1 Given that θ is an obtuse angle measured in radians and that $\sin\theta = k$, find, in terms of k, an expression for

(i) $\cos\theta$, [1]

(ii) $\tan\theta$, [2]

(iii) $\sin(\theta + \pi)$. [1]

(i) $\sin\theta = k \to \sin^2\theta = k^2 \to 1 - \sin^2\theta = 1 - k^2 \to \cos^2\theta = 1 - k^2$

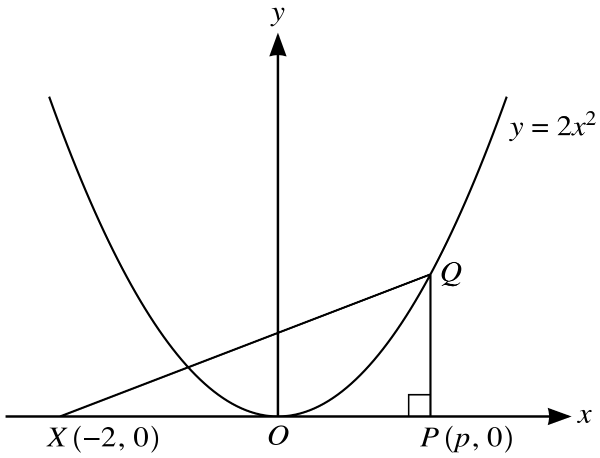
$\cos\theta = +\sqrt{1-k^2}$ (rejected) θ is obtuse

$\boxed{\cos\theta = -\sqrt{1-k^2}}$

(ii) $\tan\theta = \dfrac{\sin\theta}{\cos\theta} = \dfrac{k}{-\sqrt{1-k^2}}$ #

(iii) $\sin(\pi + \theta) = -\sin\theta = -k$ #

2



The diagram shows the curve $y = 2x^2$ and the points $X(-2, 0)$ and $P(p, 0)$. The point Q lies on the curve and PQ is parallel to the y-axis.

(i) Express the area, A, of triangle XPQ in terms of p. [2]

The point P moves along the x-axis at a constant rate of 0.02 units per second and Q moves along the curve so that PQ remains parallel to the y-axis.

(ii) Find the rate at which A is increasing when $p = 2$. [3]

$X(-2, 0) \quad P(p, 0) \quad Q(p, 2p^2) \quad Q$ lies on $y = 2x^2$

$\therefore x_Q = p \rightarrow y_Q = 2p^2$

(i) Area of triangle $XPQ = \frac{1}{2}(p+2)(2p^2) = p^2(p+2) = \boxed{p^3 + 2p^2}$ #

(ii) $A = p^3 + 2p^2 \rightarrow \frac{dA}{dt} = \frac{dA}{dp} \times \frac{dp}{dt}$

$\rightarrow \frac{dA}{dt} = (3p^2 + 4p) \times \frac{2}{100} = (3(2)^2 + 4(2)) \times \frac{2}{100}$

$\rightarrow \boxed{\frac{dA}{dt} = 0.4 \text{ unit/sec}}$ #