Question 2

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

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

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 =

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

$-2x + 8 = 6y - 18$ $\div 2$

$-x + 4 = 3y - 9$

$0 = x + 3y - 13$

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 $x = 0$

$+ 3y - 13 = 0$

$3y = 13$

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

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~~e

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

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

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

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

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

$x + 9x - 13 = 0$

$10x = 13$

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

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

$x + 3y - 13 = 0$

$3y = -x + 13$

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

$y = \frac{-\frac{10}{13} + 13}{3}$

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

$= \frac{\cancel{156}^{52}}{13} \times \frac{1}{\cancel{3}_1}$

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

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

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

iv) The area of parallelogram OABC = base × height $= 2\sqrt{10} \times 0.4155 = 2.627$ 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 from O to BC

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