$f(\ ) = (\ )^2 - 2(\ ) - 4$

(a) Find the slope of the curve $y = x^2 - 2x - 4$ at the point $P(2, -4)$ by finding the limit of the secant slopes through point P.

(b) Find an equation of the tangent line to the curve at $P(2, -4)$.

$f(x)$ x, y $f(2) = -4$

a) Algebraically, secant line goes through $(2, -4)$ & $(2+\Delta x, f(2+\Delta x))$

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{f(2+\Delta x) - f(2)}{(2+\Delta x) - 2}$$

as $\Delta x \to 0$, $\Delta x \neq 0$

$$= \frac{\left[(2+\Delta x)^2 - 2(2+\Delta x) - 4\right] - (-4)}{\Delta x}$$

$$= \frac{4 + 4\Delta x + \Delta x^2 - 4 - 2\Delta x - 4 + 4}{\Delta x}$$

$$= \frac{2\Delta x + \Delta x^2}{\Delta x} = \frac{\Delta x(2+\Delta x)}{\Delta x} = 2 + \Delta x$$

Since $\Delta x \to 0$, $m = 2$

b) $y = mx + b$

$-4 = 2(2) + b \Rightarrow -4 = 4 + b$

$\Rightarrow b = -8$

$y = 2x - 8$