Edexcel Further Maths AS-level

Further Mechanics 2

Formula Sheet

Provided in formula book	Not provided in formula book

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Motion in a Circle

$r = radius$	$v = r\dot{\theta}$
$v = linear\ speed$	
$\omega = \dot{\theta} = angular\ speed$	

Motion in a Horizontal Circle

$$Radial\ Acceleration = -r\omega^2 = -\frac{v^2}{r}$$

(towards the centre of the circle)

Centre of Mass of Plane Figures

Plane Figures

If a system consists of n particles with masses $m_1, m_2, \dots, m_n$ are positioned at $(x_1, 0), (x_2, 0), \dots, (x_n, 0)$ respectively, then

$$\sum_{i=1}^{n} m_i x_i = \bar{x} \sum_{i=1}^{n} m_i$$

where $(\bar{x}, 0)$ is the position of the centre of mass of the system.

If a system consists of n particles with masses $m_1, m_2, \dots, m_n$ have position vectors $\boldsymbol{r_1}, \boldsymbol{r_2}, \dots \boldsymbol{r_n}$ then

$$\sum_{i=1}^{n} m_i \boldsymbol{r_i} = \bar{\boldsymbol{r}} \sum_{i=1}^{n} m_i$$

where $\bar{\boldsymbol{r}}$ is the position vector of the centre of mass of the system.

For a rod with end positions (x_1, y_1) and (x_2, y_2) the centre of mass is the midpoint $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.

For a uniform triangular lamina with coordinates $(x_1, y_1), (x_2, y_2)$ and (x_3, y_3), the centre of mass has position $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$.

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Standard Results for Uniform Bodies

Triangular lamina	$\frac{2}{3}$ along median from vertex
Circular arc, radius r, angle at centre 2α	$\frac{r\sin\alpha}{\alpha}$ from the centre
Sector of circle, radius r, angle at centre 2α	$\frac{2r\sin\alpha}{3\alpha}$ from the centre
Semicircle, radius r	$\frac{4r}{3\pi}$ from the centre

Further Kinematics

Acceleration Varying with Time

$$a = f(t) = \frac{dv}{dt} = \frac{d^2x}{dt^2}$$

Acceleration Varying with Displacement

$$a = f(x) = v\frac{dv}{dx} = \frac{d}{dx}\left(\frac{1}{2}v^2\right)$$

Acceleration Varying with Velocity

$$a = f(v) = \frac{dv}{dt}$$

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