

## MECHANICS

*Uniformly accelerated motion*

$$v = u + at, \quad s = \frac{1}{2}(u + v)t, \quad s = ut + \frac{1}{2}at^2, \quad v^2 = u^2 + 2as$$

*Motion of a projectile*

Equation of trajectory is:

$$y = x \tan \theta - \frac{gx^2}{2V^2 \cos^2 \theta}$$

*Elastic strings and springs*

$$T = \frac{\lambda x}{l}, \quad E = \frac{\lambda x^2}{2l}$$

*Motion in a circle*

For uniform circular motion, the acceleration is directed towards the centre and has magnitude

$$\omega^2 r \quad \text{or} \quad \frac{v^2}{r}$$

*Centres of mass of uniform bodies*

Triangular lamina:  $\frac{2}{3}$  along median from vertex

Solid hemisphere of radius  $r$ :  $\frac{3}{8}r$  from centre

Hemispherical shell of radius  $r$ :  $\frac{1}{2}r$  from centre

Circular arc of radius  $r$  and angle  $2\alpha$ :  $\frac{r \sin \alpha}{\alpha}$  from centre

Circular sector of radius  $r$  and angle  $2\alpha$ :  $\frac{2r \sin \alpha}{3\alpha}$  from centre

Solid cone or pyramid of height  $h$ :  $\frac{3}{4}h$  from vertex