Show steps for partial credit. You are allowed a scientific, non-graphing, calculator. No cell-phones, IPODs etc... can be out during the test. Box your answer for full-credit. Thanks and Enjoy! Each problem worth 11pts hence there are 14(11) = 154pts to earn. Also, your name worth 6pts. So, 160pts is perfect score.

1.) Suppose $F(x) = \frac{1}{2x+3}$ and $G(x) = \sqrt{3 + x^2}$. Find the formulas for

a. $(FG)(x)$

b. $(F \ o \ G)(x)$

2.) Calculate the following indeterminant limit:

$$\lim_{x \to 3} \left(\frac{1}{x-3} \left[\frac{1}{x} - \frac{1}{3} \right] \right)$$

3.) Calculate the following limit:

$$\lim_{x \to \infty} \left(\frac{2x^2 + 3x + 12}{7x^2 + 6x - 5} \right)$$
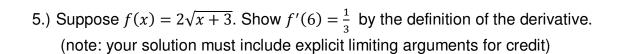
4.) Given the graph below, find the value and limits if they exist, if not write d.n.e or ∞ or $-\infty$ as best fits:

a. $\lim_{x \to 2^+} (f(x)) = $ _____ .

b. $\lim_{x \to 2} (f(x)) = $ _____ .

c. $\lim_{x \to 2} (f(x)) = $ _____ .

d. f(2) = _____ .

e. $\lim_{x \to -3^+} (f(x)) = $ _____ .

5.) Suppose $f(x) = 2\sqrt{x+3}$. Show $f'(6) = \frac{1}{3}$ by the definition of the derivative.

(note: your solution must include explicit limiting arguments for credit)

6.) Suppose $f(x) = 2x^2 + 3$. Show $f'(a) = 4a$ by the definition of the derivative.
(note: your solution must include explicit limiting arguments for credit)

7.) If $f(x) = x^3 + 1$ then find the equation of the tangent line at $x = 2$. Sketch the graph and tangent line.

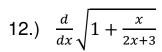8.) Calculate the derivative below and simplify your answer:

$$\frac{d}{dx}\left[\sqrt[3]{8x^4} + 1/x^2\right] =$$

Calculate the derivative as indicated in each of the problems that follows. No need to simplify answer, just perform the differentiation and neatly box the result.

9.) $\frac{d}{dx}\left[(2x^2 + 1)\left(x^2 - \frac{1}{x}\right)\right] =$

10.) $\frac{d}{dt}[t^{10}(2t + 10)^3] =$

11.) $\frac{d}{dx}\left(\frac{x+6}{x-6}\right)^5 =$

12.) $\dfrac{d}{dx}\sqrt{1+\dfrac{x}{2x+3}}$

13.) Find the interval(s) of real numbers which solve $x^4 - 4x^2 < 0$. Please use a sign-chart to guide your solution.

14.) On which interval(s) is the function $f(x) = 3x^5 - 20x^3$ increasing ?