1. (10 points) Show your intermediate work in finding your derivatives wherever possible. You do not have to simplify your derivatives.

(a) If $f(x) = \dfrac{15x^4}{2} - 4x + \sqrt{x^2+3}$, what is $f'(1)$? (*i.e.* find the derivative, then plug in $x = 1$)

STEP 0: COEF. & REWRITE POWER $\quad f(x) = \frac{15}{2}\underbrace{x}^{4} - 4\underbrace{x} + \underbrace{(x^2+3)}^{1/2}$

STEP 1: $\quad f'(x) = \frac{15}{2}\cdot 4x^3 - 4\cdot 1 + \frac{1}{2}(x^2+3)^{-1/2}\cdot(2x)$

$$f'(x) = 30x^3 - 4 + (x^2+3)^{-1/2}\cdot x$$

$$f'(1) = 30(1)^3 - 4 + (1^2+3)^{-1/2}\cdot 1$$

$$= 30 - 4 + 4^{-1/2}$$

$$= 26 + \frac{1}{4^{1/2}} = 26 + \frac{1}{2}$$

$f'(1) =$ 26.5

(b) If $g(x) = \left(3 - \dfrac{8}{x^2}\right)(2x + 6 - x^3)$, what is $g'(2)$?

STEP 0: $\quad g(x) = (3 - 8x^{-2})\cdot(2x+6-x^3) = f(x)\cdot g(x)$

STEP 1: $\quad g'(x) = \underbrace{(3-8x^{-2})}_{F}\cdot\underbrace{(2-3x^2)}_{S'} + \underbrace{(16x^{-3})}_{F'}\cdot\underbrace{(2x+6-x^3)}_{S}$

$$g'(2) = \left(3 - 8\cdot\frac{1}{4}\right)\cdot(2-3(2)^2) + (16\cdot(2)^{-3})\cdot(2(2)+6-(2)^3)$$

$$= (3-2)\cdot(2-12) + (2)\cdot(4+6-8)$$

$$= (1)(-10) + (2)(2) = -10 + 4$$

$g'(2) =$ -6

(c) Find the equation for the tangent line to $y = \dfrac{3x^2 - 4x + 5}{2 - 4x}$ at $x = 0$.
(Your final answer should look like $y = mx + b$).

STEP 0: ✓ $\quad$ STEP 1: $\quad y = \dfrac{3x^2-4x+5}{2-4x}$ = HEIGHT

$$y' = \frac{(2-4x)\cdot(6x-4) - (3x^2-4x+5)(-4)}{(2-4x)^2}$$ = SLOPE

$$y' = \frac{(2)(-4) - (5)(-4)}{(2)^2} = \frac{-8+20}{4} = 3$$

Equation for tangent line: $y = 3(x-0) + 2.5$