



GRESHAM
COLLEGE

The Mathematical Life of Sir Christopher Wren

Professor Sarah Hart

Gresham Professor of Geometry



*There are two Causes of Beauty,
natural and customary.*

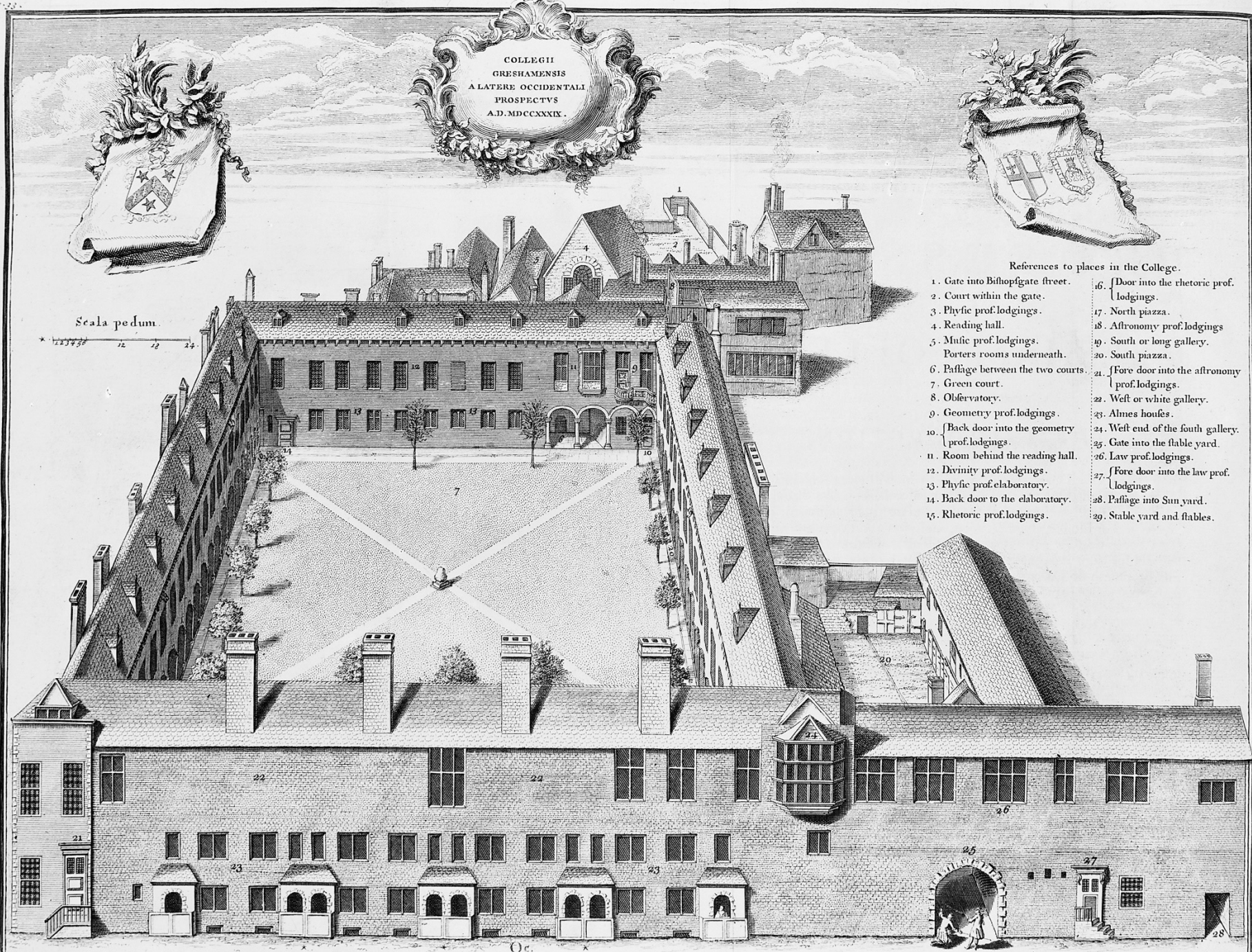
*Natural is from Geometry, consisting
in Uniformity (that is Equality) and
Proportion. Customary Beauty is
begotten by [...] Familiarity [which]
breeds a Love to Things not in
themselves lovely.*

*Here lies the great Occasion of Errors;
here is tried the Architect's judgment:
but always the true Test is natural or
geometrical Beauty.*



Mathematical Demonstrations being built upon the impregnable Foundations of Geometry and Arithmetick, are the only Truths, that can sink into the Mind of Man, void of all Uncertainty; and all other Discourses participate more or less of Truth, according as their Subjects are more or less capable of Mathematical Demonstration.





COLLEGI
GRESHAMENSIS
A LATERE OCCIDENTALI
PROSPECTVS
A.D. MDCXXXIX.

Scala pedum.

References to places in the College.

- 1. Gate into Bishopsgate street.
- 2. Court within the gate.
- 3. Physic prof. lodgings.
- 4. Reading hall.
- 5. Music prof. lodgings.
Porters rooms underneath.
- 6. Passage between the two courts
- 7. Green court.
- 8. Observatory.
- 9. Geometry prof. lodgings.
- 10. { Back door into the geometry
prof. lodgings.
- 11. Room behind the reading hall.
- 12. Divinity prof. lodgings.
- 13. Physic prof. elaboratory.
- 14. Back door to the elaboratory.
- 15. Rhetoric prof. lodgings.
- 16. { Door into the rhetoric prof.
lodgings.
- 17. North piazza.
- 18. Astronomy prof. lodgings
- 19. South or long gallery.
- 20. South piazza.
- 21. { Fore door into the astronomy
prof. lodgings.
- 22. West or white gallery.
- 23. Almes houses.
- 24. West end of the fourth gallery.
- 25. Gate into the stable yard.
- 26. Law prof. lodgings.
- 27. { Fore door into the law prof.
lodgings.
- 28. Passage into Sun yard.
- 29. Stable yard and stables.

*I must congratulate
this City, that I find in
it so general a relish
of Mathematicks.*

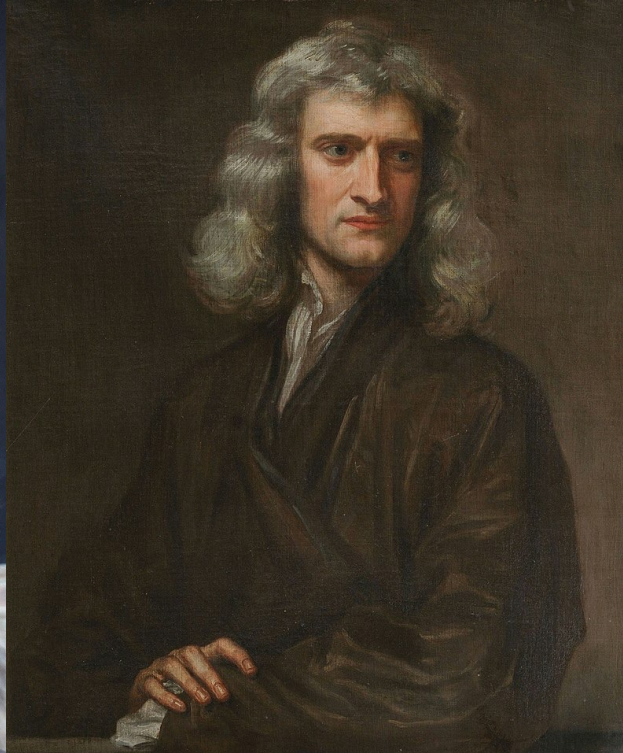
SIR CHR. WREN.
Late Surveyor General of
the Royal Buildings.
He died the 20th of 1703 aged 80.



Robert Hooke

1635 ~ 1703

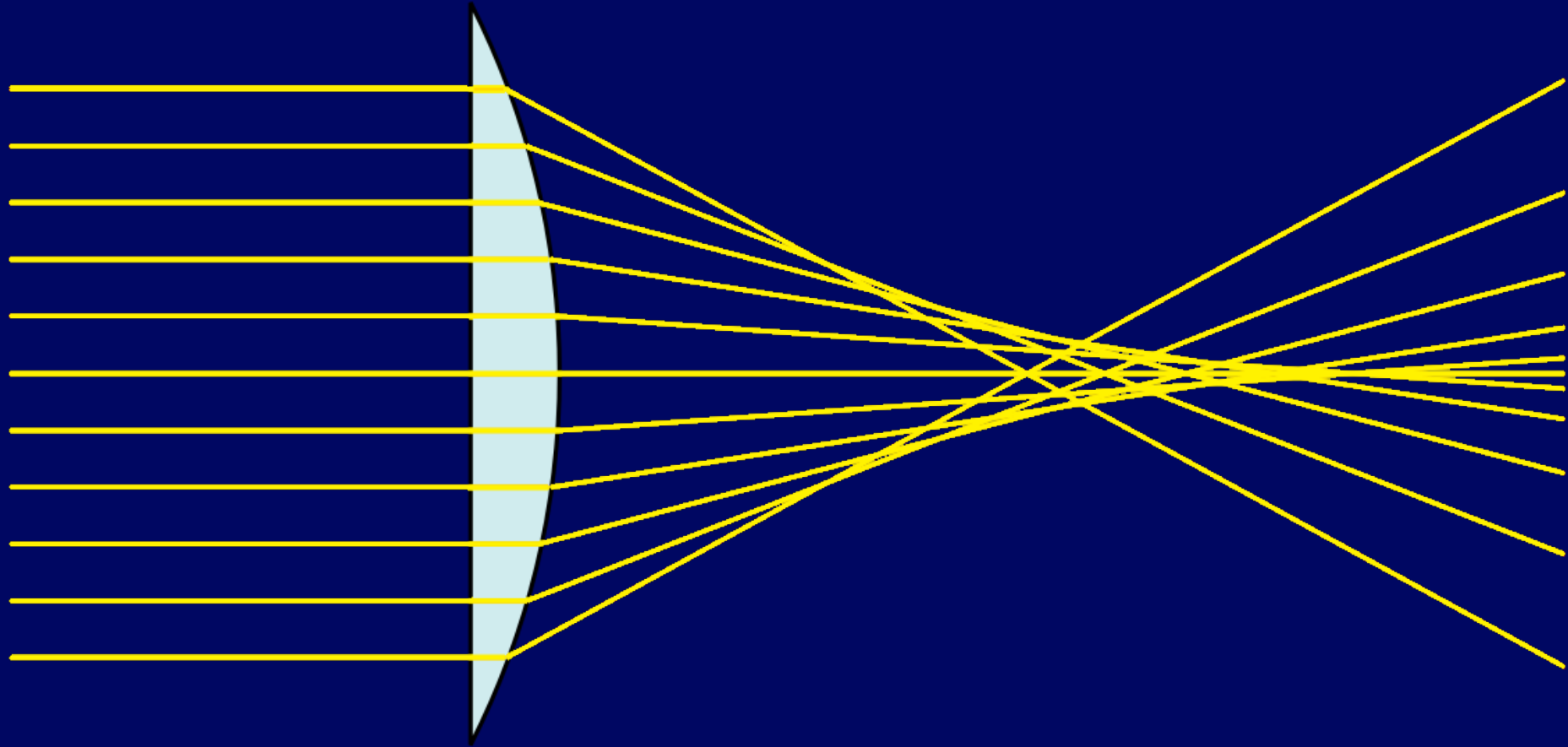
natural philosopher
microscopist
astronomer
physiologist
anatomist
physicist
mechanist
horologist
geologist
architect
surveyor
artist

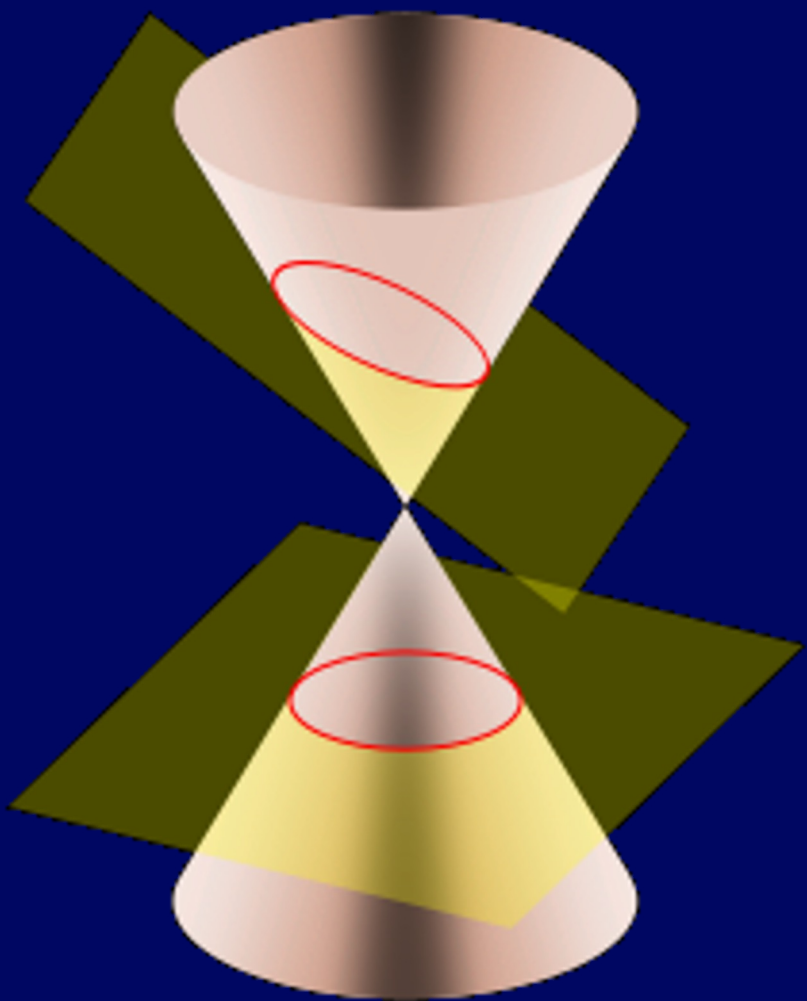


Scholium

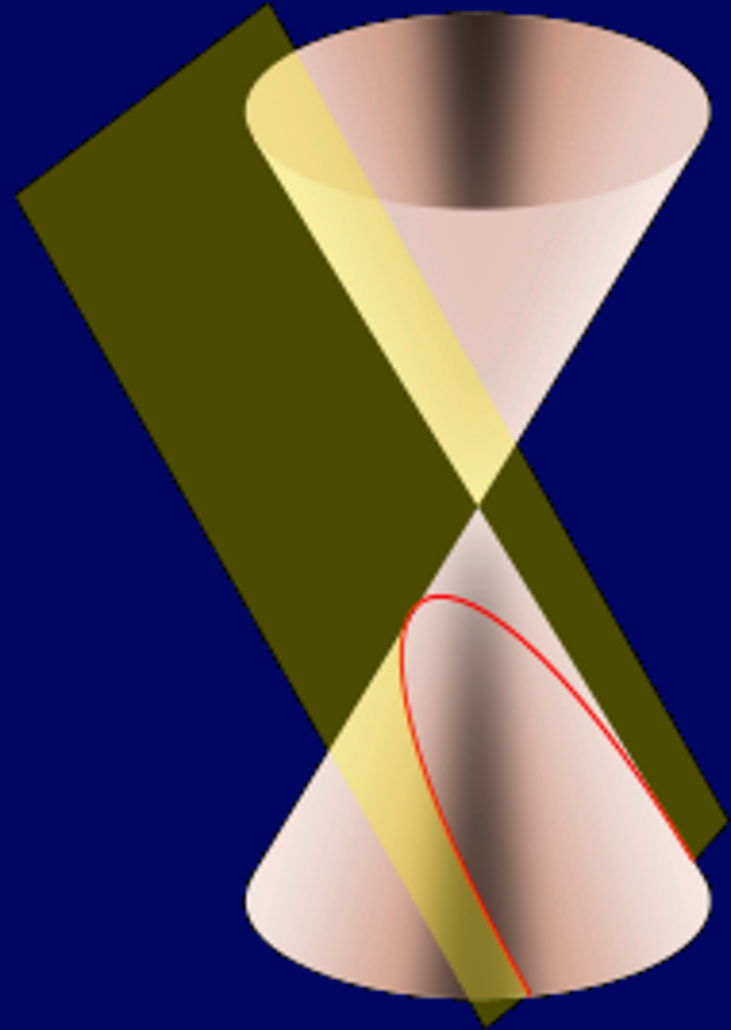
Casus Corollarii sexti obtinet in corporibus caelestibus (ut seorsum colligerunt etiam nostrates *Wrennus*, *Hookius* & *Hallens*) & propterea quæ spectant ad vim centripetam decreascentem in duplicata ratione distantiarum a centrīs decrevi fusius in sequentibus exponere.

How to make lenses





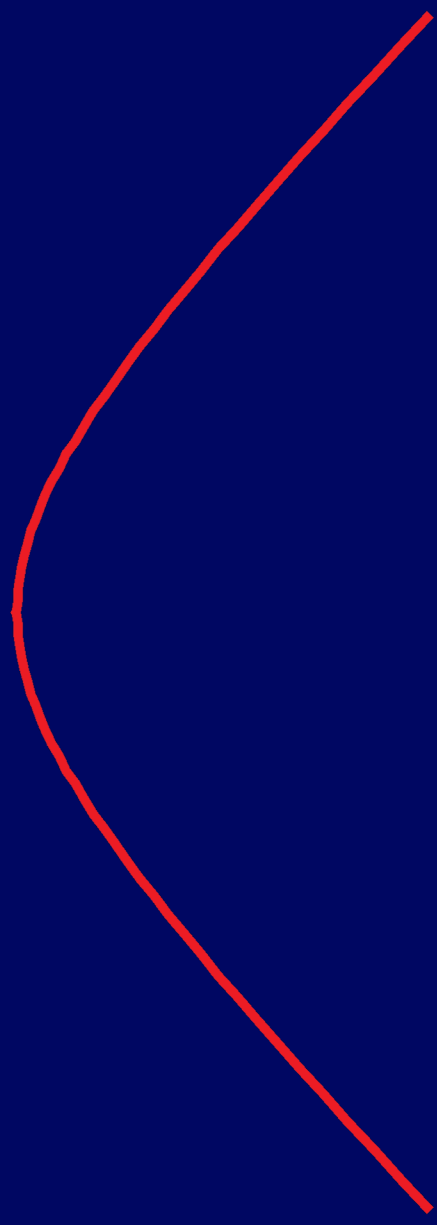
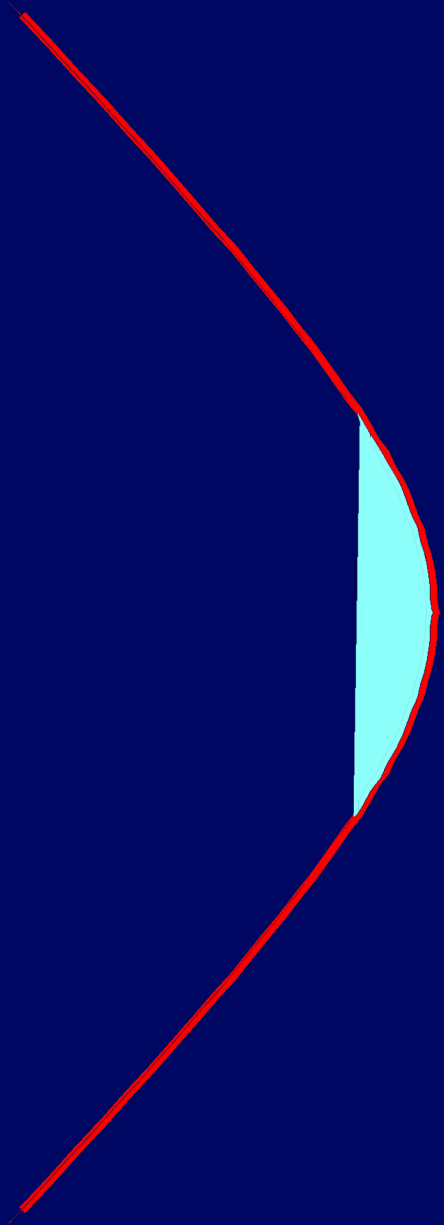
Ellipse



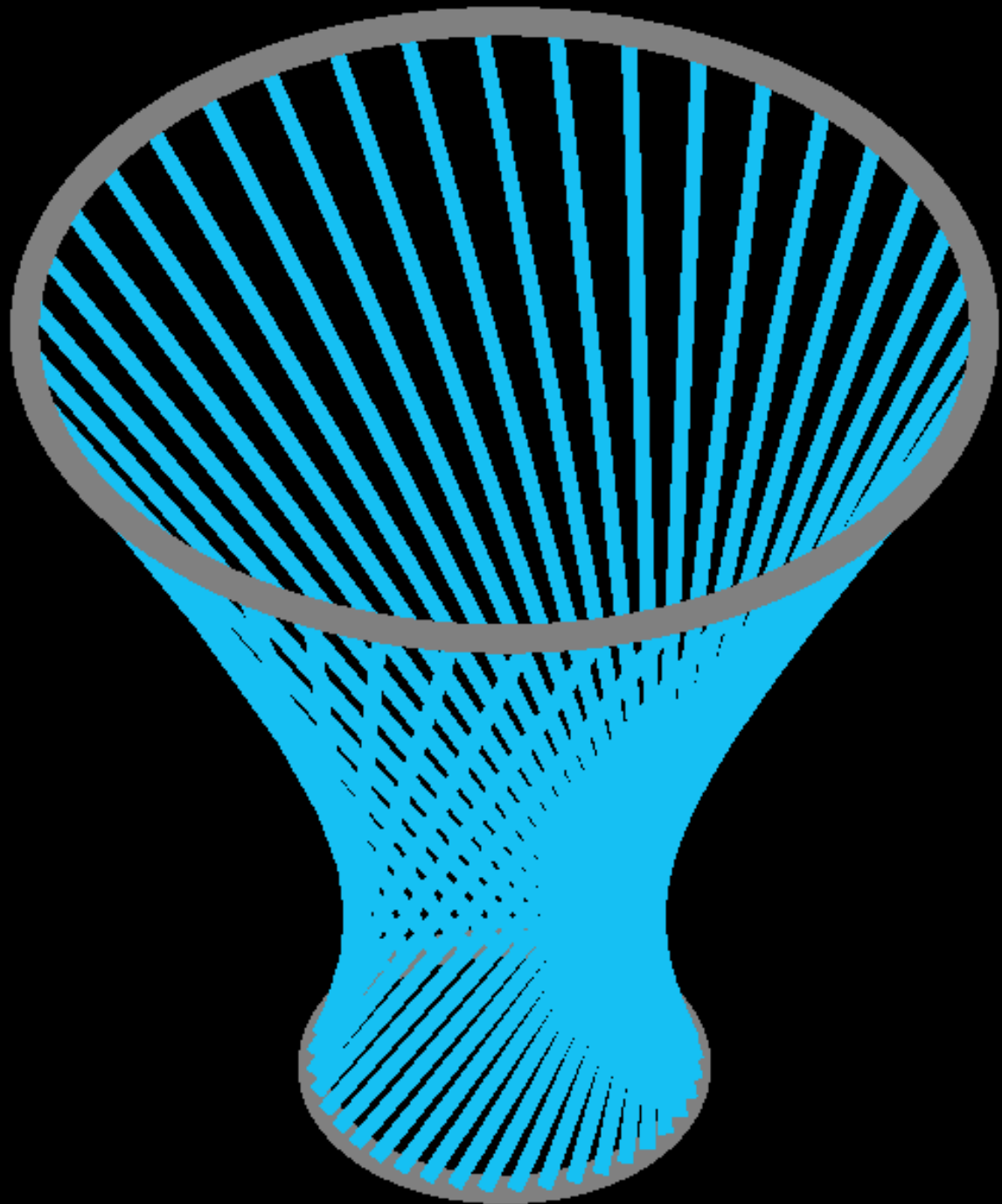
Parabola



Hyperbola

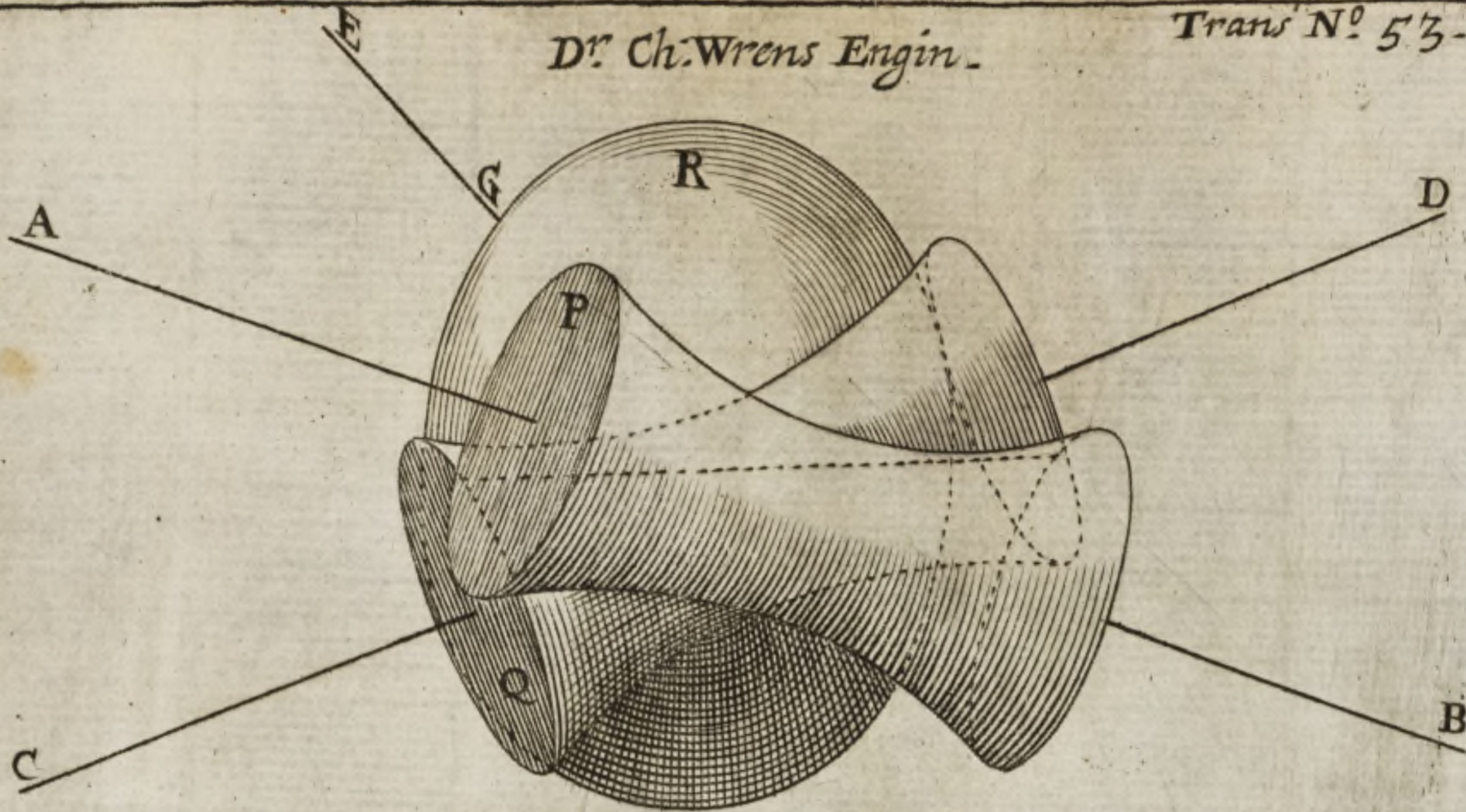






Dr. Ch. Wrens Engin.

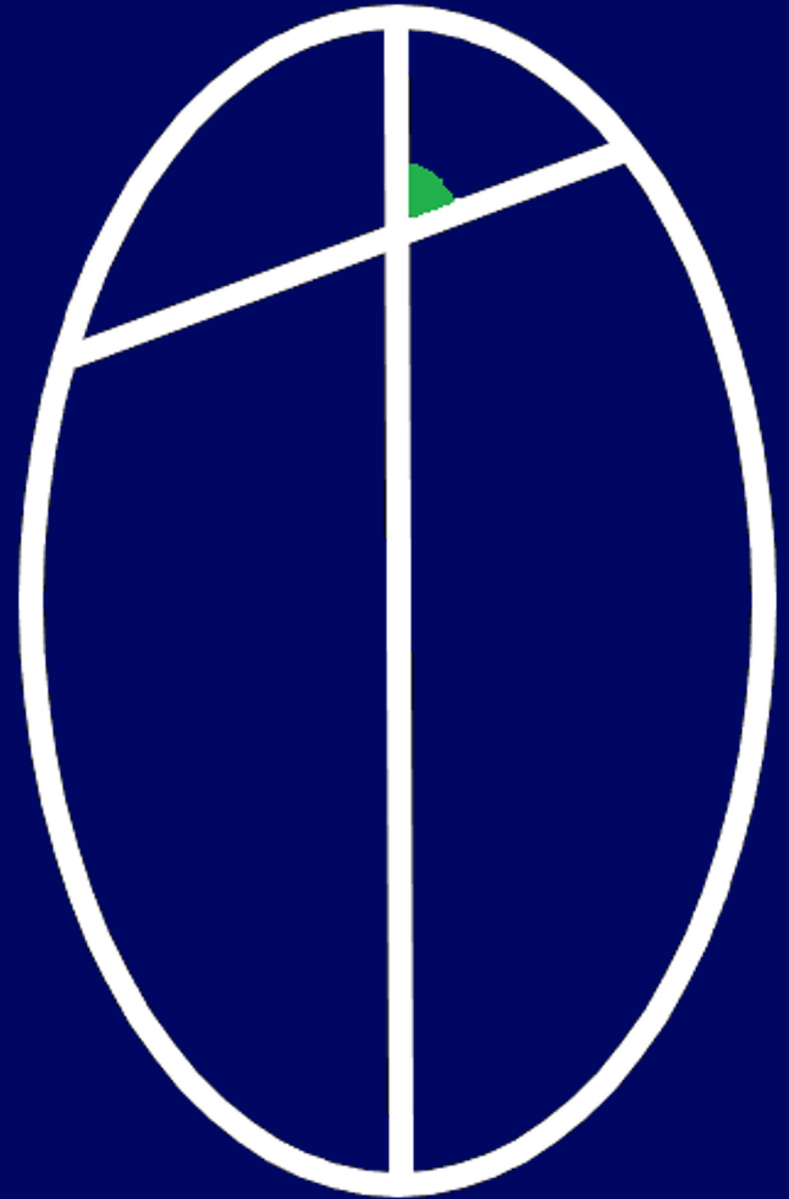
Trans N^o 53-



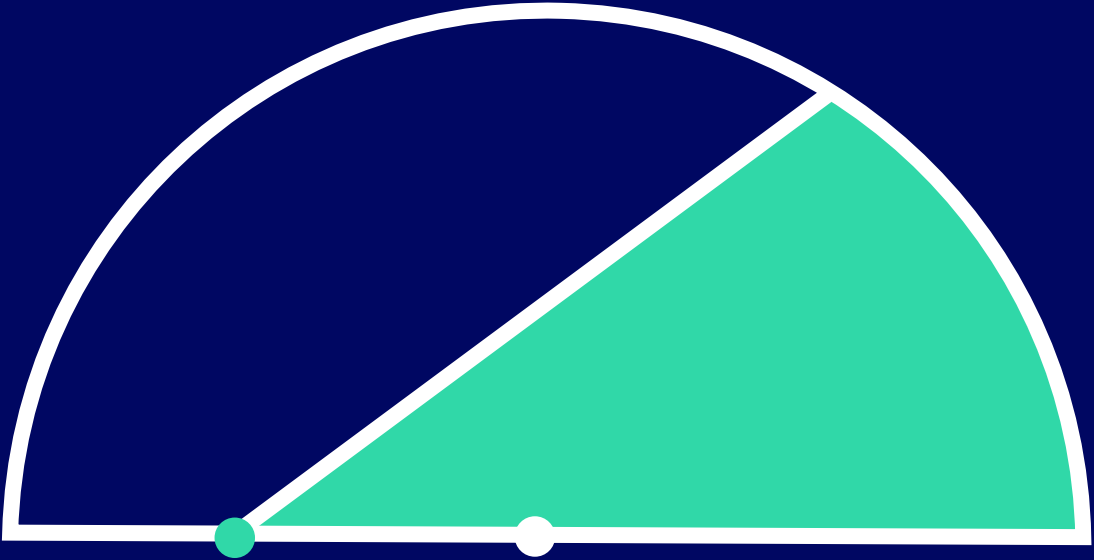
A challenge from France

*Jean de Montfort greatly desires
that those distinguished gentlemen,
the Professors of Mathematics, and
others in England renowned for
mathematical skill, may condescend
to resolve this problem.*

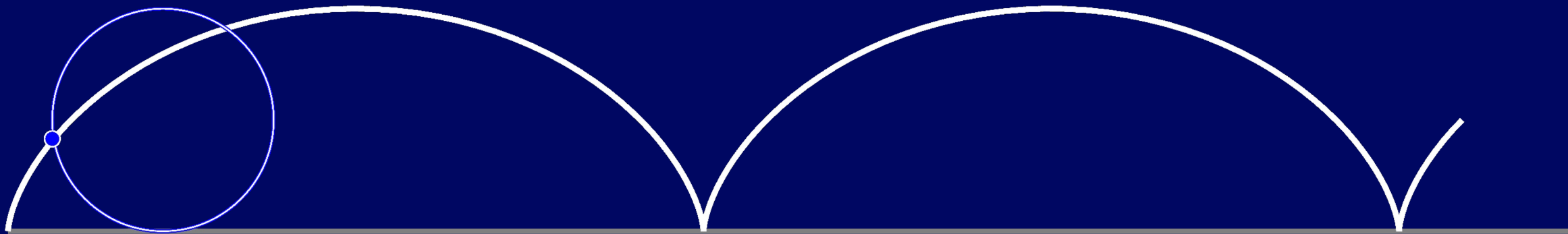
February 1658



Kepler's Problem



The Cycloid



Quadrature

Circle area πr^2

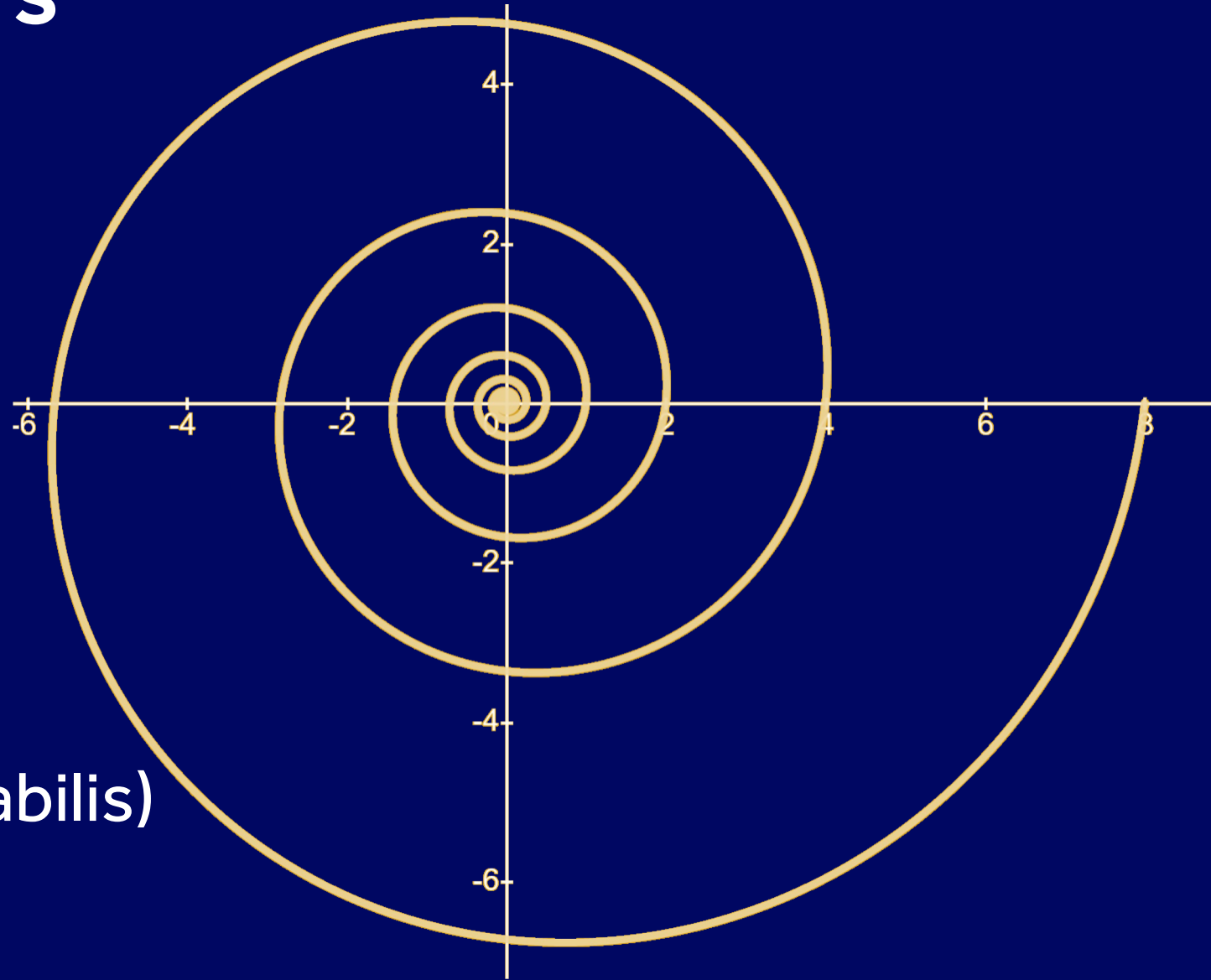
Area under arch $3\pi r^2$

Rectification

Circle circumference πd

Length of arch $4d$

Seashells and Antlers

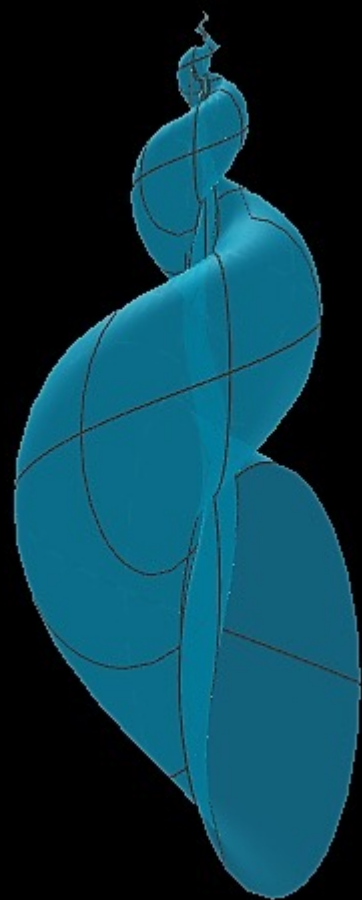
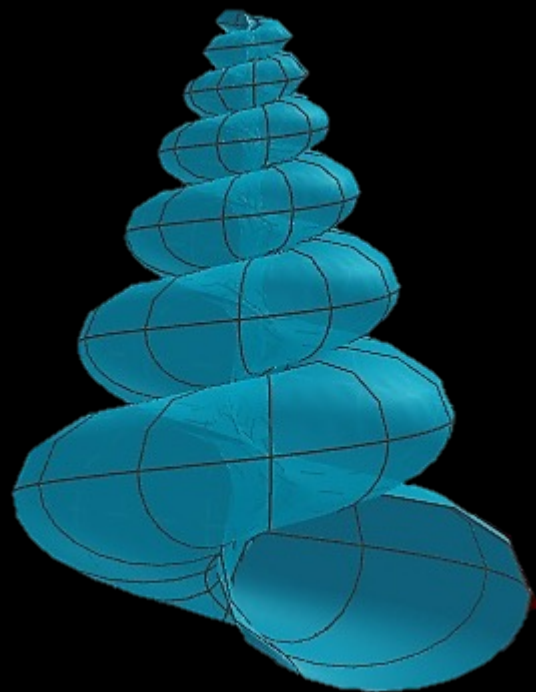
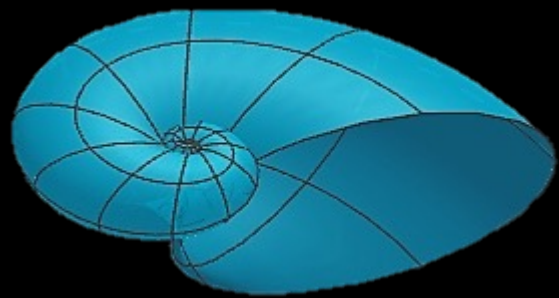
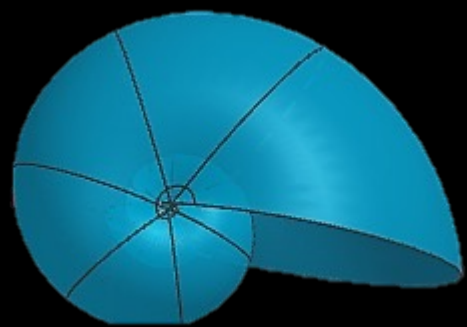


Logarithmic Spiral (spira mirabilis)

- $r = k^\theta$ eg $r = 2^{\theta/360}$

- John Wallis:
rectification of logarithmic spiral by
"convolution"
- Wren: cone \rightarrow "solid" spiral
- Recently: "Power cone construction"







Giant Eland, Boreray Ram, Markhor (Screw-horned goat)





The best shape for an arch

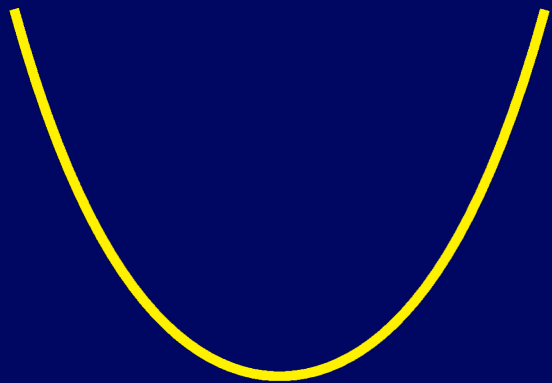
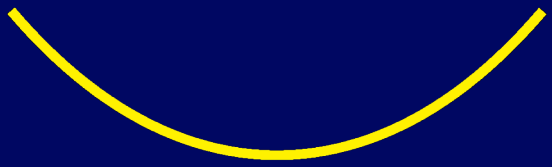
Royal Society meeting, January 1671:

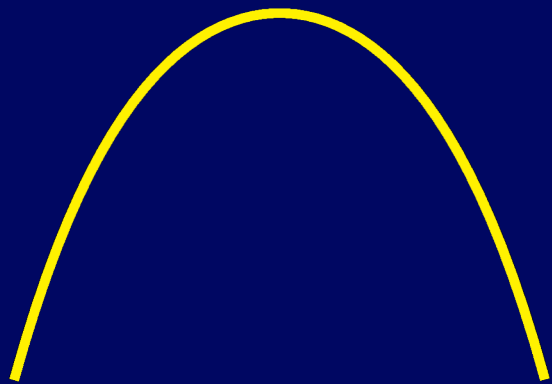
Dr Wren delivered to the President his demonstration of what line it is, which an arch, fit to sustain any assigned weight, makes. The President was desired to examine it, and to give an account of it to the Society. Mr Hooke, being called upon for his demonstration of the same subject answered, that he had already declared the substance of it to the President, who yet desired him to give it also in writing, that so it might be with more leisure and conveniency examined.

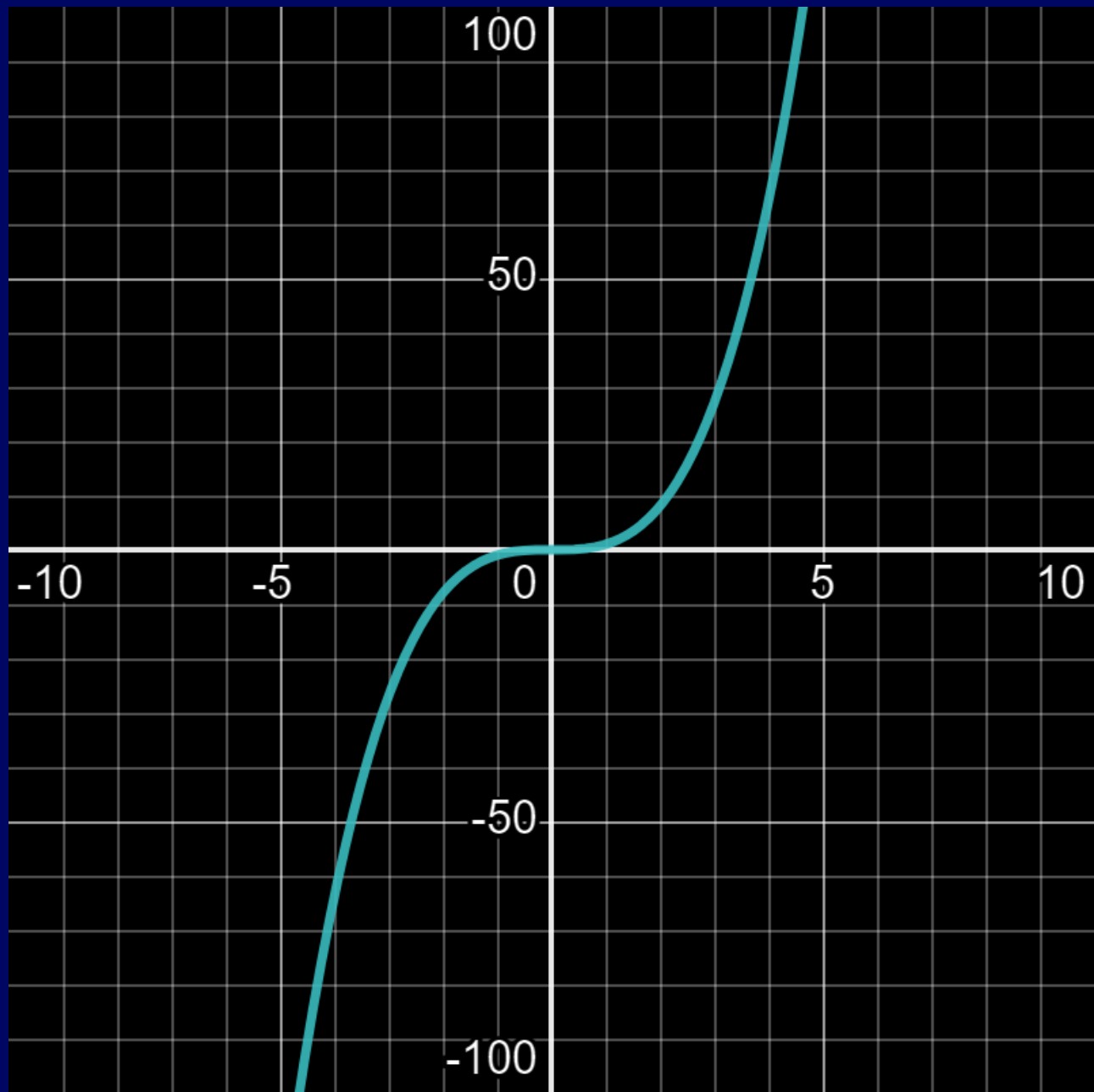
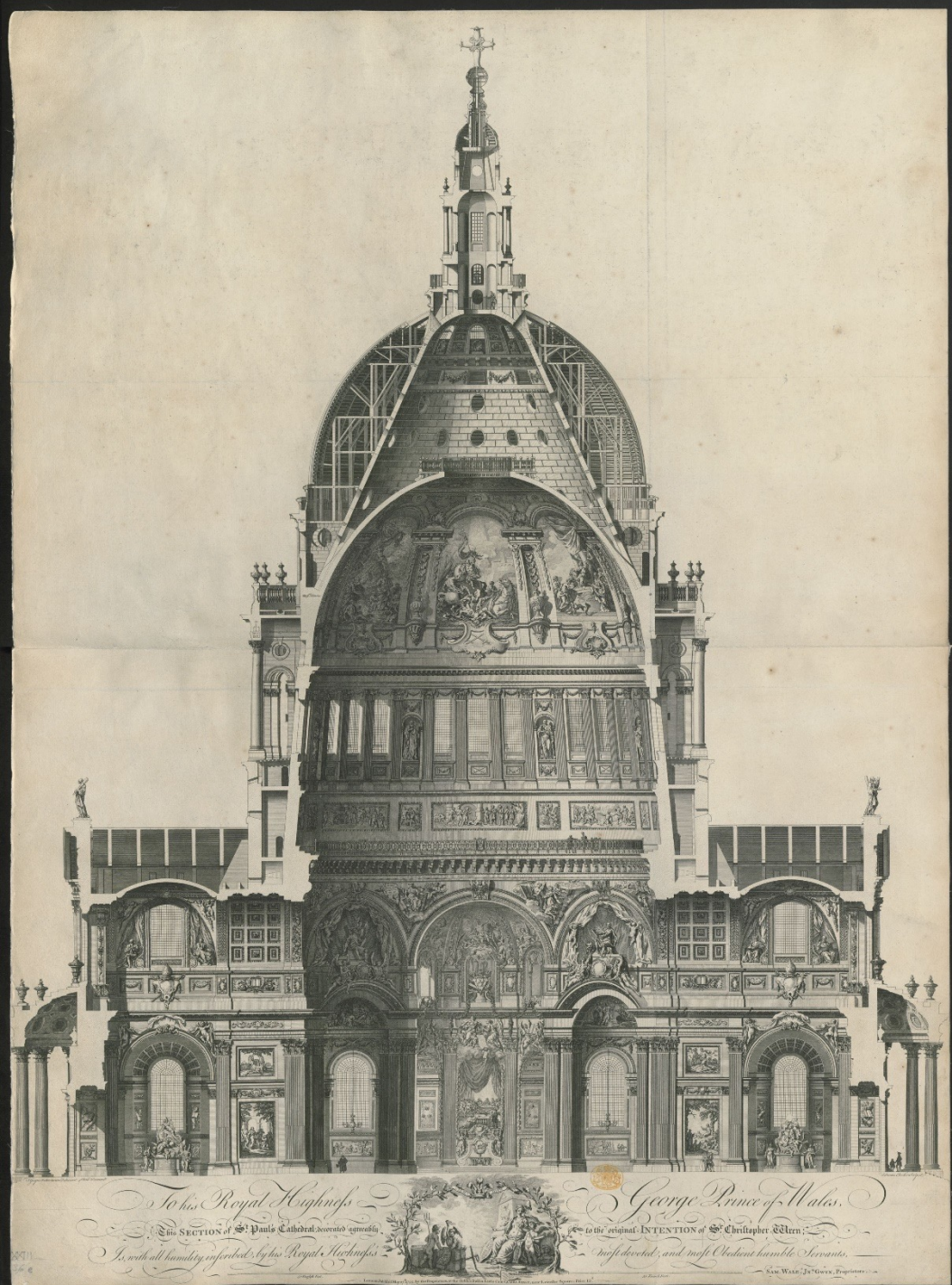


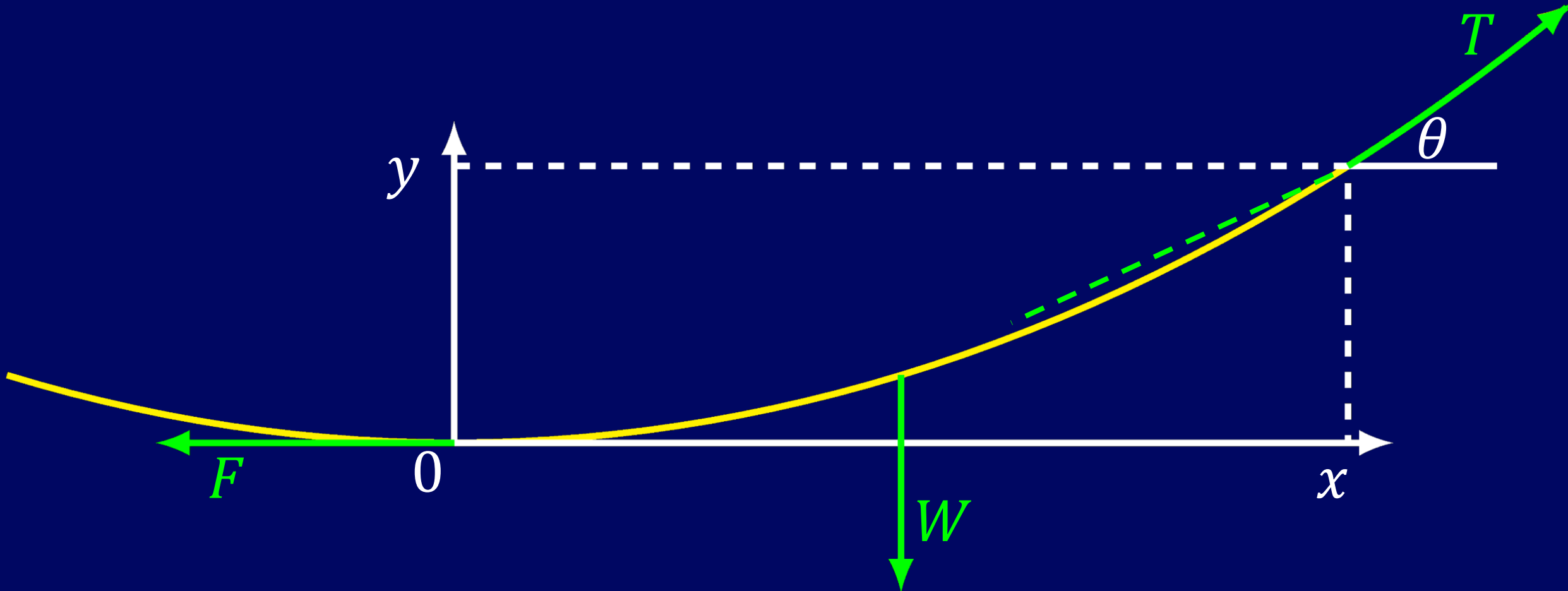


ROBERT HOOKE
1635-1703
Scientist
Architect
Engineer





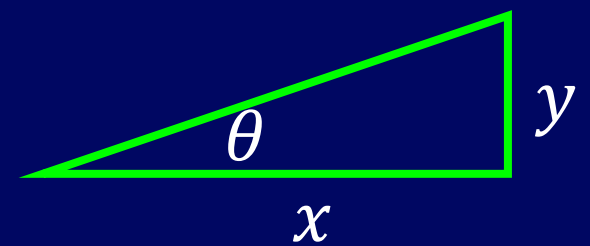




- $T \sin \theta = W$
- $T \cos \theta = F$
- $\tan \theta = \frac{W}{F}$

Approximations

- $W \propto x$, so $\frac{W}{F} = ax$ some a
- $\tan \theta \approx \frac{y}{x}$



$$\frac{y}{x} \approx ax$$

$$y \approx ax^2$$

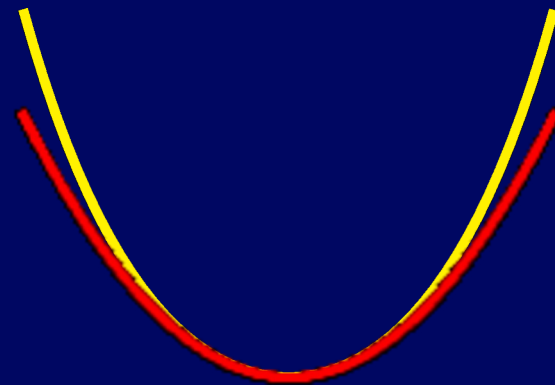
Catenary

$$y = \frac{1}{2b}(e^{bx} + e^{-bx} - 2)$$

$$= \frac{bx^2}{2} + \frac{b^3x^4}{24} + \frac{b^5x^6}{720} + \dots$$

Parabola

$$y = \frac{b}{2}x^2$$



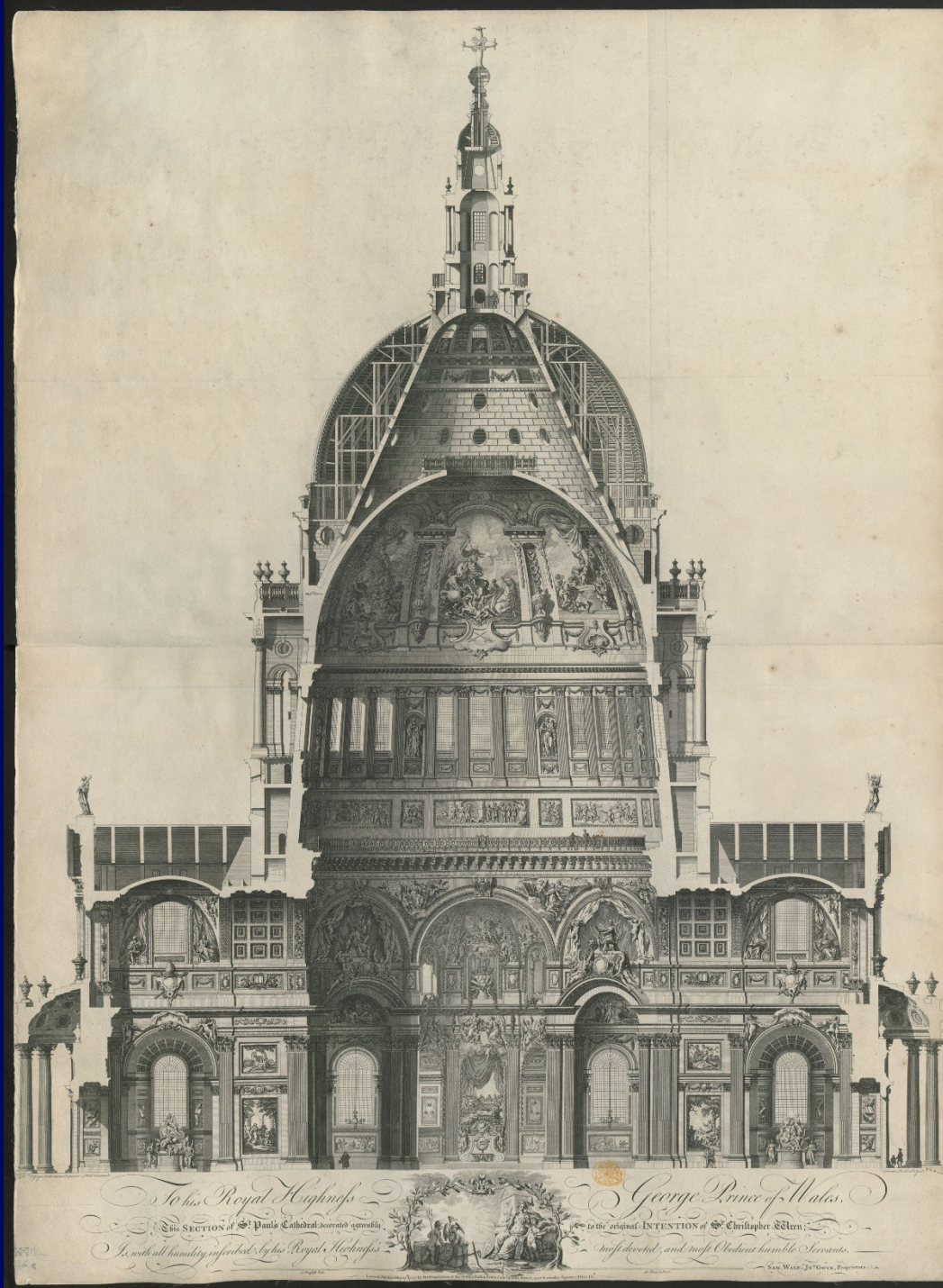
The Ideal Dome

Approximation

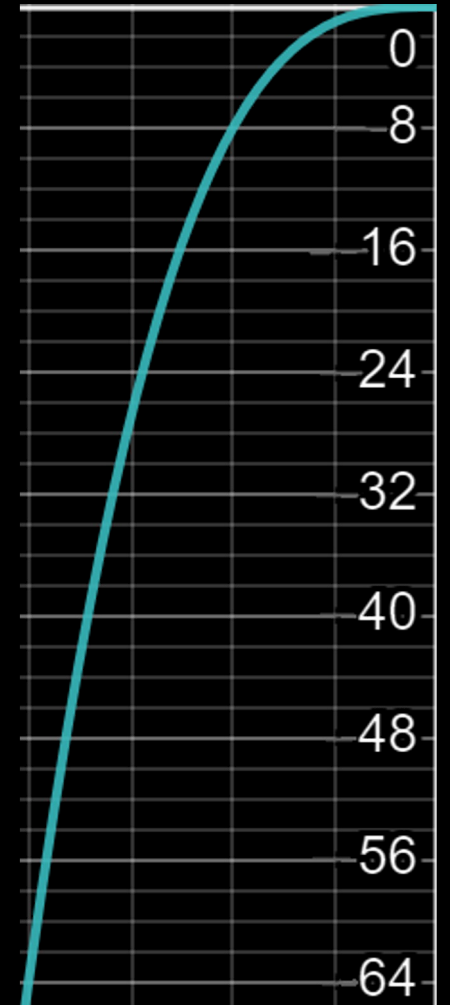
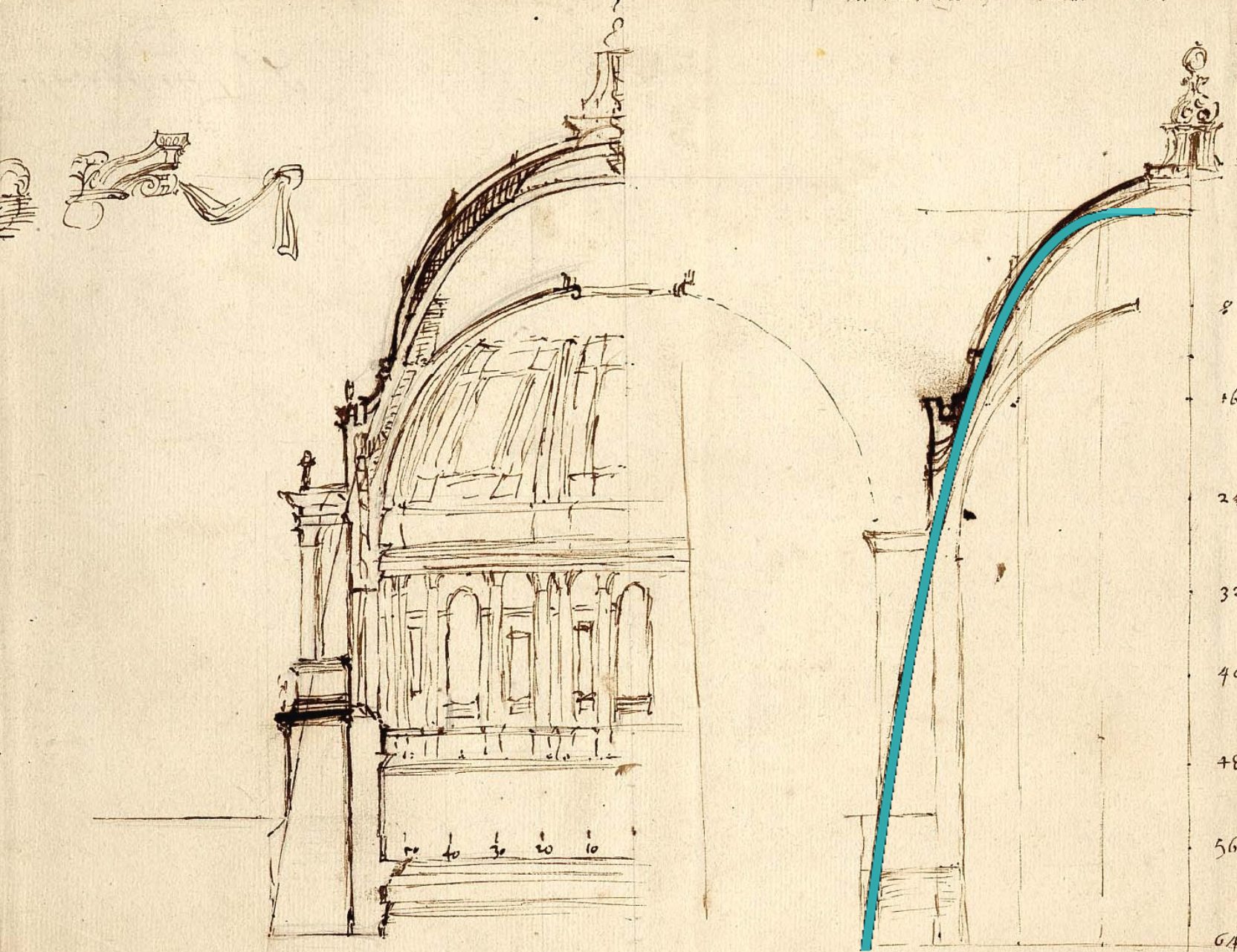
$$\frac{y}{x} \approx ax^2, \text{ so } y \approx ax^3$$

Modern solution

$$y = a\left(x^3 + \frac{x^7}{14} + \frac{x^{11}}{440} + \dots\right)$$



Wren's "cubico-parabolical conoid"



P. Chr. Wren's own hand.

Unexpected mathematical lives - or - Mathematicians of Note

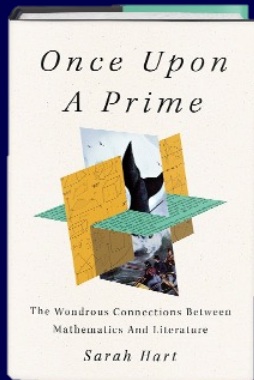




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The Mathematical Life of Florence Nightingale

16th May 2023, 1pm



Read my book!
Once Upon a Prime: The
Wondrous Connections between
Mathematics and Literature



ENGRAVED BY T. COLE.

Florence Nightingale