1.) (15 pts.) Use $f'(x) = \lim_{\Delta x \to 0} \dfrac{f(x+\Delta x) - f(x)}{\Delta x}$ to determine the derivative of $f(x) = x^2 - 3x + 4$.

$$f'(x) = \lim_{\Delta x \to 0} \frac{((x+\Delta x)^2 - 3(x+\Delta x) + 4) - (x^2 - 3x + 4)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{x^2 + 2x\cdot\Delta x + (\Delta x)^2 - 3x - 3\cdot\Delta x + 4 - x^2 + 3x - 4}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x \cdot (2x + \Delta x - 3)}{\Delta x}$$

$$= 2x + 0 - 3 \quad \text{so} \quad f'(x) = 2x - 3$$

2.) Consider the function $f(x) = \dfrac{x}{x-2}$ and assume that its derivative is $f'(x) = \dfrac{-2}{(x-2)^2}$.

a.) (2 pts.) What is $f(4)$? $f(4) = \dfrac{4}{4-2} = 2$

b.) (2 pts.) What is $f'(4)$? $f'(4) = \dfrac{-2}{(4-2)^2} = \dfrac{-1}{2}$

c.) (5 pts.) Find an equation of the line which is tangent to the graph of f at $x = 4$.

$x = 4$, $Y = 2$ and tangent slope is $m = f'(4) = \dfrac{-1}{2}$

so $Y - 2 = \dfrac{-1}{2}(X - 4)$ OR $Y = \dfrac{-1}{2}X + 4$

d.) (6 pts.) Find an equation of the line which is perpendicular to the graph of f at $x = 4$.

$X = 4$, $Y = 2$ and $\perp$ slope is $m = 2$ (negative reciprocal of $f'(4) = -1/2$) so

$Y - 2 = 2(X - 4)$ OR $Y = 2X - 6$