Name____________________________________

1. a. Give an overview of calculus--differential calculus and integral calculus--and the principal problem being solved in each branch. Include diagrams.

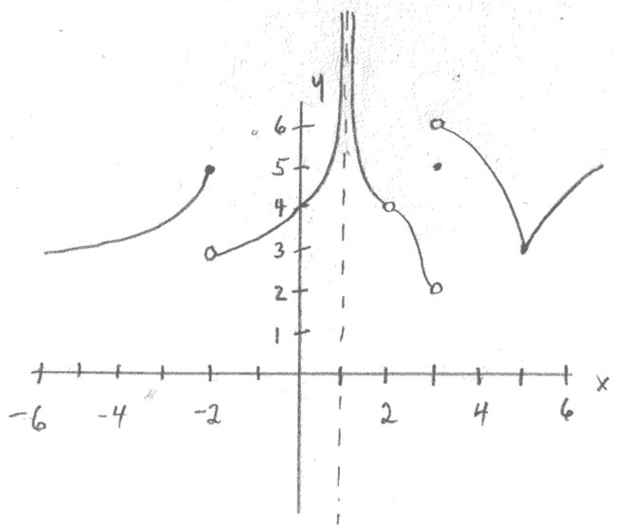
b. Estimate the <u>slope</u> of the tangent line to the curve, $y = f(x) = 4x^2 - 3x + 5$, at $x = 2$ by any approach: numerical, graphical or algebraic.

c. Give the <u>equation</u> of the tangent line to the curve, $y = f(x) = 4x^2 - 3x + 5$, at $x = 2$.

2. Determine the following limits by the method indicated:

a. $\lim_{x \to 5} \dfrac{x^2 - 8x + 15}{x^2 - 3x - 10}$ (by algebra)

b. $\lim_{x \to -2^+}$ f (x) where f is the function in this graph:



c. $\lim_{x \to 1}$ f(x) where f is the function in the graph above.

d. $\lim_{x \to 2}$ f(x) where f is the function in the graph above.

e. $\lim_{x \to 3}$ f(x) where f is the function in the graph above.

2. f. $\lim_{x \to 0} \dfrac{e^{2x} - 1}{\ln(7x + 1)}$ (numerically to 5 decimal place.)

Show the calculated values in a t-table.

g. $\lim_{x \to 3^+} \dfrac{4}{(x - 3)^2}$ (by graphing)

h. $\lim_{x \to 3} \dfrac{4}{(x - 3)^2}$ (by graphing)

i. $\lim_{x \to 2} \begin{cases} x^2 + 1 & x < 2 \\ 7 & x = 2 \\ 4x - 3 & x > 2 \end{cases}$ (by algebra and graphing)

2. (Continued) For the next two parts, use the table below.

x	f(x)		x	f(x)
-6	4.8		-4	6.1
-5.1	5.62		-4.9	5.62
-5.01	5.7911		-4.99	5.3166
-5.001	5.7998		-4.999	5.3014
-5.0001	5.7999		-4.9999	5.3001

j. $\lim\limits_{x \to -5^-} f(x)$ (estimate numerically)

k. $\lim\limits_{x \to -5} f(x)$ (estimate numerically)

3. Use “the dozen” limit theorems to determine and verify the $\lim\limits_{x \to 4} \dfrac{(5x - 18)^6}{\sqrt{2x + 1}}$

Cite either the theorem or just the theorem name used at each step.

4. Verify that $\lim_{x \to 4} (3x - 7) = 5$ using the definition of limit

(the epsilon- delta method). Do both the <u>discovery</u> and the <u>verification</u> phase.

5. a. Determine whether $f(x) = \begin{cases} x^2 - 31 & x < 6 \\ 5 & x = 6 \\ 10 - x & x > 6 \end{cases}$ is continuous at x = 6.
of the definition that are satisfied and which ones are not.

b. Determine all places where the function in part 2.b. is continuous and name the kind of discontinuity it has at each place where it is not continuous (infinite discontinuity, jump discontinuity or removable discontinuity)

6. Give the places where these function are continuous:

a. $f(x) = 3x^6 - \dfrac{2}{x^3} + \pi x$

b. $f(x) = \dfrac{4x^2 + 6x}{x^2 - 3x - 18}$

c. $f(g(x))$ *where* $f(x) = \sqrt{x}$ *and* $g(x) = x^2 - 16$

7. Consider the function $f(x) = \dfrac{x - 3}{x + 2}$.

Does the Intermediate Value Theorem (IVT) guarantee that the function has a zero (takes on the value of N = 0) in the following closed intervals?

(In these questions I'm not asking whether the function takes on the value zero in the interval; I'm asking whether the Intermediate Value Theorem guarantees that the function takes on the value zero in the interval. Give reasons for your answers. A graph may be helpful.)

a. between x = -1 and x = 2

b. between x = 1 and x = 5

c. between x = -4 and x = 0

d. between x = -4 and x = 5