

- MX 11** A particle is fired from the origin  $O$  with initial velocity  $18 \text{ ms}^{-1}$  at an angle  $60^\circ$  to the horizontal.  
**SP a**

The equations of motion are  $\frac{d^2x}{dt^2} = 0$  and  $\frac{d^2y}{dt^2} = -10$

(i) Show that  $x = 9t$ .

**1**

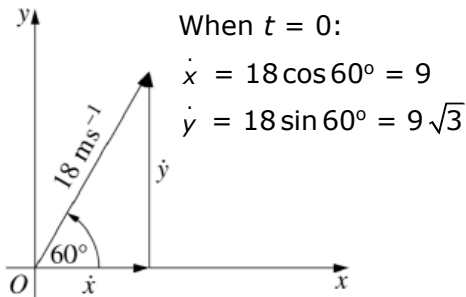
(ii) Show that  $y = 9\sqrt{3}t - 5t^2$ .

**2**

(iii) Hence find the Cartesian equation for the trajectory of the particle.

**1**

(i)



$$\ddot{x} = 0$$

$$\dot{x} = C_1$$

Substitute  $t = 0$ ,  $\dot{x} = 9$ :

$$\therefore C_1 = 9$$

$$\therefore \dot{x} = 9$$

$$x = 9t + C_2$$

Substitute  $t = 0$ ,  $x = 0$ :

$$\therefore C_2 = 0$$

$$x = 9t$$

(ii)  $\ddot{y} = -10$

$$\dot{y} = -10t + C_3$$

Substitute  $t = 0$ ,  $\dot{y} = 9\sqrt{3}$ :

$$C_3 = 9\sqrt{3}$$

$$\therefore \dot{y} = 9\sqrt{3} - 10t$$

$$y = 9\sqrt{3}t - 5t^2 + C_4$$

Substitute  $t = 0$ ,  $y = 0$ :

$$\therefore C_4 = 0$$

$$\therefore y = 9\sqrt{3}t - 5t^2 \dots *$$

(iii) Substitute  $t = \frac{x}{9}$  into \*:

$$y = 9\sqrt{3}t - 5t^2$$

$$= \sqrt{3}x - \frac{5x^2}{81}$$

\* These solutions have been provided by [projectmaths](http://projectmaths.com.au) and are not supplied or endorsed by NESA.

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