Do all your work and put all your answers WITH your work, CIRCLED, on the white paper provided. All I want on this sheet is your NAME! Spend no more than 2 minutes on any single problem on your first pass through the test. If you don't finish a problem in 2 or 3 minutes, start a fresh sheet of paper for the next problem, and so on.

1. (15 pts) The point $P(2,14)$ lies on the graph of $f(x)=2x^2+3x$. Estimate the slope of this curve at P, by evaluating the slope between the point P and the point $Q(2.001, f(2.001))$.

2. (5 pts) Any guess as to what the actual slope is at $x=2$?

3. (5 pts) Based on your answer to #2, write the equation of the tangent line to $f(x)$ at $x=2$.

4. (5 pts each) Evaluate the following limits, if they exist. If one does not exist, explain why.

   a. $\displaystyle\lim_{x\to-3^+}\frac{2x^2+13x+21}{|x+3|}$ b. $\displaystyle\lim_{x\to-3^-}\frac{2x^2+13x+21}{|x+3|}$ c. $\displaystyle\lim_{x\to-3}\frac{2x^2+13x+21}{|x+3|}$

5. (15 pts) Sketch the graph of the piecewise-defined function $f(x)=\begin{cases} x^2-4 & \text{if } x<1 \\ -3x+6 & \text{if } x\le1 \end{cases}$. Label intercepts with ordered pairs.

Bonus (5 pts) On what intervals is f in #5 continuous?

6. Simplify $\displaystyle\lim_{h\to0}\frac{f(x+h)-f(x)}{h}$ for the following functions:

   a. (10 pts) $f(x)=2x^2-3x+7$

   b. (5 pts) $f(x)=\dfrac{1}{x}$

7. (10 pts) Sketch a plausible graph of a function f that has the following properties:

   a. $\displaystyle\lim_{x\to-3^-}f(x)=2$ c. $\displaystyle\lim_{x\to2^-}f(x)=\infty$ e. $\displaystyle\lim_{|x|\to\infty}f(x)=5$

   b. $\displaystyle\lim_{x\to-3^+}f(x)=6$ d. $\displaystyle\lim_{x\to2^+}f(x)=-\infty$ f. $f(-3)=4$

8. (10 pts) Prove that $\displaystyle\lim_{x\to2}(3x-7)=-1$, using the $\varepsilon-\delta$ definition of limit.

9. (5 pts) Prove that the equation $\sin\left(\dfrac{\pi}{3}x\right)=x-1$ has a root in the interval $(0,3)$, but *do not solve*!

BONUS SECTION: Work any 3 bonus questions for up to 15 bonus points.

1. (5 pts) Prove that $\displaystyle\lim_{x\to4}(3x^2-13x+14)=10$

2. (5 pts) Evaluate $\displaystyle\lim_{h\to0}\frac{\sqrt{2x+2h}-\sqrt{2x}}{h}$, if it exists. If it does not, state why.

3. (5 pts) See if you can squeeze out a convincing argument to find $\displaystyle\lim_{x\to0}\left(x^2\sin\left(\dfrac{\pi}{x}\right)\right)$

4. (5 pts) Write the definition of the piecewise-defined function from its graph: