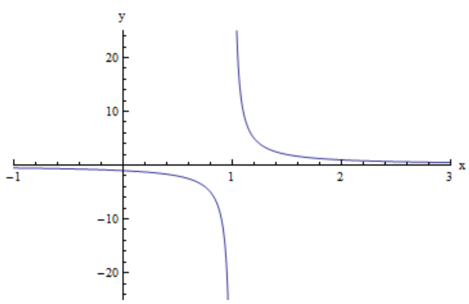
1) Find the following limits. Show your work for credit. . If the limit does not exist, explain why. Do not use L'Hopital's rule. <5 each>

a) $\lim_{x\to 3} \frac{\sqrt{x+1}-2}{x-3}$

b) $\lim_{x\to 0} \frac{\sin(7x)}{\sin(3x)}$

c) Use the graph of y = f(x) to find the limits:



- $\lim_{x\to 1^+} f(x) =$
- $\lim_{x\to 1^-} f(x) =$
- $\lim_{x\to 1} f(x) =$

d) $\lim_{x\to -\infty} \frac{x^3-2x+1}{2-5x^3}$

2) Find the equation of the tangent line to $f(x) = 2xe^x + 3$ when x=0

<10 pts>

3) The absolute extrema of f(x) = $\frac{lnx}{x}$ on the interval $[1, e^2]$.

<10 pts>

4) Use the definition to find the derivative of $f(x) = \frac{3}{x-2}$. Any other method will be worth very little. Do not skip any steps.

<10 pts>

5) Find dy/dx by implicit differentiation: $5x^2 - xy - 3y^4 = x^3$

<8 pts>

6) Differentiate the following. You don't need to simplify your answers. <7 each>

a) $f(t) = 3\tan(t^2) + 3tln(t)$

b) b) $g(x) = (\sec(x) - 5\sqrt{x} + \pi)^{1/3}$

c) $f(x) = (cosx)^{2x}$

d) $g(\theta) = \frac{sin^2\theta}{5\theta}$

7) A ladder 10 feet long is resting against a wall. If the bottom of the ladder is sliding away from the wall at a rate of 1 foot per second, how fast is the top of the ladder moving down when the bottom of the ladder is 8 feet from the wall? You must show all work clearly for credit. Put units on answer. <8 pts>

8) Suppose that an inflating balloon is spherical in shape, and its radius is changing at the rate of 3 centimeters per second. At what rate is the volume changing when the diameter is 20 centimeters? Put units on answer. Don't use decimals. <7 pts>

9) Given $f(x) = 3x^5 - 5x^3 + 3$, use calculus to find the following. You must show all work. <9 pts>

a) Find where f(x) is increasing and decreasing. Use interval notation.

b) Find the relative extrema in (x,y) form. Classify as max or min.

10) Find the inflection point(s) of f(x) = xe^x. Use exact values. <6 pts>

11) An open (no lid) rectangular box with square base is to be made from 48 $ft.^2$ of material. What dimensions will result in a box with the largest possible volume ? Show all work clearly using calculus for credit. Put units on your answers. <10 pts>

12) Evaluate the integrals. <7 each>

a) $\int \frac{x^4-3x^2+x}{x^2}\,dx$

b) $\int \; t\sqrt{5t+3}\,dt$

c) $\int (3sec^2x - \pi + \frac{3}{1+x^2})dx$

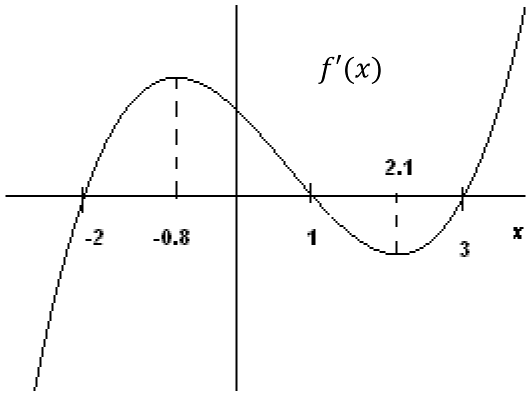
13) Evaluate. Show all work. **Leave in exact form (no decimals) <8 each>**

a) $\int_0^2 4xe^{x^2}dx$

b) $\int_0^{\frac{\pi}{3}} (4\sin x + 3cosx)\, dx$. Leave answer in exact form (no decimals)

14) Sketch the region bounded by $y = 2x^2 + 10$ and $y = 4x + 16$. Shade the region. Then, find the area of this region. <10 pts>

15) Given the graph of the **DERIVATIVE**, f', answer the following: <12 pts>



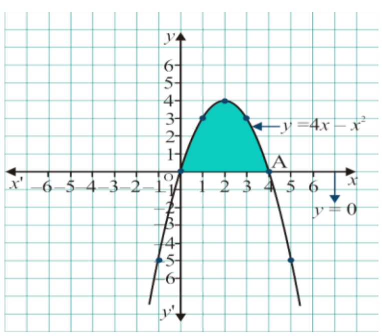
a) On which interval(s) is f(x) increasing?

b) On which interval(s) is f(x) concave up?

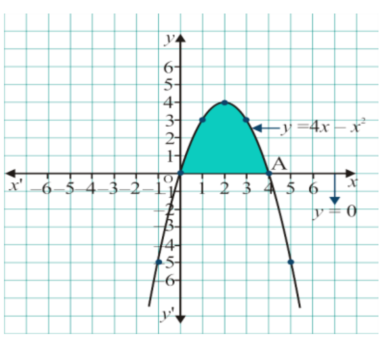
c) List the x-coordinates of any relative minima of f(x).

d) List the x-coordinates of any inflection points of f(x)

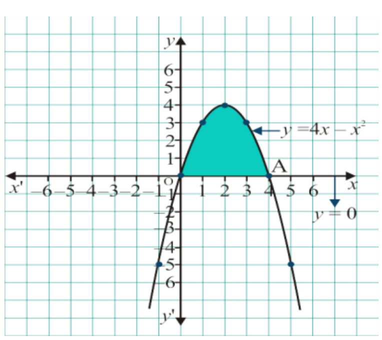
16) **<u>SET UP, but no do not evaluate an integral</u>** that represents the volume of the solid generated by revolving the region A below about the: <15 pts>



a) x –axis (again, set up integral only)



b) y-axis (again, set up integral only)



c) the line y= -2 (again, set up integral only)