational Line*: Again
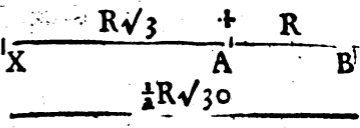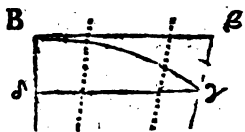

let the line $\frac{1}{2}R\sqrt{30}$ be equal in power to 30 ſquares of the Semiradius, or of half the expoſed Rational R ; which is therefore (by 8, 9, e 10.) *a Rational commenſurable in power*. But that *Aggregate*, ſaith Mr *Hobs*,is equal to this *Line* ; (an *Irrational*, to a *Rational* ;) which is Abſurd. To this I know not yet what Anſwer he will make: Whether he will tell us, as *pag.* 159. that ſo *ſmall a difference* ſhould not break ſquares ; Or, will think fit to *retract*, what he before granted , *pag.* 53. that *Euclide's* Tenth book is *Accurate* ; (For to complain of *Symbols*, or of *Arithmetical Calculation*, or of *Ludolphine Numbers*, there will be no cauſe ; for here is nothing of all theſe:) Or, what other Anſwer he will think upon. Nor am I ſolicitous what it will be : But if *Thomas* and *Hobs* can ſatisfie one another; I think You and I are ſatisfied already , what to think of it.

I thought, not to have troubled You with the *Conſequents* which he infers from thoſe falſe Quadratures : About Dividing an Arch *in raſione data, prop.*46. And, concerning the *Cycloide*, in the 22 remaining Propoſitions ; and at leſt 20 Conſectaries. Becauſe,though they had no other Faults, but that of a Falſe Foundation, they muſt needs fall with it. But there being ſo many others, and ſome of them ſuch Pretty ones, I cannot paſſe without letting You ſee a few of them.

In his *prop.* 46. *To divide an Arch in any Proportion given;* (beſide that it is grounded on a falſe quadrature) ſuppoſeth alſo, That if a Circular Arch B*y* (at leſt, if leſſe than half

a Qua-

Quadrant) lye between two Parallel ſtreight-lines, γ δ
he Sine, and Iβ a contingent line equal to that Arch ;
what ever ſtreight-line Cuts thoſe
wo Parallels Proportionally, doth
lſo cut that Arch in the ſame
Proportion. Which how Abſurd
t is, having ſhewed ſufficiently in
my *Elenchus, pag.* 97, 98, 99, 103,
104, 111, 112, 113. &c. (for he is oft harping upon the
ſame ſtring) I ſhall at this place ſay no more of it. And
thoſe Arguments or Evaſions, with which *Thomas* is here
ſatisfied, *p.* 148, 149. (becauſe *Hobs* tells him, how truly, I
will not ſay; That *præter numeros Ludolphinos* I have produ-
ced nothing to the contrary) are, there, ſhewed to be Abſurd
enough. Nor wil it be neceſſary to repeat them here, becauſe
the Abſurdity is ſo very viſible upon the firſt View, to any
one who underſtands Mathematicks, though but a little.

His 47th Propoſition, (which begins his diſcourſe of the
Cycloide, and on which the reſt depend,) doth, in the
Conſtruction, preſently ſuppoſe the truth of his *Ninth*
Quadrature, That *Arcus Semicirculi poteſt Decem* (*Semi-*
radies, lege) *Semidiametros.* And therefore, for want of
a good foundation, that whole diſcourſe falls. But there
are, beſide this, many other miſtakes, of which I ſhall
ſhew a few.

The firſt I ſhall mention, is a fine *Argute Sophiſm* (in
the Demonſtration of his 49th Propoſition) called *Amphi-*
bologia; (to ſhew, how Neatly he can play the Mountebank
in Mathematicks;) and it conſiſts, not in the Equivocal
Signification of a ſingle Word ; but in the Ambiguous
Syntax of the Sentence. 'Tis juſt in this form ; *Octennium*
ſuperat Decennium Biennio : Atque Octennium ſuperat Sexen-
nium Biennio : Æquantur igitur Sexennium & Decennium.
I know not well how to put it into Engliſh without playing
the Poet ; (for, in Proſe, our Engliſh Syntax will
hardly bear the Elegance of that Amphiboly.)

Eight

Eight-years Ten-years *surpasse by just Two years ;*
Eight-years surpasse Six-years *by just Two years :*
That Six *and* Ten *are equal, hence appears.*

The first part of the Antecedent is true, if *Octennium* be,
there, the *Accusative* case ; The second is true, if, in it,
Octennium be the *Nominative* case : And the Consequence
is true, if, in *both places*, it be either the Nominative or
the Accusative ; (I mean, if in Both the Nominative, or
in Both the Accusative.) And just such is his Argument,
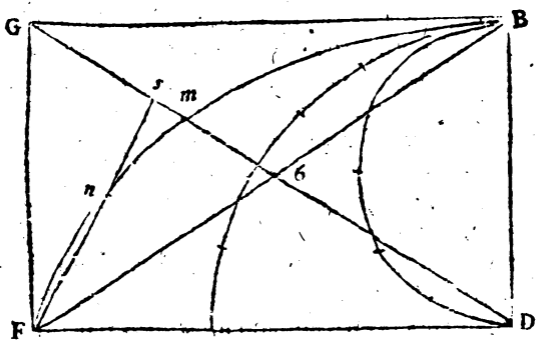
(which I must give you in his own words, because a Trans-
lation would spoil it ;) *Superat Triangulum* GFs *spacium*
Cycloidale FGm, *spacio trilineo snm, minus spacio bilineo*
FnF. Which *that it may be True,* You are first to suppose
Triangulum to be the Accusative Case, and *Spacium Cy-*
cloidale the Nominative, and understand it thus,

$$FGm \underline{\hspace{0.3cm}} GFs = snm \underline{\hspace{0.3cm}} FnF.$$

But then again, *to carry on his Argument,* (the Consequence
being otherwise lame,) You are, contrarywise, to suppose
Triangulum to be the Nominative case, and *Spacium Cy-*
cloidale the Accusative ; and understand it thus ;

$$GFs \underline{\hspace{0.3cm}} FGM = snm \underline{\hspace{0.3cm}} FnF.$$

To which he doth thus subsume, *Sed Triangulum* sF6
(*Triangulo* GFs *æquale*) *superat spacium* F6m, *eodem spacio*

trilineo snm, *minus spacio bilineo* FnF: That is

$$sF6 (=GFs) \_ F6m \simeq snm \_ FnF.$$

From whence he concludes, *Therefore* FGm *and* F6m *are Equal*. And on this Consequence, depends the most of that which follows.
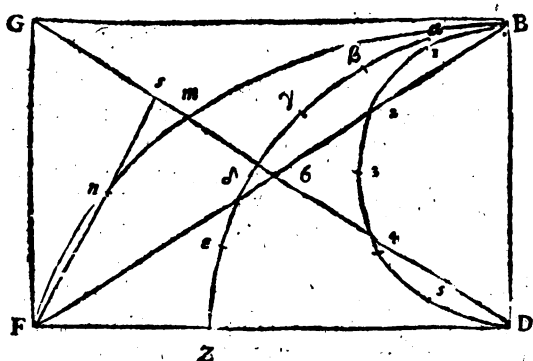
In his next Proposition, *prop.* 50. he would prove, That the *two segments* FGm *and* BGm *do æquiponderate* on the line *Bm D*, Because they are *Equal*, and, *Equally Distant*. The Consequence is good, (if, by *their distance*, be meant, as ought to be, *the distance of their Centers of Gravity*;) but neither part of the Antecedent. That they are *Equal*, he supposeth proved in the precedent Proposition, whose proof we last examined. That they are *Equally distant* from the line GD, he thus proves, *Because* B *and* F (*the utmost Points of each*) are equally distant from it, (and, that their *Nearest* parts be Contiguous, is manifest.) But what is this to the purpose? The Equiponderation of two Figures, doth not depend upon the Equidistance either of their *Vtmost* points, or of their *Nearest* points, or *Both*; but, of their *Centers of Gravity*. 'Tis true, that, had the Segments been *Like* and *alike-sited*; if Equal, the Equidistance of any two Homologous points would have concluded the Equidistance of their Centers of Gravity, and consequently their Equiponderation: But of such *Vnlike* figures as these, the case is much otherwise. And this is such a Mistake as cannot easily be thought to proceed (as he useth to distinguish) *from Negligence, or Security*, but, *from Ignorance of the Subject whereof he treats*. He might as well have concluded, that a *Semicircle* and a *Trapezium* equal thereunto, whose Bases are the same, and their Heights equal, would Equiponderate on opposite sides of their Common *Base*; For he might here prove, as much as in the present case, That their Utmost points are Equally-distant from that common Line; and their Bases Contiguous. But no man, who knows what belongs to Staticks, would hence infer, their Equiponderation: Because the

Equidiftance of their Centers of Gravity cannot be her
concluded. And 'tis certain, that the *Trapezium* muft nee
Preponderate.

The fame Errour, he doth prefently commit over agai
to prove, That *F6m*, and *B6m*, do alfo Equiponder
upon the fame line. And then, a third time, to prove
like of *FDm*, and *BDm*.

And thefe *Fundamental miftakes* (with fome others
good) do fo infect all that follows, That, befide the fi
falfe Conftruction of *prop. 47*, which infects the whole; The
is not in all that follow, unleffe *prop. 48, 54, 55, 5*
(which yet are not exempt from the influence of that fal
Conftruction) and *prop. 67*, with one of its Confectarie
any One Propofition, which is not alfo, *Otherwife Falfe.*

I fhall yet inftance but in one more. (For I do not judg
it meet to give You the trouble of a particular account
all.) 'Tis *prop. 62.* which I rather fingle out, as well, becauf
it is not fo complicated with the reft, but that it may b
confidered apart; as alfo, becaufe the Demonftration of i
is fomewhat extraordinary.

He doth firft, Suppofing the Arch of the Semicirc
B3D to be divided into any number of equ arts, at th

points 1, 2, 3, &c. and that of the Quadrant BZD, into the same number of equal parts, at the points α, β, γ, &c. Indeavours to prove, That, Because Bα, Bβ, Bγ, &c. in the Quadrant, are equal to B1, B2, B3, &c. in the Semicircle; and the *Right-Sines* of Those, to the *Chords* of These; (which is True:) Therefore, if from the points α, β, γ, &c. in the Quadrant, be let fall Perpendiculars, or Right Lines, on their Semidiameter BD; these *Right-Sines* of the Quadrant, will cut the Semicircle, each in its respective point, 1, 2, 3, &c. Or, (which is equivalent,) if that Quadrant lye not in the plain of this Semicircle, but stand erect perpendicularly upon it; those Right Sines from β, γ, &c. will fall on the Parallels to DF, which passe through the Points 1, 2, 3, &c. respectively. Which is so wild a Consequence, (and the thing inferred so absurd,) that I know not how to fit it with an Epithete so Mild, as may not make You apt to say, *I am Severe.* The worst I shall say of it is, That, it is one of *Mr Hobs's Consequences.*

And that which next follows, is just like it. Having thus-proved, That if that Quadrant be erected perpendicular to the plain of this Semicircle, on any of the Parallels to BD, which compleat the Rect-angle DG; the Sines let fall from α, β, γ, &c. will fall on the Parallels to DF passing through the respective Points, 1, 2, 3, &c. He hence would prove (by a Consequence as good, as either Antecedent or Consequent is true,) That the Parallels to BD which compleat the plain of the Cycloide DBmF, do continually decrease *in Arithmetical Proportion* till that at F they vanish; as also the Quadrantal Archs described by those Parallels upon the Axe DF: (That is, he would prove, that the Cycloid BmF is a streight line: For, That the Parallels in the Triangle DB6F do so decrease, is manifest; and the Quadrantal Archs by them described:) And, therefore, that the Plains of those Quadrants do decrease in the Duplicate proportion of lines so decreasing: (That

is, That the Solide defcribed by the converfion of the Cycloide DBmF upon the Axe DF, is a Cone : For, that the Plains of the Cone, m de by fuch converfion of the Triangle DB6F, do fo decreafe, is manifeft.) Which is a a Miftake fo *Like* the former, as if they were *Twins*.

There is yet a Third fo like thefe two, that, though I muft not fay, they be *Three Twins* (left it should feem a Solœcifm,) yet they look fo much alike as if they were all Born at *one* birth. For having proved, (as he fuppofeth,) that the Parallel Plains, which cut at equal diftances the Solide defcribed by converfion of the Cycloide DBmF upon the Axe FD, to Decreafe in the Duplicate proportion of Lines continually decreafing in Arithmetical Proportion: He thence infers, (what that *prop.* 62. affirms,) That the Solide made by this Converfion, is to the Cylinder made by a like converfion of the Rectangle GD, as 2 to 3. Which is neither *True* (for 'tis indeed as 5 to 8,) nor doth it follow from what he pretendeth to have proved. For, did thofe parallel Plaines decreafe in fuch proportion, (that is, were that Solide, a Cone ; as, by fuch fuppofition, it muft needs be ;) the proportion would not be, as 2 to 3, (as he infers,) but, as 1 to 3 : For, fuch is that of a Cone to the Circum- fcribed Cylinder.

I promifed You to give but this One Inftance : And therefore fhall with this conclude what I fay to the Geo- metry of his Difcourfe concerning the Cycloide. Onely, as an *Inftance* of his *good Language*, (for I do not purpofe to afflict Your Ears with much of it,) I fhall repeat a line or two. Having *prop.* 67. (which is the onely True Pro- pofition of all that concern the Cycloide,) affirmed, That Cylinders are in Proportion compounded of that of their Bafes and that of their Altitudes ; He tells *Thomas* (who feems to doubt it) that *Hobs*, hath Demonftrated the truth of this Propofition ; (and glories in it, as if it were a dif- covery of his own, never known before :) *Demonftrat it Hobbius lib. de Corpore, cap.* 13. *Art.* 14. *And Caput ipfe Walliſiu-*

Wallisius non improbavit ; sed quia nihil in eo reperit quod potuit rodere, Hobbii ipsius esse negavit. Non quod alienum esse putarat, sed quia instituto ejus Mentiri expedivit. Nor shall I make any other Reply to it, but onely refer You to what I have said against that Chapter for ten pages together in my *Elenchus* (from pag. 16. to pag. 25. inclusive.) From whence, I suppose, You will be satisfied, That neither *I had said nothing against it*, nor *do I deny it to be his.* Much of that Chapter is, *doubtlesse*, his own ; though the *Best* of it, I suppose, he will not deny to have been known before. And then, To whether of us Two, the *Expedient* he mentions doth belong ; I shall leave to You to judge.

To his Appendix : Wherein he pretends to *Amend* somewhat that was Amisse, in his book *De Corpore* ; I shall say nothing. For, though indeed it be somewhat *Altered*, I do not find that it is *Amended.* The fundamental Mistakes still remain ; and so it stands Confuted as before.

I shall, here, conclude this long Digression. Wherein I have given You some Account of his *Six Dialogues* written against me : Not onely to shew You the Reasons for which I did not then think it necessary for me to Answer them : But rather to make it evident to You, That the *Author of those Six*, may, without danger, be *Neglected*, when he writes a *Seventh* ; (which is the first part of what I was to shew ;)And (which is the latter part) That he, who takes all those to be *good Geometry* ; and, hopes from thence to raise a *Reputation* of being *the First that hath made the Grounds of Geometry, Firm and Coherent*, will Need at least, if not *Deserve*, Your *Pitty*.

His *Seventh* Dialogue, Intituled, *Dialogus Physicus*, (which gave occasion to this Discourse,) remains yet to be considered. Which though it seem, mainly to be directed against those Noble *Experiments* of Your *Pneumatick Engine* ; Yet (so much is he concerned, in every thing he doth, to be revenged of me, for not approving his Mathematicks,)

maticks,) he cannot conclude it, till he have first distributed some tokens of his displeasure towards me, for presuming to answer a Paper (which proved to be *His*, but was pretended to come from *France*,) pretending to the *Geometrical Duplication of a Cube*. Which, though it there come in the last place, You will give me leave to take first into Consideration, because of its Connexion with that whereof we last discoursed.

Having therefore taken occasion *pag.* 32. (from what he had before been treating of concerning Your *Pneumatick Experiments*,) to commend his *Physicam Hobbianam*, (which might be allowed as consonant to the present Subject, being an Inquisition into the *Nature of the Air*,) He proceeds to commend his *Ethicks*, and *Politicks*, (Not because the subject whereon he was discoursing lead him to it; but, because he thinks it necessary, when ever he writes any thing, to Commend All that ever he had written before;) But, more especially, his *Geometry*; his (manifold) *Quadrature of the Circle*, his *Division of an Arch*, or *Angle*, and what he had lately delivered concerning the *Cycloide*, and the *Center of Gravity in a Semicircle*, contrary to what others had before demonstrated; (which being the last things he had written, and not yet commended by any, 'twas necessary that *Thomas* and *Hobs* should mutually declare their approbation of them:) Which leads him to that of his *Duplication of the Cube*, (as, much conducing to the Explication of the *Nature of the Air*:) whereof, had he not thus publikely owned it, he might have lost the credit.

For, Observing that *Mr Hobs's Geometry* (whether by reason of others Envy, or for what other cause, I will not now dispute,) was not now in any great Repute; and, Fearing least that *Odium Hobbii*, which he so much complaines of, as so prejudicial to Man-kind in hindring the reception of his Notions, without which it is impossible to make any progresse in the Search of Nature; (For,

Convenient.

Conveniant, Studia conferant, Experimenta faciant quantum volunt, Nisi & principiis utantur meis, Nihil proficient ; The *Nature* of *Motion*, the *noblest* and *most necessary* piece of *Mathematicks*, he tells us, being *never yet Touched upon by any but* Mr *Hobs* ;) might be prejudicial also to this of the *Cube*, (and, thereby, not onely deprive him of the Credit, but all man-kind of the Benefit, of his New Discovery :) To obviate those evils ; he caused his *Probleme* of *Doubling the Cube*, to be printed in *French* ; (as done by V. A. Q. R. which he now interprets to signifie *Un Autre Que Roberval*;) and divers papers of it to be given abroad, which were pretended to be brought from *Paris* ; (For had it been in *English*, or thought to be done at home, the Matter would presently have betrayed the Author :) Not doubting, but that, the *Odium* would cease to operate when the Person was concealed ; and, no *Prejudice* obstructing an impartial Estimate, his Demonstration would presently find Reception and Approbation : Which could not afterwards be withdrawn, when He should appear to be the Author. By which means, he should both Benefit Mankind against their wills, and, unawares, receive their Approbation.

But, so ill a Fate attends his Actions though in Disguise, and that secret Antipathy to Mr *Hobs*'s Inventions, though not known to be his, did operate so strongly ; that, notwithstanding the Artifice, this Demonstration fared no better than those he did avow for his. And, which is worst of all, when it had received Confutation from several hands (which might have taught any man who could but *Understand*, though he knew not how to *Make* a Demonstration, What was to be done ;) He, Then, proclaims himself the Author of it ; when it had been more prudence, by concealing himself, to decline the Reproach of what he thinks a Credit.

The

The Paper, made English, speaks thus.

"The Doubling of the Cube.
"By V. A. Q. R.

" *A Streight-line being given; To find between It, and its Half, Two Means Proportional.*

" Let AB be the ftreight-line given; and ABCD, the
" Square thereof, cut into four equal Squares, by the two
" ftreight-lines EF, GH, which cut each other in the
" Center of the Square ABCD, at the Point I: So that
" the four fides be divided each into two equal parts at
" the four points E, F, G, H. I am then to find Two
" Means Proportional between DC and DF.

" I draw the Diagonals AC, BD; and defcribe the four
" Quadrants of Circles ABD, BCA, CDB, DAC;
" whofe Archs cut thofe Diagonals in K, L, M, N. At
" which Points, thofe Archs are cut, each into two Equal
" parts. Which is fufficiently known fo to be.

" I produce BA, CD, to the Points O and P, fo far
" as till they be equal to AB, DC, each to each. And ha-
" ving defcribed the Quadrant of a Circle ADO, and
" drawn the Diagonal AP, (which will cut the Arch DO
" into two Equal parts, at the point Q.) And being pro-
" duced on the other fide at R, will mark BR equal to the
" Right-Sine of 45 degrees, that is, to the Semidiagonal
" BI. And by confequent SD is the Exceffe of the greater
" Extreme AD above the Semidiagonal AS.

" This SD, I cut in two Equal parts at T. And, in
" AD produced, I take DV equal to DF, and making T
" the Center and TV the Semidiameter, I defcribe the
" Circle VXYZ, cutting DC in X, DA in Y, and the
" ftreight-line RS produced in Z. And I fay, that the

" two ftreight-lines DY,DX,are the two Means Propor
" tional required,between DP equal to AB,and DV equal
" to its half.

" For,drawing the ftreight-lines VX, XY, the Angle
" VXY (in the Semicircle) will be a Right Angle ; And
" the ftreight-line XT drawn and produced unto the Con-
" cavity of the Circle VXYZ, will fall on Z, becaufe
" ST, and TD, are equal, and by confequent SZ equal to
" DX, and XZ will be the Diameter of the Circle
" VXYZ. The Angle therefore XYZ in the Semicircle
" is a Right-Angle ; And , drawing the right line VZ,
" it makes VXYZ a Rectangle , and its fides VX, YZ,
" parallel.

" Now, if the ftreight-line YZ produced, fall upon P,
" the whole PZY will be a ftreight-line parallel to VX ;
" and the alternate Angles YPX, VXP, equal. And the
" Angles YPX, and XYD, will be alfo equal ; and the
" three Right-angled Triangles PDY, YDX, XDV, will
" be like Triangles. And confequently, the four ftreight-
" lines PD, DY, DX, DV, will be in the fame continual
" proportion.

" I am therefore to Demonftrate, that YZ produced,
" will fall upon P.

" Let PV be drawn, and cut into two equal parts at *a*.
" And alfo the ftreight-line *ab* drawn parallel to AV, cut-
" ting PD in *c*. And likewife *Td* drawn parallel to PD,
" cutting *ab* in *d*; and *dc* divided into two equal parts at *g*.
" On the centre *g*, at the diftance *ga*, let the Semicircle
" *abb* be defcribed, cutting PD in *b*, and *ab* in *b*.

" This being done ; the two ftreight-lines *ab*, *bb*, be-
" ing drawn will make a right Angle at *b*. Now *ac* is the
" half of DV. And, becaufe *dg* and *gc* are equal, *db* will
" alfo be equal to the half of DV, and *ab* will be the half
" of YV.

" Therefore, as PD to DY, that is to fay, to the com-
" pound of DS and SY, fo is P*c* (the half of PD) to *cb*

the compound of the halves of DS and DY, and conse-
quently *Pb* produced will fall upon **Y**. And the streight
lines *bb, ba*, will be the halves of XY, XV. And XY being
divided into two equal parts at *i*, *the figure* Yihb *will be
a Rectangle*, *and* Yb *parallel to* XV. But YZ is parallel to
XV. Therefore YZ produced will fall upon P. And
(by what hath been demonstrated) the four streight-
lines PD, DY, DX, DV, will be in the same continual
proportion. I have therefore, between a streight-line
given and its half, found two Means Proportional. Which
was to be done.

" **Consectary.** A Cube whose Side is the Greater (*lege,
the Lesser*) of the two Means, is the double of that Cube
whose Side is Half the Greater Extreme. For the Pro-
portion of the Cube to the Cube, is Triplicate to that of
the Side to the Side ; And the Proportion of PD to DV
is Triplicate to that of PD to DY.

I thought fit to recite his Paper *verbatim*, not onely to
let You see, How like an Artist Mr *Hobs* hath done it ; but
likewise because in his Reply to my Confutation, he puts
me to prove a Negative (That such a thing is *not demon-
strated* in his paper.) And though I had already proved it
to be False (and consequently, that it was not Possible to
be demonstrated;) yet, because this proof doth not seem to
him sufficient, I have produced the whole, that You may
see if any where therein You can find this Impossibility
performed.

You may perhaps wonder (and so did *I* till *I* knew Mr
Hobs was the Author of that Paper) why he should clog
his *Figure*, and the *Construction of it*, with such a Multitude
of superfluous Lines and Letters, whereof he makes no use
at all either in the *Construction of the Probleme*, or the *De-
monstration* of that Construction.

For, first, he doth, on the Line given, describe a Square:

ters; once, by two Crosse-lines parallel to the sides; again, by two Crosse Diagonals from Corner to Corner. He doth then inscribe four Quadrants of Circles; whose Centers are the four Corners of that Square; and their Archs passe each by two other of the Corners. The two former streight-lines, parallel to the Sides, divide the whole, he tells us, into four Equal Squares: That they Cut each other at a certain Point, which point of Intersection is the Center of the whole Square; and, That the four sides of that Square are each of them cut into two equal parts by those crosse-lines: (equal to one of which he doth afterwards take the Line DV in the continuation of AD.) And the two crosse Diagonals, he tells us, are cut in four Points, by the four Quadrantal Archs; At which Points they do also cut those Archs into equal parts.

Now, whereas You might expect to hear, what use is to be made of all this Construction hitherto; The utmost that is to be said of it is but this; *Let AD, equal to the Line given, be continued to V, so that DV be equal to the half thereof; and let DX be perpendicular thereunto.* Which might as well have been said at first. And therefore that Square described, with all its Implements, are to no purpose.

He then proceeds to describe Three Quadrants more, in another Square on the other side of the Line DA. Bisecting one of them by a Diagonal at Q; whence QSR (parallel, I suppose, though it be not said so, to AB) is continued to the further side of the other Square, at R. Two of which Quadrants thus described are never after so much as mentioned, nor is any use made of them at all. The third Quadrant, with the Diagonal, and QS (part of the line QSR) though they might have been spared, yet I do not find fault with, because there is some use made of them in designing the point S.

The use that is made of this part of the Construction is this, (which might have been said without it :) *Now suppo-sing AD the Radius of a Circle, let AS, part thereof, be equal to the Sine of 45 Degrees.* He

He then proceeds to this purpose. *Bisecting then SD at ; on the Center T, by the point V, draw a Circle, cutting DX at X, and AD at Y. The lines DY and DX are the two Mean-Proportionals, between AD, and, its half, DV.* Which ends the Construction of the Probleme. The whole whereof, which he (confusedly) delivers in *Four Paragraphs*; is, You see, more clearly and more to the purpose expressed in little more than so many *Lines*.

When His Paper, so drawn, was brought me, (not knowing who was the Author, but supposing it to be sent from *France* as was pretended,) I was surprised; and wondred much that any other man should write so like Mr *Hobs*; (having formerly thought, that this way of Geometriaing had been peculiar to himself, and unimitable by any other.) And supposing, by the manner of it, that it was done by some Youngster, who had lately applyed himself to Mathematicks, but was unacquainted with the Methods of Construction and Demonstration; I did first, without any reflexion, (more than a bare intimation, that there was much spperfluous, and some mistakes,) reduce his Construction and Demonstration for him, into somewhat a better form, (that he might see, how much it was out of order, as he had done it; and the better discern where its strength lay, and, where its weaknesse.) And suited a Figure to the Construction thus Amended, (to let him see, how much of his was wholly Superfluous:)leaving out most of the Superfluities in his; but retaining all that was any way usefull. And then adjoyned a threefold Confutation of it.

The former part of this, it seems, Mr. *Hobs* did understand: And therefore thought fit to suppresse his own, and publish his Probleme and Demonstration in that Form, that I had drawn up for him;(but retaining his own Figure, with all its superfluities.) But the latter part, which containsthe Confutation, it seems, he understood not. For, had he understood it, he would not have been so imprudent

as to expofe himfelf as the Authour of that weak miftake
when he had the opportunity of concealing it.

And he hath in both, Truly enough reprefented
my words, or the fenfe of them, (fo much, *I* mean
thereof as he thought fit to expreffe;) fave onely
that, inftead of 1,997. or (as I had written it) 1|997
he hath twice fubftituted 1997, (leaving out the note of
Separation between the Unite, and the Decimal parts an-
nexed;) and then makes advantage of this Falfification.

His Demonftration, omitting the fuperfluities, is to this
purpofe. *Drawing the Diameter XTZ, and the ftreight-lines
VX, XY, YZ; the Angles VXY, XYZ, are Right Angles;
and YZ parallel to XV. And therefore, if YZ continued, till it
meet with XD produced, do cut off DP equal to DA or the
double of DV, (the Triangles PDY, YDX, XDV, being like
Triangles,) the lines DP, DY, DX, DV, will be in continual
proportion: And, the Cube of DP, double to that of DY.* And
thus far his demonftration is right.

Now, *That YZ fo produced will cut off DP equal to DA,*
he thus endeavours to prove. *Take DP equal to DA,* (I
add, *or of what length foever;* For, whatever the length of
it be, the Demonftration proceeds as well;) *Drawing the
ftreight-line PV, and bifecting it at a; and drawing ab paral-
lel to DY, cutting DP at c; and Td perpendicular to ab: then,
bifecting dc at g; and, on the center g drawing, by the point a,
a Semicircle, cutting cD at h, and ab at b: Becaufe ca is equal
to the half of DV; and cg to the half of DT; ab will be equal to
the half of VY; and therefore, joyning Pb, this continued, will
fall upon Y; and joyning bh, ha, thefe will be equal to the
halves of YX, XV, and parallel thereunto.* Which is likewife
true: But fo is not that which he infers from it, *viz.*

*Bifecting therefore YX in i, and joyning ih; the figure Yihb
will be a Right-angled Parallelogram: and therefore YbP
will be Parallel to XV, and confequently, the fame with YZ
produced.*

But here his Demonftration is lame, and, confequently,

his whole Proceſſe failes. And I had given him a threefold Confutation of it.

First I ſhewed, Where his Demonſtration was defective. He had proved indeed, *That* bh *is equal and parallel to* Yi; and, conſequently, *That* bY *was alſo Equal and Parallel to* hi; and therefore, that *Yihb* is a *Parallelogram*; but not, That it is *Right-angled*: there being nothing in all the Proceſſe to determine, what are the Angles of that Parallelogram; the Equality of the Parallel ſides being the onely thing proved; which is as true in *Rhomboeids* as in *Rectangles*. That which I took to be the occaſion of his miſtake, I ſayd, was this; That, having proved *ahb* to be a Right Angle, and *ah* parallel to VX; and, *imagining* (what ſhould have been *proved*) that *hi* was the Continuation of *ah*; he did, conſequently, *imagine*, that *bhi* was alſo a Right Angle, and *hi* parallel to VX. But, That *hi* is the Continuation of *ah*, ſhould have been *proved*, (not, *taken for granted,*) the whole weight of the Demonſtration lying upon it. (Nor is it indeed True; For *ah* continued, will never come at *i*; but paſſe ſomewhat lower, between it and Y: XYb, and *ihb*, being here Obtuſe Angles.)

What he Now offers for the proof of it, is but a Repetition of the ſame Miſtake. *Who ſees not,* ſayth he, *That if, compleating the Circle, we draw the Diameter* hgk; *the line* hk *will be Equal and Parallel to* TZ; *and* Pb *to* aT; (which is very true;) *and, conſequently,* (but this Conſequence I cannot ſee) *that* ah *paſſeth through the Center* T, *and biſects* XY *at Right Angles at* i? He doth again *imagine* (but hath not proved) that *ah, hT,* and *Ti;* are all parts of the ſame ſtreight-line *ai.* Whereas, in truth, they be Three different Lines, and make Two Angles, one at *h*, another at T; nor is any of them a part either of *ai*, or of *hi*, or of *aT*. 'Tis true, that *Ti* biſects *XY* in *i* at RightAngles; and, that *ah* continued will ſomewhere cut XY at Right Angles, not in *i*, but ſomewhat nearer to Y; and, *ah* is indeed Parallel to *Ti*, but not a part of the ſame ſtreight-line

with it; Nor will a ſtreight-line from *a* to *i*, come at, at either at *h* or T, but ſomewhat higher than *h*, and lower than T, cutting *h*T in the middle; Nor is *hi* part of the ſtreight-line *ai*, but makes an Angle with it at *i*. 'Tis true alſo that P*b* is Parallel to a ſtreight-line from *a* to T, but not to the line *ah*; nor will that ſtreight-line from *a* to T come at *h* at all; nor is coincident with *hi* continued, but Parallel thereunto. (So many Miſtakes are there in one Amendment!) And, whereas Mr. *Hobs imagineth* (without proof) that *ab*, *h*T, *Ti*, *a*T, *hi*, and *ai*, ly all in one conti-nued ſtreight-line; they are indeed Six ſeverall ſtreight-lines; whereof *ab*, *Ti*, and *a*T, *hi* are the oppoſite ſides of a Rhomboeid; and *ai*, *h*T, the Diagonals of it, (And, if he think otherwiſe, he ſhould have proved it, not taken it for granted.) 'Tis true indeed, that there is a Point ſome-where, to be taken; where, if we place P, the foure points *a*,*h*,T,*i*, will ly in one ſtreight-line. But that this point is at a Diſtance from D, juſt Double to DV, he hath not proved.

And the better to expreſſe all this, I thought fit to adde a Figure, of my own, ſuited to the Conſtruction and De-monſtration as it is here amended. Wherein I have retain-ed, of his, ſo much as was neceſſary to expreſſe the True Proceſſe of his Conſtruction, and the Full Strength of his Demonſtration: Omitting thoſe Superfluous Lines and Letters (which, You ſee, were very many) which ſerved but firſt to confound Himſelf, and then his Reader. And I have therein purpoſely taken the line DP, not preciſely equal to DA, but, at pleaſure, (as is intimated in my Emendation:) As well the better to expreſſe thoſe *Six Lines* belonging to the Rhomboeid *ahiT*, (which, though diſtinct, would yet have lyen ſo near to one another as not to be expreſſed conveniently to the view;) As alſo, that the ſame Figure might ſerve for my Second Refutation, which now follows.

My Second Refutation was, Becauſe the length of the line

line DP, which is the chief thing to be Demonstrated, is not at all concerned in his Demonstration. But, what ever be the length of DP; (whether equal, greater, or lesse than the double of DV,) his Demonstration proceeds a-like. And therefore, doth no more prove, that DX, and DY, are the mean-proportionals between DV, and DP *the double* of it; than, between DV, and DP *of what length soever.*

But *for this,* he sayth, *I bring no Demonstration.* It's very true; (not was it my businesse, there, to *bring* a Demonstration; but, to *Answer* what he pretends to be a Demonstration, and shew the weaknesse of it:) But had he re-viewed his Demonstration, and applyed it to DP of any o-ther length he pleased; he would have found (without a Demonstration of mine,) that it would proceed *verbatim* just as it doth now. For, *what ever be the length of DP;* if he joyn PV, and from its middle point *a*, draw *ab* parallel to VY, cutting PD at *c*, and, from T, let fall the Perpen-dicular T*d*; and, (bisecting *dc* in *g*,) on the center *g*, draw the Semicircle *ahb*; (and so forth, as in his construction;) Because *a* is the middle of PV, *c* will be the middle of PD, and *ac* equal to the half of DV, and *cg* to the half of DT, and therefore *ab* to the half of VY; and, consequently, P*b* continued, will fall upon Y; and *bh*, *ha*, will be equal to the halves of YX, XV, and parallel thereunto; and *bi* parallel *b*Y, and equal to it: (which is all that he proves in his case.) If therefore from hence he can infer, *in his case,* that T*ibb* is a *Rectangle* (and, consequently, Y*b*P, the same with YZ produced;) I may as well infer it, *in any case;* and conclude, as he doth, that DX, and DY, are two mean-Proportionals between DV, and DP, whatever be the length of DP. His Argument therefore, either doth not prove, That they are the Mean-Proportionals between DV, and the double of DV; or else it doth also prove, That they are the mean-proportionals between DV and any line whatever. *Quod erat propositum.* So that, You see, it was
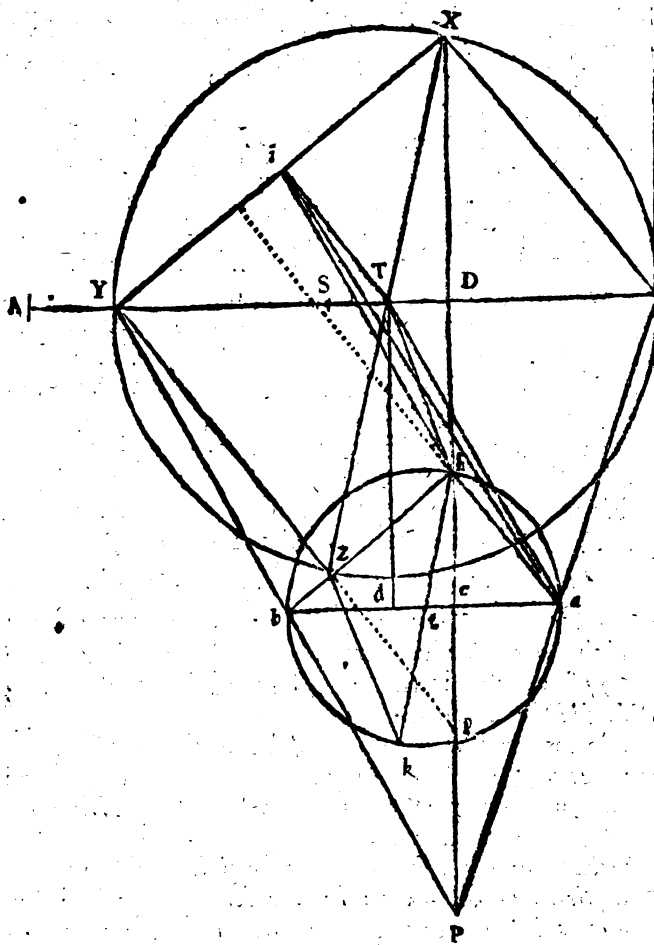
as not for want of a Demonſtration, that he had it not at
rſt; but onely upon a Preſumption, that the Authour of
he Paper had known how to apply his own Demonſtration
o another caſe, without my help.

My Third Refutation, undertakes to ſhew, not onely
that what he affirms is Undemonſtrated, but that 'tis Falſe:
And doth demonſtrate, that DX, DY, are not (as he af-
firms) the two Mean-Proportionals between DV and the
Double of DV; but, between DV and a line ſomewhat
Leſſe than the Double of it. Thus. Suppoſing DV,
equal to 1. DA the Double of it will be equal to 2. And
AS (which is to DA, as the Sine of 45 degrees to the
Radius, or as the Subtenſe of 90 degrees to the Diameter)
will be √2. And, therefore, SD equal to 2--√2. Which
added to SY (equal to DV) makes YD equal to 3--√2.
And, conſequently, DX, (a mean-proportional between
DV and DY, that is, between 1 and 3--√2,) is equal to
√u:3--√2: (the Root-Univerſal of 3-√2.) And there-
fore, the Fourth Proportional muſt be (not 2, as Mr *Hobs*
affirms, but) 3--√2 *into* √u:3--√2 For,

As DV, to DX ::So is DY. to the Fourth.
1.   √:3--√2. ::   3--√2.   3--√2 *into* √:3-√2.

Which Fourth (reduced to ordinary numbers) is equal to
1,997 *fere*; and is therefore leſſe than 2, the double of
DV. *Quod erat oſtendendum.*

I do not know, whether it will be worth Your while, to
conſider of Mr *Hobs*'s Anſwers to this Demonſtration:
But, becauſe it may be conducing to what I am moving for,
I ſhall preſent them as they are.

Firſt, *That this Fourth Proportional is equal to* 3--√2
multiplied into √:3--√2; *he doth very well perceive; but,*
That this is equal to 1997, he ſaith, *he cannot underſtand.*
Truly, no more can I. But, if he cannot underſtand how
it can be equal to 1,997 *fere*, or (as I had then written it)
to 1|997 *fere*, he can underſtand very little. For if he
have

have so much Arithmetick as to extract the Square root of a number given; he might understand that

$$\sqrt{2} \text{ is equal to } 1.41421,3564$$
$$\text{and therefore } 3 - \sqrt{2} \text{ equal to } 1.58578,644 --$$
$$\text{and its root, } \sqrt{3 - \sqrt{2}} \text{ equal to } 1.25928,013 --$$
$$\text{and } 3 - \sqrt{2} \text{ into } \sqrt{3 - \sqrt{2}} \text{ equal to } 1.99694,935 --$$

That Fourth Proportional therefore is somewhat lesse than 1,997, or $1\frac{222}{1000}$, and therefore not equal to 2. Which, if Mr *Hobs cannot understand*, it is not my fault.

Next, because he *doth not understand this*; He endeavours to find the length of that Fourth Proportional, his own way. And first he thinks it fit to change the Measure: And whereas I supposed DV to be 1, and therefore DA (the double of it) to be 2; He will suppose DA to be 1000, and DV to be 500 : (Which I do not blame ; because it is as free for him as for me, to take the first term at pleasure :) And, consequently, AS to be $\frac{1}{2}\sqrt{2000000}$, which is somewhat more than 707. And therefore DY somewhat more than 792, but lesse than 793. Wherefore, saith he, $792 = 3 - \sqrt{2}$. That is, (for so, I hope, he would be understood) 792 of his measures, equal to $3 - \sqrt{2}$ of mine. The root of which 792 is equal, he saith, to 28 *fere* ; (that is, to somewhat more than 28, though lesse than 29.) *The product therefore of 28 multiplied into 792 is*, saith he, *the Fourth Proportional*. That is, according to his Arithmetick,

| DV. | DX. | DY. | A fourth. | are in continual Pro- |
| 500. | $\sqrt{792}$. | 792. | $792\sqrt{792}$. | portion. |

I need not tell You, That there is an Errour in his Calculation. ('Tis visible, and too grosse.) I shall onely tell You, what I take to be the Occasion. Having taken 792 in his measure, as equal to $3 - \sqrt{2}$ in mine, for his Third term: And, observing that, in my Analogy, (because the first term is 1,) the Square-Root of my Third term, is equal

to my Second: He thinks that, in his Analogy, (where the first term is 500,) it must be so to. And hence concludes, That the Third Term multiplied into its Root, in his Analogy, (because it did so, in mine,) will give the Fourth Proportional. Whereas a little Arithmetick might have taught him, That, although $\sqrt{:3-\sqrt{2}}$. be the mean-proportional between 1 and $3-\sqrt{2}$; yet is not $\sqrt{792}$ the mean-proportional between 500 and 792, but between 1 & 792.

I forbear to advertise further, That his Calculation, whether Right or Wrong, doth, no more than mine, answer his Geometrical Construction, (for his $792\sqrt{792}$, or 22176, is no more equal to the Double of 500, than my 1,997 *fere* to the double of 1; but, as he computes it, *more than Twelve times as great*; I should have said, More than *Two and twenty times*:) Because it was not his design by an Arithmetical Calculation to prove the truth of his Geometrical Construction; but, to shew that *several Computations Arithmetical do not agree amongst themselves*. And this, if he mean it of a Right and a Wrong, I shall easily grant him: And the Instance he hath brought, doth prove it.

His Third Attempt upon my Demonstration, is, To tell *Thomas*, what he thinks to have been the Occasion of Mistake in my Calculation. (For, that there is a Mistake, either in His, or Mine, is very certain.) *The Errour*, he saith, *is no other, but this, That I take,* DX *to be equal to* $\sqrt{:3-\sqrt{2}}$. And 'tis true, that I do so take it. But why is it an errour, so to do? *He thinks, That I did thus argue; Because* 1 *multiplied into* $3-\sqrt{2}$ *makes* $3-\sqrt{2}$, *therefore* $\sqrt{:3-\sqrt{2}}$ *is the mean proportional between* 1 *and* $3-\sqrt{2}$. Why he should think that I do thus argue, there appears no other Reason, but, Because he thinks it is an Errour, and it is fit that I should be thought to Erre. For there is not in my paper any mention of such Multiplication, or, of what would be the Product of it. But, suppose I had thus argued, Why should he think it an Errour so to argue? *'Tis true*, he

faith, *That if* 3--√2 *be multiplied barely into* 1, *it makes* 3--√2 *without alteration:* (Yes, it doth so;) *But, if multiplied into One-line, it makes a Rectangle.* I might here ask, Whether when he saith 3--√2 *multiplicatus in Unam Lineam, facit Rectangulum,* He mean, the *Line* 3--√2, or the *Number* 3--√2. If, the *Line,* he should have said *Multiplicata,* or rather *ducta* (for *Linea* is of the Feminine Gender;) But if, the *Number;* then the Latine is True, but the Geometry is False: For a *Number* multiplying a *Line,* doth not produce a *Rectangle,* but a *Line;* Two Yards being as much a *Line,* as One Yard; not a *Rectangle.* But I am content to believe, that he intended it of *the Line* 3--√2. And then, tis very true, That the *Line* 3--√2 into the *Line* 1, makes 3--√2 a *Rectangle,* not, a *Line:* (Nor is there any other reason why he should think I was Ignorant of it, but onely, Because He Knew it; As if he thought, It ought to be presumed, That *I* am Ignorant of whatever He Knows.) But, *I* suppose, he knows also, That this *Rectangle* is equal to some *Square;* and, That the *Side* of this Square is a *Line;* And, That this *Line* is equal to √:3--√2: And therefore the *Line* √:3--√2: is the mean-proportional between the *Lines* 1, and 3--√2, as I affirmed. And then, Where lies the Mistake?

So that *I* should not argue (as Mr *Hobs* imagineth) *The Line* 1, *multiplied by the Line* 3--√2, *makes the Line* 3--√2, *and therefore* √:3--√2: *the Root of this Line, is the Mean-proportional;* But rather thus, *The Line* 1, *into the Line* 3--√2, *makes* (not a Line, but) *the Rectangle* 3--√2; *To which Rectangle if we suppose a Square Equal, The Side of this Square will be a Line* (not a Rectangle) *and this Line will be equal to* √:3--√2. *And therefore the Line* √:3--√2: *is equal to* DX *the mean-proportional between the Line* 1, *and the Line* 3--√2. *that is, between the Lines* DV, *and* DY.

As for example; Suppose we this 1, to be 1 F, (or if the Symbol displease him, in stead of 1 F, he may say *One Foot,* and then 'twill cease to be a Symbol;) If therefore DV

DV be equal to 1F, or F *into* 1 ; DY will be equal to
F *into* 3 — √2, (for that DV to DY is, as 1 to 3 — √2, he
doth not deny :) And consequently, the Lines, DV=
F *into* 1, and DY = F *into* 3 — √2, will contain a Rectangle
DV×DY equal to FF *into* 3 — √2. Which Rectangle is
therefore equal to the Square of the Mean-Proportional
DX, and the side of that Square will be, F *into* √: 3—√2.
=DX. And, consequently, as the First Terme 1F, multi-
plied by √:3 — √2, gives F *into* √:3 — √2 equal to the
Second DX, so DY = F *into* 3 — √2 the Third terme, mul-
tiplied by the same √:3 — √2, makes the Fourth term
F *into* 3 — √2, *into* √:3 — 2. That is, The length of the First
term DV, whatever it be ; multiplied (not by 2, as Mr.
Hobs would have it, but) by 3 — √2 *into* √:3 — √2 is the
Fourth Proportional. Nor was it any Errour in me, so to
affirm. The whole Processe of the Calculation is this.

$$1F, \text{ or } F \textit{ into } 1 = DV$$
$$F \textit{ into } 3 - \sqrt{2} = DY.$$
therefore, FF *into* 3 — √2 = DV×DY = DXq.
and, F *into* √:3 — √2 = DX.

Then, As DV = F, is to DX= F *into* √:3 — √2.
So DY= F *into* 3-√2. To Dp=F *into* 3-√2 *into* √:3-√2.
Not, to DP = F *into* 2 ; as Mr. *Hobs* affirms.

I have now done with His Reply to my Refutation of
his pretended *Doubling of the Cube*. There was, he tells
us, beside this, Another *Refutation* of it ; which, he sayth,
is very *Probable*. And I could tell him of a Third ; from
a *Noble Hand*. But this Third was in *Symbols*, and there-
fore he did not think fit to understand it, or take any no-
tice of it.

That other Refutation, which he allows to be *very Pro-
bable*, is this.

Suppose AD = 2.

And therefore DV = 1.

AV = 3.

AS = √2.

SV, or YD = 3 − √2.

The Cube of AD is = 8.

The Cube of DY = 45 − √1682 = almost 4.

For 45 − √1681 = 4.

DY therefore is somewhat lesse than the Greater of the two Mean-Proportionals between AD and DV.

For Answer to this Demonstration, he thinks fit to examine, whether 45 − √1682 be indeed equal to the Cube of DY or 3 − √2. And he attempts two Methods to satisfie himself.

He proceeds first upon this Supposition ; That if 3 − √2 be multiplied into it self ; and that product multiplied again by 3 − √2 ; this later Product will be equal to the Cube of 3 − √2. And, with much labour, and manifold Reductions of Surd Numbers, and the Application of some intricate Rules, he doth at length accomplish that work ; and finds, that 45 − √1682, is indeed, according to that Method, equal to the Cube of 3 − √2.

I shall not trouble you with an account of his intricate processe in that inquiry ; because you may see it in himself : but onely shew you, in the operation annexed, with how much ease that might have been dispatched, of which he makes so much ado.

$$
\begin{array}{r}
3 - \sqrt{2} \\
3 - \sqrt{2} \\
\hline
9 - 3\sqrt{2} \\
- 3\sqrt{2} + 2 \\
\hline
11 - 6\sqrt{2} \\
3 - \sqrt{2} \\
\hline
33 - 18\sqrt{2} \\
- 11\sqrt{2} + 12 \\
\hline
45 - 29\sqrt{2} \\
\text{or } 45 - \sqrt{1682}.
\end{array}
$$

But a Single Inquiry doth not satisfie his curiosity ; and therefore he attempts a second Method of finding the Cube of 3 − √2 : Upon a Supposition, That the Cube of 3 − √2,

is

is equal to the *Cube* of 3, together with 3 *times* 3 *into the Square* of √2: wanting 3 *Squares* of 3, *into* √2, and, the *Cube* of √2. Which had he pursued aright, would have given the same account with that of his former Inquiry: as by the Operation annexed may appear.

The Cube of 3 is	$= +27$
3 times 3, into the Square of $-\sqrt{2}$,	$= +18$
3 Squares of 3, into $-\sqrt{2}$	$= -27\sqrt{2}$
The Cube of $-\sqrt{2}$	$= -2\sqrt{2}$
Therefore, the Cube of $3-\sqrt{2}$,	$= 45 - 29\sqrt{2}$
	or $45 - \sqrt{1682}$.

But, in the pursuit of this Rule; instead of 2√2 or √8, he tells us, that *the Cube of* √2, *is Equal to* 2, (that is, The Cube of √2, and the Square of √2, are the same.) And, for 27√2, or √1458, he takes its near value in effable Numbers, *viz.* 38$\frac{4}{11}$. And then sums up the value of his Cube, thus found, to be 45 − 40$\frac{6}{11}$. Which is *much Leſſe*, he tells us, than 45 − √1982. (He ſhould rather have ſayd, 'Tis *much Greater*: for that is almoſt 5, and this is leſſe than 4.)

$$+27 - 38\tfrac{4}{11}$$
$$+12 - 2$$
$$\overline{+45 - 40\tfrac{6}{11}}$$

And, leaſt we might otherwiſe think it an Errour of *Negligence*, not of *Ignorance*; He doth, upon Deliberation p. 37. *Chooſe* the Errour, and *Reject* the Truth; *Blaming* thoſe who think *the Cube of* √q 2, *to be equal to* √q 8.

From hence he doth infer ſome Obſervations. Firſt, That *His two Computations (though both performed according to the Rules of Algebra) do not agree.* Which, abating his Parentheſis, is very True: and, the Reaſon's plain.

Secondly; That *Neither of them agree with his Geometrical Proceſſe.* Which is True alſo; and, the cauſe Evident.

And therefore Thirdly, (but here *I* am not of his mind) *That it is not meet to examine Geometrical Problems by Algebraiſal, or Arithmetical Calculations.*

All

All that *I* shall Observe from it, is but this. If Mr. *Hobs* did understand the strength of these Confutations, and did yet think fit to publish himself the Authour of that Paper thus confuted, (when he might have concealed it,) and pretend it to be all True: You may Pitty his *Prudence*. If he *did not understand* it; You must Pitty his *Mathematicks*.

I had thoughts, here, of inserting another *Problem* of the same Authour; and, performed much after the same rate with this of *the Duplication of the Cube*. 'Twas, *To find two Mean-Proportionals between two Lines given*. Which, as being a Noble Attempt, and rarely performed, was lately Presented to *His Majesty*. But this being immediately confuted by that same Noble Hand, which had, but a little before, Confuted that of his *Duplication of the Cube*: And, being since *Retracted* (as I am informed) by the Authour himself, and confessed Erroneous: I shall forbear, at present, to trouble You with It, or its Refutation; till Mr. *Hobs* shall think fit to Resume it again, or new Vamp it; as he did his false Quadratures once rejected.

Nor shall I detain You longer in examining his *Mathematicks*; of which, I suppose, You may already have seen enough to make you Weary. For, though *Thomas*, upon a like Intimation, tell him, *Noe*; but *Paradoxis Detector*: Dial. *pag.* 177. I am apt to think, You will rather have cause to say, as He there, *pag.* 178. *Paradoxa non sunt*; *Absurda sunt*. Which yet is easily Answered. For, as he tells us of his *Politicks*, if we may beleeve him, *Lesson.* *p.* 56. That, *His Doctrine therein is generally received by All, but those of the Clergy*; and, *Their Testimonies*, he tells us, *are Invalide*: So, *His Geometry* (he may tell us as well) *is not Refuted by any but Mathematicians*: whose Judgement in this case, is not to be credited.

To the rest of this *Dialogue*, it is but little that I shall say. For, Your-self being concerned in it, You have, I presume

Prefume, given Your felf a better account of it, than I am
like to do.

But here, I think, that firft he doth You wrong:
Afcribing thofe Experiments to the *Society* at *Gresham-
Colledge*, which are peculiarly Yours; Being Made and
Publifhed by Your felf, before that Society had a be-
ginning.

Yet I fuppofe, he did it not fo much either for your
Difparagement, or, to Gratifie that Society; as, to Ad-
vantage the Reputation which he promifed to himfelf
from it; as thinking it a more Noble Victory to have out-
done fuch a Society; than to have the better of a Single
Perfon.

And I am the rather induced to beleeve this, Becaufe *I*
do not find that he hath any Superlative Refpect for them:
The Defigne of that Piece feeming rather to look the o-
ther way; So many faults he finds with, the *Name*, the
Number, the *Perfons*, the *Principles*, the *Defigns*, and
Experiments of that Society.

He is not fatisfied, *pag.* 3. with the Name *Society*, but
thinks they ought to be called an *Academy*: For, in *France*
and *Italy*, he tells us, *fuch Companies are fo called*; and, be-
caufe Mr. *Hobs* hath been in *France*, he ought to bring us
a Name from thence. Which *Academy*, he defines to be,
Such a Meeting as whereof Mr Hobs was one;(as that at *Mer-
fennus* his Chamber.) For though this Definition do not at
prefent agree to that Society at *Gresham-Colledge*; Yet it is
to be fuppofed that it Will very fuddenly; when they fhall
have found True, by Experience, what he now tells them,
That they will never be able to make any advance, what ever
ftudy or induftry they ufe, *till they make ufe of* (Him, or at
left) *His Principles*.

Nor doth he think fit *pag.* 2. that they fhould con-
fine themfelves to fome Certain *Number* of men: But,
that it fhould be free, for any that will, to intrude
themfelves. For, *London* being a *publick place*; and *Gres-
ham-Colledge*

ham-Colledge standing in *London* , it ought to be free fo any man to intrude himſelf into any *Company* that meet at*Greſhams-Colledge.*

He then thinks fit to give his *Judgement, pag. 3.* of the *Perſons*, which are wont there to meet : That *D will tell ſtories enough, if you will believe him;* H, I, K, *are Algebriſts, and therefore ought to be excluded,* (becauſe, 'tis fit that every one that will, ſhould be admitted;)That *E, F, G ſerve to make up a Number* ; &c. Only, there is one C, which is *an Honeſt, Subtile, Ingenious Perſon* , and , *Known* to Mr. *Hobs.* And *pag.* 16, That *There is no Difference, between Them and a profeſſed Mechanick, but this, That the Mechanick is rather to be preferred.*

Their *Pretenſes,* he would have it thought *p.2.* are such as His are wont to be ; *viz.* That *the Knowledge of nature, to the great Advantage of this Nation, and of all Mankind, muſt either be Advanced by Them, or that we muſt for ever Deſpair that it will be done by Any.* But herein, I think he doth miſtake them. 'Tis true indeed, That Mr *Hobs* doth often thus pretend, or what is *tant-amount* ; And therefore thought it fit that *His Doctrine* ſhould be made the Standard for *Schools* and *Pulpits*: And, *Leſſ. p. 56, 57,* that, if he ſhould not *recommend* it for ſuch, *he had written it to no purpoſe.* Nor is it *Vaunting,* to deſire, that *by entire Soveraignty it be Impoſed upon the Univerſities,* &c. but, *a Neceſſary part of the Buſineſſe he took in hand.* And *Dial. pag.* 180. He believes, That *Never Any will be able to give a better account of the Effects of Nature, than He hath done.* And therefore adviſeth *Thomas* (*Dial. Phyſ. p.* 32,) to *reſt contented* with *Phyſica Hobbiana,* and to *Live by his Ethicks* : For, all that the *Charge and Furniture* of other men can amount to, is onely an *Attempt,* he tells us *pag.* 23. *Eatenus tantum prodire quantum antea prodierat Hobbius.* But, that any such have been the Pretenſions of thoſe at *Greſham-College* ; as That none ſhall ever be able to adde to what They ſhall do: *I* have not yet heard. For though M *Hobs* would

have it thought, pag. 1. that *they have taken up their Princi-*
ples from him ; yet surely, not All his Principles ; nor
this, in particular, Thus to Pretend. For, though there
are in that Society, many Noble, and very Excellent Per-
sons ; Yet I do not think, that the Estimate of their
Worth, is to be made by what onely is done at those Mee-
tings ; (so small a Portion of their Employment :) Much
lesse are we to think them guilty of so much Vanity, as
Mr *Hobs* would, very unhandsomely, insinuate.

But their *Successe,* he thinks, will be far short of what
he would insinuate to be their Pretense : and doth expect
(for, so much he there intimates,) that *Themselves will be
Despised, and, Philosophy for their sakes.* For though in his
Epistle to *Sorberius,* he would seem to promise this Mee-
ting some good successe, that *dubitandum non sit quin Con-
ventus hic promovendis Scientiis plurimùm sit profuturus ;* yet
that Promise is there suspended upon *Condition,* That *they
will proceed upon his Principles ;* otherwise, (he hath read
their Destiny,) they must never expect to do any good, what
ever their Study, Pains, or, Experiments may be : *Nam
Conveniant, Studia conferant, Experimenta faciant quantum
volunt ; nisi & Principiis utantur meis, nihil proficient.* And
pag. 8. he tells us, That, *without admitting his Hypothesis,
It is Impossible, but that all their Cost, their Skill, and Labour
will come to nothing.* And, positively, p. 5. That *He Despairs
of any Fruit from this Meeting.*

Their *Principles,* which he sometimes intimates, they Have
Borrowed from him ; as pag. 1. Sometimes, that they Should
have done it, and, Ought to do yet, or else they must de-
spair of successe ; as in his *Epistle, Preface,* and p. 8. 23.
& alibi. are especially those two ; Concerning *Motion,* and,
concerning his *Simple Circular Motion.* First therefore he
would have it thought, That He was the Inventer of this
Notion, That *Sension, and other Effects of Nature are per-
formed by Motion ;* To prove which, he, twice at left,
(Epist. and pag. 23.) cites out of *Aristotle, Ignota Motu,*

ignorari Naturam. His other Invention, of *Simple Circular Motion,* he tells us, *pag. 9.* is *the same with that of the Earths Annual Motion, introduced by the Copernican Hypothesis.* And therefore Mr. *Hobs* must needs be the first Inventer of Both.

The *Knowledge of Nature,* or *Causes Natural,* he would not have them look to find *in Libris Magistrorum (Præfat.)* But, *in Libris Hobbii,* those Causes may be found, than which (he told us, in his former *Dialogues, p. 180.*) *he doth not believe that better will ever be found by any.*

He would have them take heed of medling with those things *quæ capi non possunt,* (for he thinks fit to prescribe the *Subject,* as well as the *Method* of their Inquiries:) as *Rarefaction & Condensation* (for these are things *quæ intelligi non possunt;*) and, *Immaterial Substances,* most of all, (for fear least it should be thought, There is *a God,* or *Souls Immortal.*)

Their way of *Experimental* Inquiry, he doth not like. For, though in his former Dialogues, *pag.* 180. he doth acknowledge, That *the History of Nature is hereby Inriched; without which the Knowledge of Nature is but in vain expected.* And here, *pag.* 2. That *we are not easily to take upon trust what is related in Story:* Yet 'tis, he saith, *pag.* 2, 23. &c. to no purpose to make these New Experiments, (whether to Furnish themselves with New *Phenomena,* or to satisfie themselves of the Truth and Certainty of what is related by others;) For, first, *unlesse All be present at every New Experiment, Some of them must either Believe the rest, or still remain in Doubt:* Next, *Because there is every day more to be seen Abroad, (in Heaven, on Earth; by Land, by Sea,) than the Few Experiments which they can make in a Private Room:* But most especially, Because, *after all their Pains, their Cost and Charges, the uttermost of what they can hope for, is but, To find out, what Mr. Hobs hath found out already.*

Beside these general Animadversions on that Meeting, and

What they do; and, his Prognostication of the Event:
He thinks fit in particular to apply himself, as he pretends,
to the *Experiments made at Gresham-Colledge, by that Soci-*
ety; Meaning indeed, those made by Your self (at *Oxford*
and else-where) and Published by You in that Excellent
Piece, which You call *Experiments Physico-Mechanical,*
touching the Air; written by way of Letter, to that Noble
Lord, Your Nephew, the Lord Vicount of *Dungarvan,*
Eldest Son to the present Earl of *Cork*, Your Brother.
For though that Piece were published long before the
Meeting of this Society; yet (because himself is so good
at Prognosticks) he might think You wrote it only by way
of *Prognostication* of what was after to be done by a Mee-
ting, which was not then thought of.

Now, that he might not want an Adversary; He is
pleased to Suppose the Author of those Experiments to
Maintain, whatever Mr *Hobs* hath a mind to *Oppose*. And
he begins with that of *Vacuum.*

I do not remember, that You have therein any where
declared Your Opinion, Whether there Be, or Be not, a
Vacuum. But onely related matter of Fact, as it appeared
upon Your Experiments, without inferring from it either
the Affirmative or the Negative in that Question. That
much of that which We call *Air*, is *Drawn out* of the
Recipient, or the Recipient (in a great Measure) *Emptied*
of it; it's very like You may somewhere Affirm, (and, I
think, Mr *Hobs* doth not Deny :) But whether or no some
Homogeneous Æther, as Mr *Hobs* would have it, do suc-
ceed in the place of that *Heterogeneous Mixture* which we
call *Air*, such as that is wherein we *Breath*; because You
have not thought fit to deliver an Opinion, Mr *Hobs* thinks
fit to determine for You what Your Opinion shall be.
And, because He is of Opinion, *There is not a Vacuum*;
He will therefore have it Your Opinion, pag. 4, &c. That
there is. In order to the Confutation of which, there is
amongst other his *Postulata*, this Necessary One, (which

he hath oft occasion to have recourse unto,) *Suppono, Universum mundum esse Plenum,* p. 12, 24, 25, &c. And from hence, he doth very strongly infer, *Ergo, Non datur Vacuum.* ἴτε ἴδες δ οἴξαι.

In like manner he deals with You touching the Nature of *Fluids. It's* possible that You may have somewhere intimated, That in divers of those things, which, as to Sense, appear *Fluid,* and *Homogeneous,* there are a multitude of *Heterogeneous* particles not *Fluid.* (For it is like You have sometimes seen a Thousand little Moats dance in the Sun-beams; which, when the Room is all equally, either Light or Dark, no Sense can take notice of, but deems the whole, for ought appears, to be Fluid and Homogeneous.) But, whether there be or be not in Nature a Body properly Fluid and Homogeneous, whose every smallest particle is, like the Whole, Fluid and Homogeneous; Because You have not (so far as I remember) yet declared Your Thoughts; He thinks it fit (being good at other *Divinations* as well as at *Prognosticks)* to tell You What they are. And, because it is His Opinion, That *there is a Body thus Fluid;* He will have it Your Opinion (that he may have somewhat to dispute against) That *there is not:* And, That the onely thing which distinguisheth the *Fluid* from *Non-Fluid,* is the *Smallnesse* of those particles whereof it doth consist, *pag.* 5. &c. For Confutation of which, You are to allow him this *Postulatum, pag.* 4. *Suppono, Aerem Fluidum,* i. e. *facile divisibilem, in partes semper Fluidas, semperque Aerem.* From whence it follows, very naturally, That *there is a Fluid Body. Quod erat Demonstrandum.*

And if You shall be so Unreasonable as not to allow him these *Postulata; Desperare facis omnem Conventus vestri fructum. pag.* 5.

Again; When You intimate, That there may be in this Common Air wherein we breath, many small Particles, which, like so many small Haires in a Lock of Wool, if

Crushed

Crushed by strength, or some incumbent Weight, into a Narrower Space, will, upon the Removal of that Pressure, Dilate or Expand themselves into a Larger Room; upon a like principle as that of a Spring, or a Bended Bow, returning to its former posture when the force that bent it ceaseth, First, He doth not allow any man to believe, that there is in nature any such thing as a *Spring*, or *Motion of Restitution*, who doth not imbrace his *Hypothesis*. pag. 8. And, then, By *Air*, he would have to be understood, *Aerem ab omni terrâ aquáq, effluviis purum, qualis putatur esse Æther* ; *pag.* 4; 6, 25. &c. (You need not be solicitous about the *Syntax*; for Mr *Hobs* studies *Elegancies*, not, *True Latine*.) For Mr *Hobs* is very dexterous, in Confuting others, by putting a new Sense upon their Words, rehearsed by himself; different from what the same Words signifie with other men. And therefore, if You shall have occasion to speak of *Chalk*; He'l tell You that by *Chalk*, he means *Cheese*: and then, if he can prove that what You say of *Chalk*, is not true of *Cheese*; he reckons himself to have gotten a great victory. And in like manner; When that *Heterogeneous Mixture* (whatever it be) wherein we breath, is commonly known by the name of *Air*; and *this Air, wherein we live, abounds*, You say, *with parts of such a nature*: He tells You, that, by *Air*, he understands such an *Æther* as is among the Stars; And, that, in this *Air*, there be no such Particles, is proved by that *Postulatum* we last mentioned; *Suppono, Aerem fluidum*, &c.

Beside these goodly Confutations, He hath one great Engine, which he calls his *Simple Circular Motion*, with which he hopes to salve all the *Phænomena* in Nature. Which, by his Description of it, *Corp. Cap.* 21. I take to be such as that of the Good-Womans *Hand* that turns the Wheel when she Spins; Or, the Chandlers hand which turns the Quern when he makes Mustard: Where *every Line*, in the Hand or Body thus moved, is supposed *to retain a Position, still Parallel to it self*. Such as that of the

Earths Annual Motion, according to the *Copernican Hypothesis.*

But 6 *Dial.* p. 179. He thinks the Reason why his *Hypothesis* is not received, is, *Because very few Men,* be *fears, are able to Apprehend such a Motion.* For (Mr *Hobs* being the first that ever taught his Grandame to Spin) *never was there any man,* he saith, *before him, that took notice of any such Motion.* (For, though he tell us, in the same page, that *Copernicus ascribes the same Motion to the whole Body of the Earth ;* Yet Mr *Hobs* his Book, *De Corpore,* You ought to know, was written long before the *Copernican Hypothesis* was thought upon.) To help therefore the Fanry of such as are not able to Apprehend this Motion, he doth, in that and the following page, spend some time to give a Second Description of it.

And then (because he doth not yet find his Doctrine to passe currantly,) He doth, a Third time, in his *Dialogus Physicus,* p. 9, 10. give yet a further Description. For he doth not doubt, *pag.* 8. but that, *if it were Understood,* it would be Received.

The Result of that Description amounts to this; That, by his *Simple Circular Motion,* he means, *such a Motion* as is neither *Circular,* nor *Simple.* For he doth not mean that of *Conversion,* or *Circumvolution ;* as when a *Plain* moves round upon *one Center ;* or a *Solid* upon *one Axis,* (Which You, perhaps, would have thought the most *Simple* of all Circular Motions :) But such a Motion, as wherein *no Two Points* are moved upon the *same Center ;* nor, any *Two Lines* (such *Two* I mean, as are not parts of the same *Streight-line,*) upon the *same Axis :* but *so many Circles,* he saith, *there are, upon so many several Centers, as there are Points in the Whole. Dial. Phys. p.* 10. Nor doth he mean, That those *Points,* by this *Circular Motion* do describe *Circles ;* but (*motum in se redeuntem quemlibet*) any *Figure* whatever *whereby they may return again to a place where once they were. ibidem.* (Than which, he saith, *there is nothing*

more eaſie to be Apprehended.) Which Motion is indeed a
kind of *Vertigo*, and may, for diſtinction ſake, be called
Hobbiana ; but, why it ſhould be called *Simple Circular*, I
ſee no reaſon at all, ſave onely, becauſe it pleaſeth Mr *Hobs*
to give it that Name.

And this *Simple Circular Motion*; (which, though *nothing*,
he ſaith, *be more Eaſie to be apprehended*, yet ſo *Few*, he tells
us, *are able to Apprehend*;) He attributes to all, the Smalleſt,
Particles of Earth and Water whenever. And, for *Proof* of
it, He doth *Suppoſe*, That thus *it is*, and thus it *Ever* was,
and that 'tis *Natural* ; and in this *Eternal Cauſe*, he tells
Thomas, he ought to Acquieſce. *Dial. Phyſ. p. 7, 10. &c.*
And therefore it is not fit for You or Me to inquire further
into the reaſon of it.

I ſhall not trouble You with a Particular Account, how
he doth apply this Univerſal Engine to produce the
ſeveral Effects of Nature ; Or, with any Confutation
of it.

For, (beſide what concerns Your ſelf, which how weak it
is, I need not tell You ;) the reſt is little elſe than a Repe-
tition, out of his Book *De Corpore*, of what D. W. hath
Refuted long ſince. And, though Mr *Hobs* have thought fit
to Repeat it, firſt in his Former *Dialogues, p.* 179. &c. and
now again in this *Dialogus Phyſicus* ; (and, how oft he means
to Repeat it again hereafter, who can tell ?) It will not be
therefore neceſſary to repeat the Refutation, ſo oft as he
repeats his Errours.

Onely I cannot but obſerve, in the general, a great
Reſemblance between this his *Phyſical Hypotheſis*, and, his
Geometrical Conſtructions : For as, in theſe, he draws a
Multitude of Lines whereof there is no Uſe made, as to the
Conſtruction or Demonſtration of his Problem ; (as You
ſaw but now, in his *Duplication of the Cube* :) So, much of
his *Hypotheſis* is to no purpoſe, as to the Effects of Nature.
For whereas the main part of his *Hypotheſis* ſeems to be
placed in this, That the Motion is of *ſuch a Kind* ; (viz.

Simple Circular, wherein each *Line* is still to preserve a *Parallel Position:*) In all his *Applications* of his Engine in this *Dialogue,* I do not find that the *Parallelism,* which this Motion is to preserve, hath any influence at all upon the Salving of those *Phænomena*; but, that the Work proceeds evere whit as well, which ever end go forward. For, the Immediate Effect thereof being no more but this, that they Knock and Justle one another; any confused Motion whatsoever, might as well have served his turn for this purpose, as the *Simple Circular*; (and therefore that part of his *Hypothesis,* which supposeth the preserving of this Parallel Position, and his *Specification* of the Motion to that end, are to no purpose.) Nor is it lesse usual in a game at *Bowls* to see the Bowls in a *Volutation* Knock one another out of place, (where no such parallel position of every line is preserved;) than, at *Shovel-board,* to see one Piece knock off another, though this (as Mr *Hobs* calls it) be a *Simple* Motion, but not *Circular.* And, what he would seem to make the Reason of his Arbitrary choice of this Kind of Motion, *pag. 9.* That a *Simple Circular doth produce a Simple Circular*: How far it is from being *Universally True,* is evident from the first Instances that we gave of it. For, though the *Hand* that turns the Wheel or Quern have this *Simple Circular* Motion; Yet, who knows not that the Motion of the *Wheel* or *Quern,* turned by it, is a *Circumvolution* on a single Axis. Nor is it at all *Peculiar* to this Kind of Motion, to produce a Motion Like to it self; but every way as common to other Motions. As is Evident in the *Wheels* of a *Watch,* where each by a Circumvolution on its own Axis, communicates to the next the *Same Kind* of Motion: Which may indeed, as properly, be called a *Simple Circular*; but, is not that *Vertigo Hobbiana* which we be now speaking of.

The Result therefore of his *Natural Philosophy,* (For instead of a *Confutation,* I shall onely give You a short *Synopsis* of his *Postulata,* with his *Inferences* from them,) amounts to thus much.

First, He doth *Suppose*, That *All is Full*: From whence he is to *Infer*, Therefore *there is no Vacuum*.

Secondly, He doth *Suppose*, That *the Air is perfectly Fluid*: In order to Prove, Therefore *there is somewhat Fluid in Nature*.

Thirdly, He doth *Suppose*, That *the Air is perfectly Homogeneous*: To *Prove*, That *it is not full of Heterogeneous Particles*.

Fourthly, He doth *Suppose*, That *all Earthy Particles are in continual Motion*: To the End, that *they may Knock one another*.

Fifthly, He doth *Suppose*, That *this Motion is Simple Circular*: To No purpose.

Sixthly, He doth *Suppose*, That *thus it Ever was*: And Therefore *we ought not to inquire the Cause of it*.

Seventhly, He doth *Suppose*, That *his Supposition is a Sufficient Proof*: Else we have none at all.

Lastly, He doth *Suppose*, That *what he Affirms is well Demonstrated*: And Therefore, *What ever can be said against it, is not Refutatio, but Refutatum*.

You may *Think* perhaps, That, if any Other will please to *Suppose* the Contrary; This *Refutation* will be as *Cogent* as his *Demonstration*. If so; because I ought to be Civil to a Person whom I Honour, I will not take upon me to confute those *Thoughts*.

I have but one Remark more with which I mean to trouble You, before I dismisse this Dialogue, as I have done the rest. And it is, concerning the Authors Ingenuity therein towards Your self. For whereas, If those *Experiments* whereof You give an *Historical Narration*, (without any Reflexion on him at all, so far as I remember, or so much as Mentioning, much lesse Disparaging his Hypothesis,) do indeed so directly conduce, as he pretends, all along, to the Establishing of his Doctrine; (*quasi Natura quodam Consilio ad Physicam suam Confirmandam oblata*;) You might have expected a return of *Thanks*, for Your Cost

Cost and Pains in a Work so subservient to His Design; and, for Your Favour in Communicating those Costly Experiments; for him, as freely as any other, to make use of: Yet, Because, unhappily, (as if You had thought it lawfull to be Civil to some Other Persons,) You have let fall some Words of Commendation or Respect, for some few Persons whom You had occasion to mention; He thinks himself concerned, instead of Thanks, to *Write a Book against You.*

But while I am Writing this last Passage, I may seem to have forgotten the Businesse I was about, and to which I am to return again: Which is, to bespeak Your *Favour,* not, to *Aggravate* any thing against the Author of that Piece. In order to which, I have made that seeming Digression, to take a View as well of This, as of his Other Six Dialogues. From whence if You think I may Infer, either that You *May Neglect* safely, or, *Ought to Pitty,* the Author of those Dialogues; I have not then lost my labour: But, if You shall grant, that I may infer *Both;* I have then done my Work. For *I* shall not then doubt, but that You will either *Spare* him altogether, or at left Use him more *Mercyfully* than He deserves.

And, truly, there is one Argument yet behind, which *I* did not foresee at first, but doth suggest it self upon the View of what *I* have written. When *I* look over what *I* have been Pleading in his behalf; my Apology it self, *I* doubt You will say, is Sharp enough. And, though *I* have often checked my Pen, and spoil'd an Argument more than once (as You can witnesse) which would, if pressed home, seem too Severe: Yet, *I* must confesse, He lies so open to the lash at every turn, that

Difficile est, Satyram non scribere.———

Nor is it, almost, possible, the Matter being as it is, to give any tolerable Account of what he Writes, but that a bare Narrative, be the Words never so Mild, will be Severe enough

enough. And, saving that You are a Person extremely Civil, it will be hard for You to Touch, almost any where, the Parts are so Tender, but that the Blood will follow.

And, having said thus much, *I* shall not trouble You farther with any more: But leave it to Your own Thoughts, whether You will Judge it necessary for You to say any thing at all : Especially, if You shall think, That *I* have already said too much. Yet, if, instead of *Answering Mr Hobs* You shall think fit, to give the World a further Account of Your Thoughts ; for the *Improvement* of those Noble Experiments, whereof You have already given us the *History*: You may thereby, Gratifie a Multitude of Worthy Persons who Honour You ; and shall not more Oblige any, than

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SIR,

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Oxon. Febr. 20.
    1661.
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Your Honours

Very Humble servant,

JOHN WALLIS.

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