Review

Uniform Circular Motion:
(Horizontal)

$$a_c = \frac{v^2}{r} \qquad a_c = \frac{4\pi^2 r}{T^2}$$

$$F_c = ma_c \qquad F_c = m\frac{v^2}{r} \qquad F_c = m\frac{4\pi^2 r}{T^2}$$

F_c can be caused by:

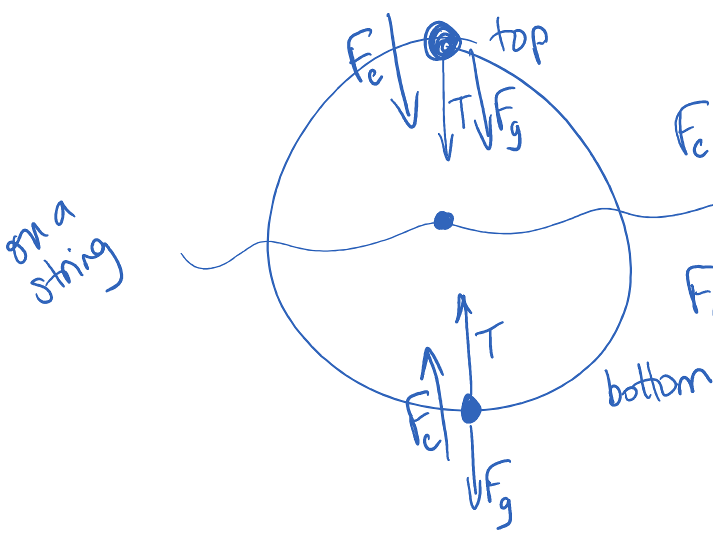
- friction $F_c = F_f$ ← μF_N
- gravity $F_c = F_g$
- tension $F_c = T$
- Normal F $F_c = F_N$

$$v = \frac{2\pi r}{T}$$

$$T = \frac{1}{f}$$

Vertical Circular Motion (non-uniform)

$$F_c = F_{net} = F_{app} - F_{ag}$$



$$F_c = T + F_g$$

$$F_c = T - F_g$$

Newton's Universal Law of Gravitation

F_g = gravitational force

$$F_g = \frac{GMm}{r^2}$$

M ← mass causing the field

m ← mass in the field

F_g = gravitational force

$$F_g = \frac{GMm}{r^2}$$ ← mass in the field

g = gravitational field strength

$$F_g = F_g$$
$$\cancel{m}g = \frac{GM\cancel{m}}{r^2} \Longrightarrow g = \frac{GM}{r^2}$$

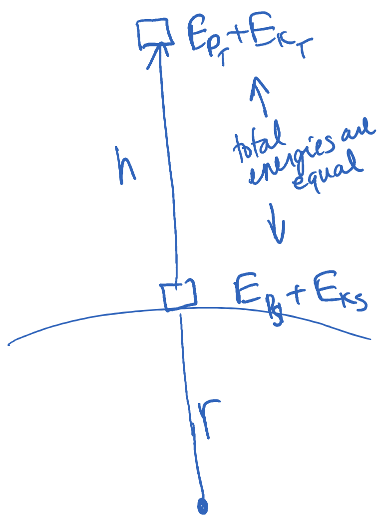
causing the field

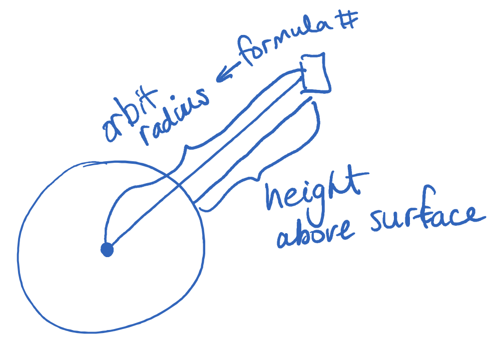
distance to centre of M

Gravitational potential energy

$$E_p = -\frac{GMm}{r}$$

ΔE = work
$E_{pf} - E_{pi}$
$E_{kf} - E_{ki}$





Orbits

Escape velocity:
$$E_p = E_k$$
$$\frac{GM\cancel{m}}{r} = \frac{1}{2}\cancel{m}v^2 \Longrightarrow v = \sqrt{\frac{2GM}{r}}$$

In orbit:
$$F_c = F_g$$
? $$\frac{\cancel{m}v^2}{r} = \frac{GM\cancel{m}}{r^2} \quad \ldots$$

or

$F = \quad r^2$

or

$$\frac{\cancel{m}4\pi^2 r}{T^2} = \frac{GM\cancel{m}}{r^2} \quad \ldots$$

?