6 **(b)** A particle moves with simple harmonic motion of amplitude 0.75 m. The period of the motion is 4 s.

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Find **(i)** the maximum speed of the particle

(ii) the time taken by the particle to move from the position of maximum speed to a position at which its speed is half its maximum value.

(*i*) Period $= 4$

$$\frac{2\pi}{\omega} = 4$$

$$\omega = \frac{\pi}{2}$$ 5

$$v_{\max} = \omega a$$

$$= \frac{\pi}{2}\left(\frac{3}{4}\right)$$

$$= \frac{3\pi}{8}\ \text{m s}^{-1}$$ 5

(*ii*) $\frac{1}{2}v_{\max} = \frac{3\pi}{16}$

$$v^2 = \omega^2\left(a^2 - x^2\right)$$

$$\left(\frac{3\pi}{16}\right)^2 = \left(\frac{\pi}{2}\right)^2\left(\left(\frac{3}{4}\right)^2 - x^2\right)$$

$$\Rightarrow x = \frac{3\sqrt{3}}{8}$$ 5

$$x = a\cos\omega t$$

$$\frac{3\sqrt{3}}{8} = \frac{3}{4}\cos\left(\frac{\pi}{2}t\right)$$

$$\Rightarrow t = \frac{1}{3}$$

$$\text{time} = 1 - \frac{1}{3} = \frac{2}{3}\ \text{s.}$$

$$\frac{3\sqrt{3}}{8} = \frac{3}{4}\sin\left(\frac{\pi}{2}t\right)$$ 5

$$\Rightarrow \quad t = \frac{2}{3}\ \text{s.}$$ 5

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