**ORBIT:** Uniformly accelerated circular motion under central force of gravity.

Speed is constant, but velocity (a vector) is changing direction.

![Diagram](Image)

Acceleration is $\Delta V$: vector subtraction from trigonometry,

$$\Delta V = V \sin \theta$$

A small angle is approximately: $\sin \theta \approx \theta = V/R$

$$\sin \theta = \theta = V/R$$

So $a = V \cdot \frac{V}{R} = V^2/R$ and it points towards the center of the circular motion since $V = \frac{\text{Distance}}{\text{Time}} = \frac{2\pi R}{\text{Period}}$;

$$a = \left(\frac{2\pi R}{p}\right)^2 / R \approx \frac{4\pi^2 R}{p^2}$$

Newton's Second Law says:

Force on satellite = $M_{\text{satellite}} \times a_{\text{satellite}}$

$$= M_{\text{sat}} \frac{4\pi^2 R}{p^2}$$

Use Kepler's Third Law:

$$p^2 = CR^3$$

So Kepler's Law tells us gravity is an inverse-square law force! By the same argument, and Newton's Third Law, the equal and opposite force exerted by the satellite on the planet the planet must be proportional to $M_{\text{planet}}/R^2$. 