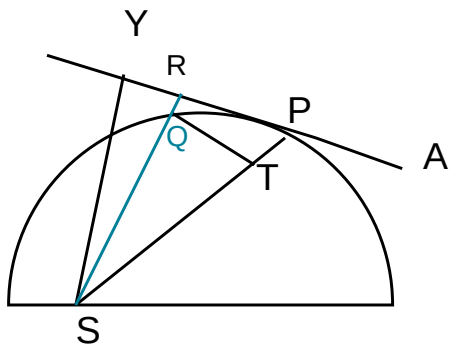
Proposition VI. Theorem V

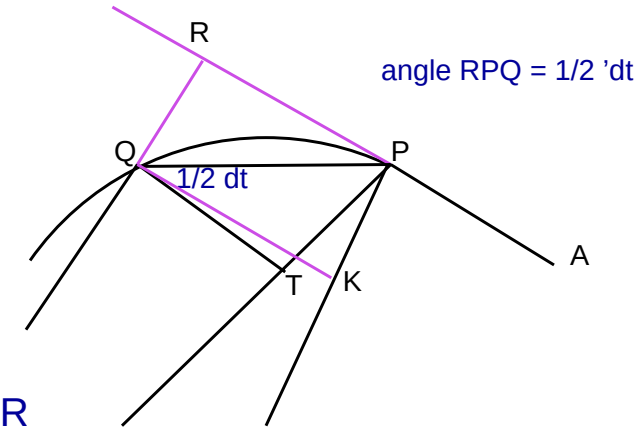
In a space void of resistance, if a body revolves in any orbit about an immovable centre, and the elast time describes any arc just then nascent; and the versed sine of that arc is supposed to be drawn bisecting the chord, and produced passing through the centre of force: the centripetal force in the middle of the arc will be directly as the versed sine and inversely as the versed sine and inversely as the square of the time

NEWTON'S RELATIONS FOR DETERMINING THE LAW OF CENTRIPETAL ATTRACTION FROM THE ORBIT

PROPOSITION VI THEOREM V

Let APQ be the orbit described by a particle about the centre of attraction S;



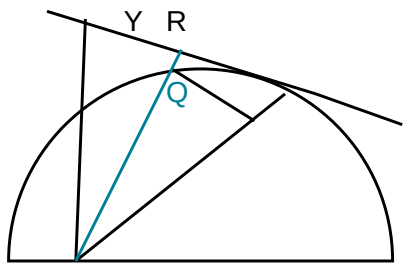


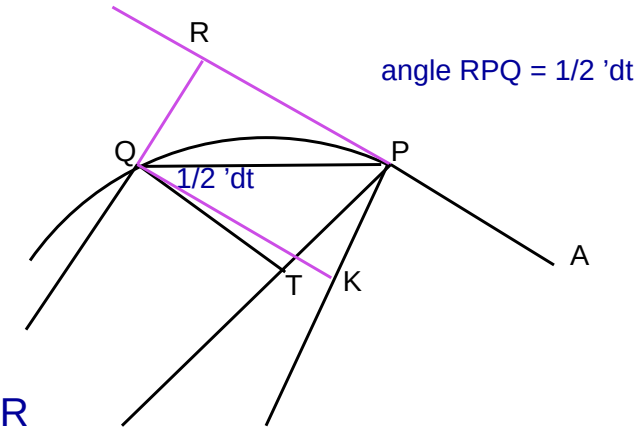
Enlargement of PTQR

* P and Q neighbouring positions of the particle at an interval dt apart;
* YPZ is the tangent at P specifying the direction of the motion
* QR is the continuation of SQ. It is the "versed sine of twice the arc PQ" meant by the Proposition.
  Note that QR may also be considered as drawn parallel to SP since the difference between them vanishes in the limit as dt --> 0
* SY perpendicular to the tangent at P
* In the absence of centripetal attraction the particle initially
* at P will by inertia proceed in the direction of the tangent at P

* and in a time dt will arrive at R. BY the centripetal force acting for a time dt, the particle is drawn to Q. Hence

$$QR = 1/2 \text{ (centripetal force)} \times (\text{'dt})^2 \qquad (1)$$





Enlargement of PTQR

Corollary I

By Proposition I, The area of the triangle SPQ = 1/2 SP * QT ~= (dA/dt) 'dt (

dA/dt is the constant rate at which the area is described is the constant of areas.

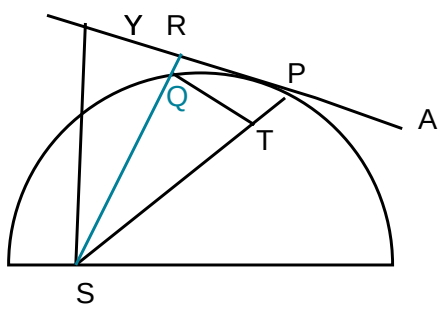
ie SYR = SRP

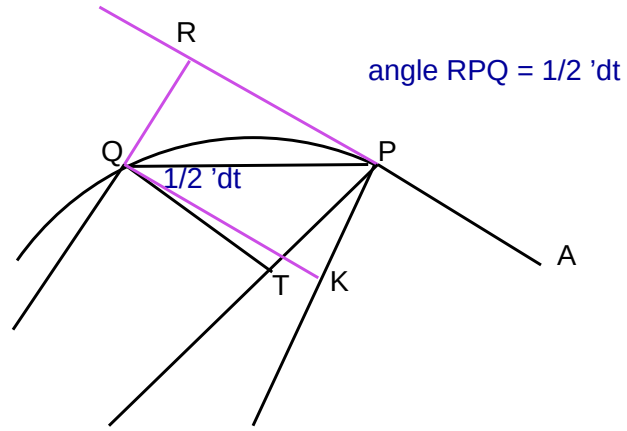
So combine equation (1) and (2) from above, eliminating 'dt we are arrive with

$$\text{Centripetal Force} \quad \sim= \quad \frac{8(dA)^2 * QR}{dt \qquad SP^2 * QT^2}$$

Corollary II

Centripetal Force ~ QR/ SY^2 QP^2





Continue from corollary I, It means that the centripetal force is proportional to the limit of the quantity on the right side when Q --> P. This relation follows directly from the limiting similarity of triangle SYP and QTP as Q -----> P; So

$$\frac{SY}{SP} \sim= \frac{QT}{QP} \text{ or } \frac{SY*QP}{SP*QT} \sim= 1$$