MATH 108 – 10 JUNE 1999 – EXAM 3

Answer each of the following questions. Show all work, as partial credit may be given. This exam will be counted out of a total of 60 points.

1. (10 pts.) If $y = u^2 + 3u$ and $u = \sqrt{3x+1}$, use the chain rule to find dy/dx.

2. Suppose that a population study of a certain city predicts that the population of the city t years from now will be $P(t) = -t^3 + 24t^2 + 800$ thousand persons.

(a) (10 pts.) At what rate will the population be changing 4 years from now? Is the population increasing or decreasing at this time?

(b) (10 pts.) Use calculus to *approximate* the total change in population during the first half of the fifth year from now.

(c) (5 pts.) Find the *exact* change in the population during the first half of the fifth year from now.

(d) (10 pts.) Find the rate at which the rate of increase of the population is changing 4 years from now. Is the rate of increase increasing or decreasing?

3. Compute the second derivative of the following functions. Reasonable simplification is expected.

(a) (5 pts.) $f(x) = x^4 + 3x^3 + 2x$

(b) (5 pts.) $f(x) = (x^3 + 3)^5$

4. (10 pts.) Find all relative maxima and minima of the function $f(x) = x^3 + 3x^2 + 1$. Be sure to give both the x and y–coordinate of the extreme points.