Math 151
Exam 1

Justify all answers with neat and organized work. Clearly indicate your answers. 100 points possible.

1. (10 pts.) Show that the equation represents a circle and find the center and radius.

$$x^2 + y^2 - 4x + 6y - 12 = 0$$

2. (10 pts.) If a ball is thrown into the air with a velocity of 40 ft/sec, its height in feet after t seconds is given by $y = 40t - 16t^2$. Find the average velocity for the time period beginning when $t = 2$ and lasting 0.01 sec.

3. (15 pts.) Express the area of an equilateral triangle as a function of the length of a side.

4. (25 pts.) Instructions: For each of the following limits that exists, find its value. (Show some work, but you don't have to quote limit laws.) If one doesn't exist, clearly explain why, and tell whether it can be expressed with the $+\infty$ or $-\infty$ symbol.

(a) $\lim_{x \to 3^-} \dfrac{2x+7}{x-3}$

(b) $\lim_{x \to 1^+} f(x)$, where $f(x) = \begin{cases} x^2 - 20, & \text{if } x \leq 0 \\ x + 4, & \text{if } 0 < x \leq 1 \\ (x+2)^2, & \text{if } x > 1. \end{cases}$

(c) $\lim_{x \to 1^-} f(x)$, where $f(x) = \begin{cases} x^2 - 20, & \text{if } x \leq 0 \\ x + 4, & \text{if } 0 < x \leq 1 \\ (x+2)^2, & \text{if } x > 1. \end{cases}$

(d) $\lim_{h \to 0} \dfrac{(1+h)^3 - 1}{h}$

(e) $\lim_{t \to 25} \dfrac{25 - t}{5 - \sqrt{t}}$

5. (15 pts.) Use the slope equation

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

to find an equation of the tangent line to the curve $y = \sqrt{1+2x}$ at the point $(4, 3)$.

6. (20 pts.) Find $\dfrac{dy}{dx}$. Please do *not* simplify your answers. Use parentheses carefully.

(a) $y = ax^3 + bx^2 + cx + d$

(b) $y = (2x^3 - 4x - 3)(5x^4 - 6x + 2)$

(c) $y = \dfrac{x^2 + 4x + 3}{x^2 + 5x - 4}$

(d) $y = x^2\sqrt{x} + \dfrac{1}{x^3\sqrt{x}}$

7. (5 pts.) Suppose that $f(1) = 2$, $f'(1) = 3$, $g(1) = 4$, and $g'(1) = 5$. Find $(g/f)'(1)$.