Start here for Question Number: 7

a) $\ddot{x} = 4\cos 2t$

at $t = 0$, $v = 1$

$\therefore \int \ddot{x} = v = \frac{1}{2} \times 4 \sin 2t = 2\sin 2t + c$

at $t = 0$, $v = 2\sin 0 + c = 1$

$\therefore c = 1$

$\therefore v = 2\sin 2t + 1$

ii) at $v = 0$

$0 = 2\sin 2t + 1$

$-1 = 2\sin 2t$

$-\frac{1}{2} = \sin 2t$

$2t = -\frac{\pi}{6}$

$\boxed{t = -\frac{\pi}{12}}$

iii) $x = \int v = -2 \times \frac{1}{2}\cos 2t + c$

$= -\cos 2t + c$

at $t = 0$, $x = 0$ (given)

$= -\cos 2(0) + c = 0$

$-1 + c = 0$

$c = 1$

$\therefore x = -\cos 2t + 1$

b) $y = x^2$

$y' = 2x = m$

at A, $m = 2(-1) = -2$

$y - 1 = -1(x + 1)$

$y - 1 = -x - 1$

i) $\boxed{y = -x}$

ii) gradient of tangent C $= m_1 =$ gradient of AB $= m_2$

Midpoint AB $= \left(\frac{2-1}{2}, \frac{4+1}{2}\right) = \left(\frac{1}{2}, \frac{5}{2}\right)$

C $= (x_1, y_1)$

$y' = 2x = m = m_2 = 1$

Gradient AB $= \frac{4-1}{2+1} = \frac{3}{3} = 1$

$y - y_1 = 1(x - x_1)$

$y - y_1 = x - x_1$

Midpoint of AB $= \left(\frac{2-1}{2}, \frac{4+1}{2}\right) = \left(\frac{1}{2}, \frac{5}{2}\right)$

$\therefore \frac{\frac{5}{2} - y_1}{\frac{1}{2} - x_1} = 0$

$\frac{5}{2} - y_1 = 0$

$\frac{5}{2} = y_1$

$x_1 =$

Additional writing space on back page.

Office Use Only - Do NOT write anything, or make any marks below this line

(iii) BT $y' = 2x = m$

at $x = 2$

$m = 4$

$\therefore y - 4 = 4(x - 2)$

$y - 4 = 4x - 8$

$y = 4x - 4$ tangent at B

You may ask for an extra Writing Booklet if you need more space to answer question 7.