Topic 6: Circular Motion

1) Circular Motion:

a) Radians/Sectors:

Converting between radians and degrees:

$$\pi \text{ rads} = 180°$$

Sector Formulae:

θ in degrees	θ in radians
$l = 2\pi r\left(\frac{\theta}{360}\right)$	$l = r\theta$
$A = \pi r^2\left(\frac{\theta}{360}\right)$	$A = \frac{1}{2}r^2\theta$

See Tables book pg 9

Linking Linear Speed and Angular Speed:

$$v = \omega r$$

See Tables book pg 51

b) Horizontal Motion:

Notes:

- Resolve all forces horizontally and vertically.
- Generate one equation from Forces Up = Forces Down
- Generate a second equation using the Centripetal Force (the force acting horizontally towards the centre of the circle)

Centripetal Acceleration and Forces:

$$Acc = \omega^2 r \qquad F = m\omega^2 r$$

$$Acc = \frac{v^2}{r} \qquad F = \frac{mv^2}{r}$$

See Tables book pg 51

c) Vertical Motion:

Notes:

- Generate one equation from Law of Conservation of Energy:

$$mgh_1 + \frac{1}{2}mv_1{}^2 = mgh_2 + \frac{1}{2}mv_2{}^2$$

- Always resolve the weight into horizontal and vertical forces relative to the radius of motion.
- Generate a second equation using Centripetal Force (the force acting along the radius towards the centre of the circle)
- Generally, link the two equations by equating expressions for v^2.
- For questions involving strings going slack, generate equations involving T, and then let T = 0.

2) Hooke's Law:

b) Hooke's Law:

Notes:

- The extension of a spring, or elastic material is directly proportional to the force causing the extension.

$$F = k(l - l_0)$$

'k' is known as the elastic constant and has units N/m.

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