Math 151
Exam 1

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible.

1. (10 pts.) Solve the inequality.

$$|8x + 5| < 20$$

2. (20 pts.) Consider the function f whose graph is given. In parts (a) through (d), state the value of the given quantity, if it exists; if it does not exist, explain why. In part (e), answer the question.

(Insert graph.)

(a) $\lim_{x \to -2^-} f(x)$

(b) $\lim_{x \to -2^+} f(x)$

(c) $\lim_{x \to 5^-} f(x)$

(d) $\lim_{x \to 5^+} f(x)$

(e) At $x = 5$, is f continuous from the right, from the left, neither, or both?

3. (5 pts.) The graph of f is given. Use it to graph the function $y = f(\frac{1}{2}x)$.

(Insert graph.)

4. (5 pts.) Use the table below to evaluate $(f \circ g)(1)$.

x	1	2	3	4	5	6
$f(x)$	3	1	4	2	2	5
$g(x)$	6	3	2	1	2	3

5. (5 pts.) The position of a car is given by the values in the table.

t (seconds)	0	1	2	3	4	5
s (feet)	0	10	32	70	119	178

Find the average velocity for the time period beginning when $t = 1$ and lasting 3 seconds.

6. (5 pts.) The point $P(4, 2)$ lies on the curve $y = \sqrt{x}$. If Q is the point $(x, \sqrt{x})$, use your calculator to find the slope of the secant line PQ (correct to six decimal places) for the value $x = 3.9$.

7. (10 pts.) Suppose $f(1) = 2$, $f'(1) = 7$, $f(4) = 12$, and $f'(4) = 23$. Let P be the point on the graph of $y = f(x)$ where $x = 1$. Let Q be the point on the graph of $y = f(x)$ where $x = 4$.

(a) Find the equation of the secant line PQ.

(b) Find the equation of the tangent line to $y = f(x)$ at P.

8. (10 pts.) Evaluate the limit symbolically (algebraically), showing all significant algebraic steps.

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

9. (10 pts.) Use the slope equation

$$m = \lim_{h \to 0} \frac{f(a + h) - f(a)}{h}$$

to find the slope of the line tangent to the graph of $y = 1/x^2$ at the point $(3, \frac{1}{9})$. (Evaluate the limit symbolically, showing all significant algebraic steps.)

10. (10 pts.) Find an equation of the perpendicular bisector of the line segment joining the points $A(-3, 5)$ and $B(-1, -6)$.

11. (10 pts.) A rectangular box has a top and a bottom. The bottom is a rectangle whose length is twice its width. The volume of the box is 10 m^2. Let w denote the width (i.e., of the smaller side) of the rectangular base.

Express the total surface area of the box as a function of w alone.

Optional Bonus Problem. (5 optional bonus points possible) Suppose that $f(x) = x^5 - x^2 + x + 3$, prove that there is at least one real number c such that $f(c) = 8$.