

EXAM 2
Math 106
November 20, 2002

Name _____

You must show all your work. Partial credit will be given.

1. For each of the following formulas find the derivative formula. (5 pts each)

(a) $f(x) = 5x^3 + 3x^2 - 2x - 5.$

(b) $y = \frac{-9}{x^2}.$

(c) $f(x) = 7x^2 + 13 \ln x.$

(d) $f(t) = 1 + 4.98e^t.$

(e) $y = (5x^2 + 3x + 7)^{-1}.$

(f) $g(t) = e^{4t^2} + \ln(2.5t)$.

(g) $f(x) = \frac{8}{(x-1)^3}$.

(h) $y = (2x - 8)e^{3x}$.

(i) $f(t) = \frac{12(0.6^t)}{6 - 3 \ln t}$.

(j) $y = 4x\sqrt{3x+2} + 93$.

2. The number of AIDS cases diagnosed from 1994 through 1997 can be modeled by

$$\text{Cases diagnosed} = -x^3 + 16.1x^2 - 90x + 247$$

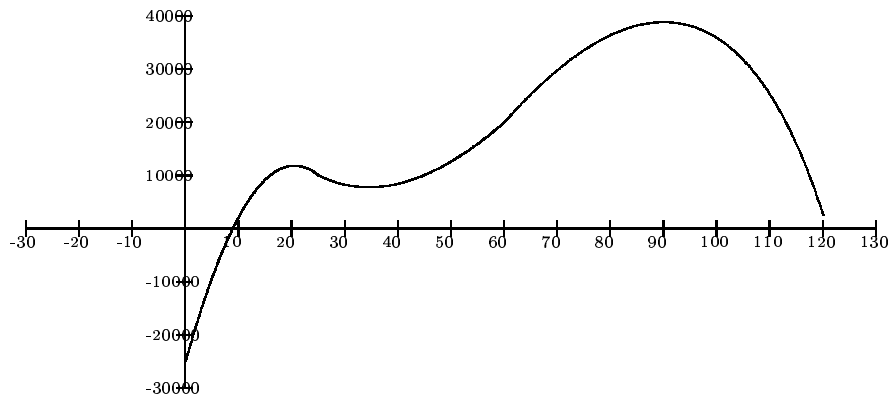
thousand cases where x is the number of years since 1990. Find the percent change and the average rate of change in cases diagnosed between 1995 and 1997. (6 pts)

3. 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 $r\%$. (Here r is expressed as a percentage, not a decimal.)

(a) What are the units of $\frac{dD}{dr}$? (4 pts)

(b) Give the English translation of the expressions $D(9) = 7.7$ and $\frac{dD}{dr} = -2.77$ when $r = 5$. (4 pts)

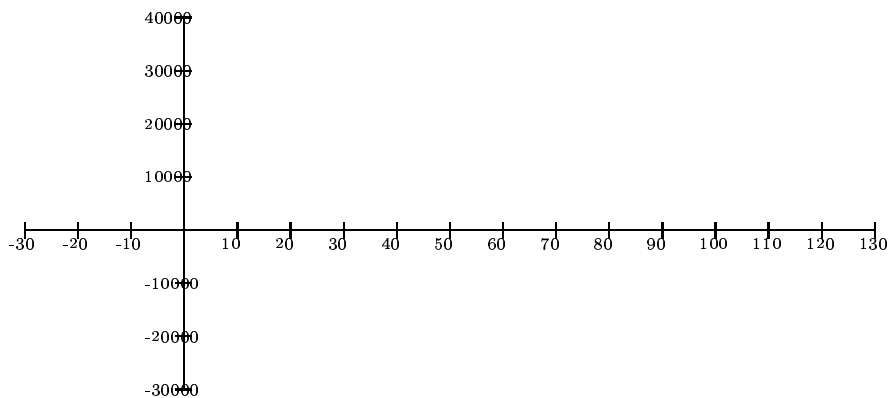
4. A graph depicting the average monthly profit for Slim's Used Car Sales for the previous year is shown below.



- (a) Estimate the average rate of change in Slim's average monthly profit if the number of cars he sells increases from 40 to 70 cars. (5 pts)

- (b) Estimate the rate of change for average monthly profit when 60 cars are sold. (5 pts)

- (c) On the axes below, sketch a slope graph (rate of change graph) for this situation. (5 pts)



5. Numerically estimate the slope of the tangent line on the graph of $h(t) = 8(1.5^t)$ at $t = 3$. (7 pts)

6. Civilian deaths due to the influenza epidemic in 1918 can be modeled as

$$c(t) = \frac{93700}{1 + 5095.9634e^{-1.097175t}}$$

deaths t weeks after August 31, 1918. How rapidly are the number of deaths growing on September 28, 1918? (7 pts)

7. An object is dropped off a building, Ignoring air resistance, we know from physics that its height above the ground t seconds after being dropped is given by

$$\text{Height} = -16t^2 + 100$$

feet. (This is the position function) Use the limit definition of the derivative to determine the speed (speed is the rate of change of position) of the object 1 second after it has been released. (7 pts)