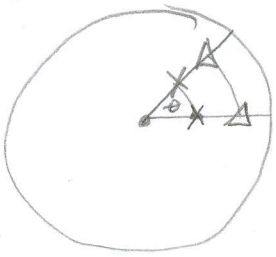
Ch. 7: Circular Motion & Universal Gravitation

- rotational motion - object spins
  - ↳ axis of rotation - the line about which the rotation occurs
- circular motion - pt. on object that rotates about single axis
- all pts. on axis of rotation (except pts. on axis) move through the same angle during any (t) interval



Same θ for X & Δ
radius & s (arc length) will be diff.

- any $\angle$ measured in radians $\theta = \frac{s}{r}$
  - ↳ radians are pure numbers w/ no dimensions

1 revolution $\rightarrow$ $360^\circ = 2\pi$ rad
$= 2(3.14)$ rad $= 6.28$ rad

- converting (deg) to (rad)

$$\theta(\text{rad}) = \frac{\pi}{180^\circ}\theta(\text{deg})$$

- angular displacement

$$\Delta\theta = \frac{\Delta s}{r}$$

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$\Delta s = 2.50\,m$
$\Delta\theta = 1.67\,rad$
$r = ?$

$\Delta\theta = \frac{\Delta s}{r}$ $\quad 1.67\,rad = \frac{2.5}{r}$

$r = 2.5/1.67 = \boxed{1.5\,m}$

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$\Delta\theta = \pi\,rad$
$\Delta s = 1.2\,m$
$r = ?$

$\Delta\theta = \frac{\Delta s}{r}$ $\quad \pi\,rad = \frac{1.2}{r} = \boxed{.38\,m}$

- angular speed describes rate of rotation; units = rad/sec

$\omega_{avg} = \frac{\Delta\theta}{\Delta t}$ angular speed / unit of time

- pg. 248 #1

$\omega_{avg} = 29\,rad/s$ $\quad \Delta t = ?$

$\Delta\theta = 3.5(6.28\,rad) = 21.98\,rad$

$\omega_{avg} = \frac{\Delta\theta}{\Delta t}$ $\quad 29\,rad/s = \frac{21.98\,rad}{\Delta t}$

$\Delta t = \boxed{0.76\,s}$

- pg. 248 #2

$\omega_{avg} = 2.2\,rad/s$
$\Delta\theta = 3.3\,rad$
$\Delta t = ?$

$\omega_{avg} = \frac{\Delta\theta}{\Delta t}$ $\quad 2.2\,rad/s = \frac{3.3\,rad}{\Delta t}$

$\Delta t = \boxed{1.5\,s}$

- pg. 263 Newton's Law of Universal Gravitation
  - ↳ gravitational force - the force that keeps planets from coasting off in a straight line

$F_g = G\frac{m_1 m_2}{r^2}$; $G = 6.673 \times 10^{-11}\,\frac{N \cdot m^2}{kg^2}$

gravitational force = constant $\times$ $\frac{mass\,1 \times mass\,2}{(distance\ b/t\ center\ of\ masses)^2}$