Math 162
Exam 2

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

1. (10 pts.) Use a carefully drawn tangent line to estimate the slope at the point D.

2. (10 pts.) (a) Let $W(t)$ be the number of words per minute (wpm) that a student in a typing class can type after t weeks in a course.

What are the units on $W'(t)$?

(b) Let $D(r)$ be the time in years that it takes for an investment to double if interest is continuously compounded at an annual rate of $r\%$ (r is expressed as a percentage, not a decimal).

What are the units on $\dfrac{dD}{dr}$?

3. (10 pts.) The number of general aviation aircraft accidents from 1975 to 1992 can be modeled (based on data from the *Statistical Abstract of the U.S.*) by the equation

$$\textit{number of accidents} = -123.7746x + 4057.6633 \text{ accidents}$$

where x is the number of years since 1975.

Calculate the change and percentage change in accidents from 1976 to 1992. (Give correct units.)

4. (10 pts.) (Based on data from *HIV/AIDS Surveillance 1992 Year End Edition.*) The number of AIDS cases diagnosed between 1988 and 1991 is modelled by $\textit{cases} = -1049.5x^2 + 5988.7x + 33770.7$, where $x =$ the number of years since 1988.

Suppose you wanted to numerically estimate the slope at $x = 3$ by using three increasingly close points. Don't do this three times, but do use $x = 3$ and the nearby point 3.001. (Give correct units.)

5. (10 pts.) Consider the following graph.

Complete the following statements about the SLOPE of the graph shown above.

(a) At point A, the SLOPE of the above graph is positive/negative/zero (circle one).

(b) Between A and B, the SLOPE of the above graph is positive/negative/zero (circle one).

(c) At point B, the SLOPE of the above graph is positive/negative/zero (circle one).

(d) Between B and C, the SLOPE of the above graph is positive/negative/zero (circle one).

(e) At point C, the SLOPE of the above graph is positive/negative/zero (circle one).

6. (10 pts.) Use the four-step method to show that the derivative of $y = 5x^2 - 3x + 7$ is $\dfrac{dy}{dx} = 10x - 3$.

(Step 1) Write down $f(x)$.

(Step 2) Find and simplify $f(x + h)$.

(Step 3) Find and simplify $\dfrac{f(x+h) - f(x)}{h}$.

(Step 4) Find the limiting value $\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ as h approaches 0.

7. (6 pts.) Find the derivative of

$$h(x) = 7x^2 - 12x + 12.$$

8. (6 pts.) Find the derivative of

$$f(x) = \frac{200}{x^3 + 8}.$$

9. (6 pts.) Find the derivative of

$$g(x) = \sqrt{x^2 - 7x}.$$

10 (6 pts.) Find the derivative of

$$F(x) = 12.62(15.82)^x(3.8x^2 + x + 5)^4.$$

11. (6 pts.) Find the derivative of

$$G(x) = (78.32x)\left(\frac{1984}{1 + 6.68e^{-0.34x}} + 1313\right).$$

12. (10 pts.) The number of medical school students (in thousands) from 1983 through 1992 can be modeled (based on data from *Statistical Abstract*, 1994) by

$$m(x) = 0.0205x^3 - 0.2115x^2 + 0.2575x + 73.3325 \text{ thousand students}$$

where x is the number of years since 1983.

(a) Find the formula for the derivative $m'(x)$.

(b) Use the derivative to find the x-value where the original function $m(x)$ has a minimum point. (Note: only consider x-values that correspond to years from 1983 through 1992.) Clearly show how this x-value was obtained. Round x to five decimal places.

(c) Find the number of medical students that corresponds to the x-value you found in part (b).