Start here for Question Number: 7

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

$\dot{x} = \int 4\cos 2t$

~~$= 2\sin 2t$~~

$= 4 \times \frac{1}{2} \sin 2t$

$= 2 \sin 2t$

initially at $t = 0$

$\dot{x} = 2 \sin 2(0)$

$= 0$

~~$\dot{x} = 2\sin 2t$~~

When $x = 0$ $v = -1$

$-1 = 2 \sin 2t$

$0 = 2 \sin 2t + 1$

$\therefore \quad \dot{x} = 2 \sin 2t + 1$

ii) at rest when $x = 0$

$x = \int 2\sin 2t + 1$

$= 2 \times -\frac{1}{2} \sin 2t + x$

$= -\sin 2t + x$

when $x = 0$

$x = -\sin 2t + 0$

$= -\sin 2t$

$\therefore$ The particle first comes to rest at

displacement $= -\sin 2t$

iii) $\dot{x} = -\sin 2t + x$ (from (ii))

(b) i) ~~$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$~~

$y = x^2$

$y' = 2x$

at $x = (-1)$

$y' = 2(-1)$

$= -2$

gradient = -2

eqn of tangent

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

at A $(-1, 1)$

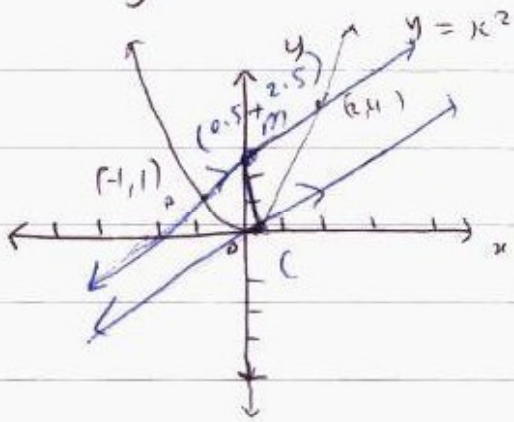
$y - 1 = -2(x - (-1))$

$y - 1 = -2(x + 1)$

$y - 1 = -2x - 2$

$y = -2x - 1$ or $0 = 2x - y + 1$

ii)



$M(AB) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

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

$= \left(\frac{1}{2}, \frac{5}{2}\right)$

$= (0.5, 2.5)$

vertical is perpendicular $m_1 m_2 = -1$

$m_{(\text{line } AB)} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 1}{-1 - 2} = \frac{3}{-3} = -1$

PTO →

Additional writing space on back page.

gradient of m_1 (line AB) = -1

gradient of m_2 (line C) = ?

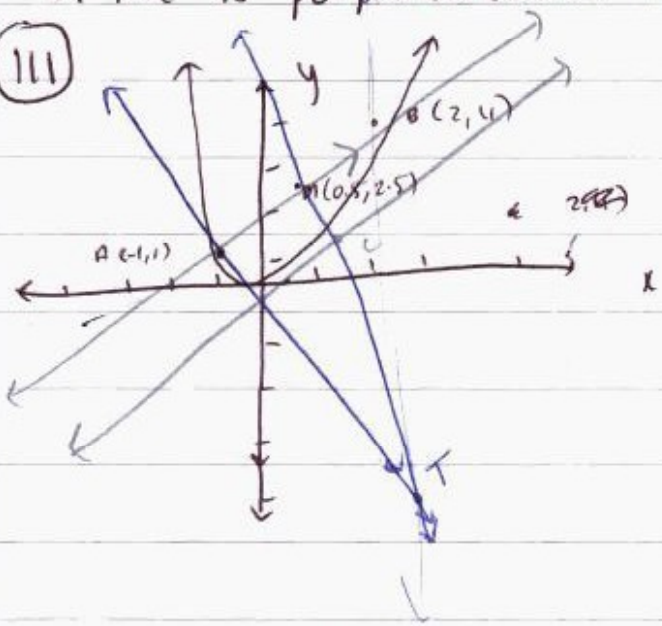
$m_1 m_2 = -1$

$-1 \times m_2 = -1$

$m_2 = 1$

∴ MC is perpendicular to line AB

(iii)



$y = -2x - 1$

at $x = 2$

$y = -2(2) - 1$

$= -5$

$T(2, -5)$

at $y = -5$

$-5 = -2x - 1$

$\frac{-4}{-2} = \frac{-2x}{-2}$

$2 = x$

point T (2, −5)

B (2, 4)

satisfies the equation of the tangent of A

$y = -2x - 1$

$-5 = -2(2) - 1$

$-5 = -5$

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