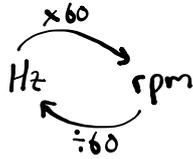Circ Mot

① $T = \frac{1}{f}$ $f = \frac{1}{T}$

$v = \frac{2\pi r}{T}$ $a = \frac{v^2}{r}$ $\boxed{F_c = \frac{mv^2}{r}}$

Memorize

$Hz \xrightarrow{\times 60} rpm \xrightarrow{\div 60}$

② Horizontal Circ. Mot.

Ⓐ $F_c = F_f$

$\frac{mv^2}{r} = \mu_s F_N$

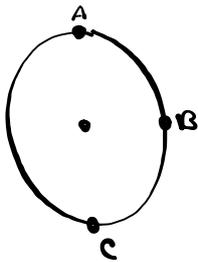$\frac{mv^2}{r} = \mu_s mg$

Ⓑ $F_c = F_g$ (orbital)

$\frac{m_o v^2}{r} = \frac{G M_s m_o}{r^2}$

$v^2 = \frac{G M_s}{r}$

Ⓒ $F_c = F_T$

$\frac{mv^2}{r} = F_T$
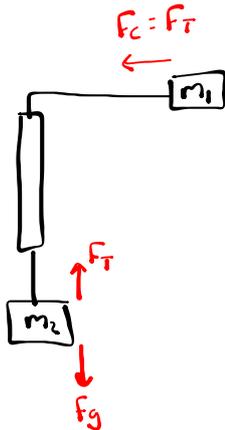
③ Vertical Circ. Mot.

ⓘ $F_c = \frac{mv^2}{r}$ ⓘⓘ $F_g = mg$

Ⓐ at top

$F_c = F_g + F_T$

Ⓒ at bottom

$F_c = F_g + F_T$

Earth

④

$F_c = F_T$

$F_{c_1} = F_T = F_{g_2}$

$\frac{m_1 v^2}{r} = F_T = m_2 g$

$\frac{m_1 v^2}{r} = m_2 g$ Cannot cancel masses

F_T

m_2

F_g

⑤ Kepler's Laws

Ⓐ Two foci. Ellipse.

Ⓑ Equal area, equal time.

Ⓒ $\frac{T^2}{r^3} = \frac{T^2}{r^3}$

$$v = \frac{2\pi r}{T} \qquad f = \frac{1}{T}$$

$$\Downarrow$$

$$v = 2\pi r \left(\frac{1}{T}\right)$$

$$\boxed{v = 2\pi r f}$$