CALCULATING PLANETARY ORBITS — 1680

	ORBITAL TRAJECTORY	LOCATION VS. TIME	MEAN DIST. FROM SUN
KEPLER	ellipse	area rule	from observations
BOULLIAU	ellipse	a geometric construction	from observations
HORROCKS	ellipse	area rule	via 3/2 power rule
STREETE	ellipse	Boulliau's construction	via 3/2 power rule
WING	ellipse	oscillating equant --- a geometric construction	from observations
MERCATOR	ellipse	a geometric construction	from observations

Principal Results from the Registered Version De Motu Corporum in Gyrum

- **A sufficient condition for Kepler's area rule to hold exactly**
- **A necessary and sufficient condition for Kepler's 3/2 power rule to hold exactly for a multiple bodies moving uniformly in concentric circles**
- **A necessary condition for bodies to be moving exactly in ellipses in which all departures from uniform motion in a straight line are directed toward a focus of the ellipse**
- **A sufficient condition for Kepler's 3/2 power rule to hold exactly for multiple bodies moving in confocal ellipses**
- **A solution for the closed-circuit motion of a projectile under a $1/r^2$ centripetal force that in principle can be applied even to comets**
- **A solution for vertical fall under a $1/r^2$ centripetal force that allows the difference between this rule and uniform acceleration in free fall to be determined**
- **A solution for Galilean motion under resistance forces that vary linearly with velocity which, in principle, allows the differences between Galileo's solutions for free fall and projectile motion and the corresponding motions in resisting media to be calculated**

Upshot: ***Kepler-Horrocks orbital rules have prima facie claim to being at least essentially exact, while Galilean free fall and parabolic projection correlatively have claim only to being approximate (and not in the mean)***

Loose-Ends in the Registered Version of De Motu Corporum in Gyrum

- **What is the basis of the reasoning from the phenomenon of the 3/2 power rule to the inverse-square for the planets in the Scholium to Theorem 2 and then to the ellipse in the Scholium to Problem 3?**

- **Is there any independent evidence for an inverse-square centripetal tendency extending throughout the space around the Sun other than the yet to be substantiated potential evidence from the trajectories of comets?**

- **What evidence is there that, contrary to the findings of Galileo and Huygens, terrestrial gravity is inverse-square? (Also, what evidence is there that air resistance varies linearly with velocity?)**

- **Insofar as at least three centers of inverse-square forces have been identified – the Sun, Jupiter, and Saturn – (and perhaps a fourth – the Earth), and at least Jupiter and Saturn are in motion around the Sun, how can the motions of the planetary satellites be referred to the planets as their centers? Indeed, to what point in space, taken to be at rest, should all the orbital motions be referred?**

- **How far do the centripetal tendencies toward Jupiter and Saturn extend outward from them, all the way to the Sun? If so, why isn't the Sun, contrary to Copernicanism, itself in motion as well?**

- **The deceleration from resistance depends on the weight of the body, as does Huygens's centrifugal tension in a string retaining a body in circular motion; yet the centripetal forces of Theorems 2 and 4 and Problem 5 appear to be independent of the weight of the body, in the manner of Galilean motion. What justifies this difference?**