

Question 2

$$a) y = x^2 + 3x$$

$$\frac{dy}{dx} = 2x + 3$$

$$\text{when } x=1 \Rightarrow 5$$

m of the tangent is 5

the equation of the tangent is =

$$5 = \frac{y-4}{x-1}$$

$$y-4 = 5x-5$$

$$y = 5x - 5 + 4$$

$$y = 5x - 1$$

b) i) The equation of AB =

$$\frac{y-3}{x-4} = \frac{3-5}{4+2}$$

$$-2x + 8 = 6y - 18 \quad :2$$

$$-x + 4 = 3y - 9$$

$$0 = x + 3y - 13$$

ii) The length of AB =

$$\sqrt{(-2-4)^2 + (5-3)^2} = \sqrt{(-6)^2 + (2)^2} = \sqrt{36+4}$$

$$= \sqrt{40} = \sqrt{4 \times 10} = 2\sqrt{10}$$

iii) The intersection on the line AB \Rightarrow when $x=0$

$$x + 3y - 13 = 0$$

$$3y = 13$$

$$y = \frac{13}{3} = 4\frac{1}{3}$$

The intersection is at $(0, 4\frac{1}{3})$

The distance O to A

The gradient of normal is 3 since the gradient AB = $-\frac{1}{3}$

$$3 = \frac{y-0}{x-0}$$

$$y = 3x$$

~~The distance~~

$$x + 3y - 13 = 0 \quad \text{substitute } x = \frac{1}{3}y$$

$$\frac{1}{3}y + 3y - 13 = 0 \quad \times 3y$$

$$1 + y^2 - 39y = 0$$

$$x + 3y - 13 = 0 \quad \text{substitute } y = 3x$$

$$x + 3(3x) - 13 = 0$$

$$x + 9x - 13 = 0$$

$$10x = 13$$

$$x = \frac{13}{10}$$

$$\text{when } x = \frac{13}{10} \rightarrow y = \rightarrow$$

$$x + 3y - 13 = 0$$

$$3y = -x + 13$$

$$y = \frac{-x + 13}{3}$$

$$y = -\frac{10}{13} + 13$$

$$= 12\frac{3}{13} \times \frac{1}{3}$$

$$= \frac{52}{13} \times \frac{1}{3}$$

$$= \frac{52}{13} = 4$$

The perpendicular distance = $\frac{|y - 3x|}{\sqrt{(\frac{10}{13})^2 + 4^2}}$

$$= \frac{|4 - 3(\frac{10}{13})|}{\sqrt{\frac{100}{169} + 16}} = 0.4155$$

iv) The area of parallelogram OABC = base \times

$$\text{height} = 2\sqrt{10} \times 0.4155 = 2.627 \text{ unit}^2$$

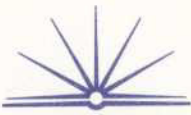
v) The perpendicular distance of BC =

~~equation of BC: $\sqrt{(6-0)^2 + (-2-0)^2} = \sqrt{36+4}$~~

equation of BC =

$$\frac{y+2}{x-6} = \frac{-2-3}{6-4}$$

$$-5x + 30 = 2y + 4$$



$$2y = -5x + 26$$

$$0 = -5x - 2y + 26$$

The perpendicular distance ~~is~~ from O to BC

$$= \frac{|ax + by + c|}{\sqrt{a^2 + b^2}} = \frac{|-5x - 2y + 26|}{\sqrt{(-5)^2 + (-2)^2}} = \frac{26}{\sqrt{29}}$$