

## Review Problems for Math 34A Spring 2009, Midterm II

The test will be 10 problems, with 4 word problems. A 3x5 notecard is allowed, but no calculators. The test will be cumulative, with a large focus on derivatives.

If you need additional problems, I strongly suggest looking at the previous review problems, as well as looking at the word problems in Section 8.13.

1) Solve for  $x$  in the following equations

(a)  $4 \cdot 2^x = 3^{x-1}$

(b)  $e^{2x} = 7^y$  .

(c)  $\frac{7}{3^x} = 4 \cdot 5^x$  .

2) Evaluate the following limits

(a)  $\lim_{x \rightarrow 3} \frac{x^2 - 3x + 2}{x + 3}$  .

(b)  $\lim_{x \rightarrow -2} \frac{x^2 - 5x - 14}{x^2 + 5x + 6}$  .

(c)  $\lim_{x \rightarrow \infty} \frac{3x + 8}{7 - x}$  .

3) A certain radioactive isotope is found in Frank's house. Using careful measurements, scientists determine that after one day, a third of the isotope remained. What is the half-life of the isotope, in hours?

4) Compute the derivatives of the following functions

(a)  $f(x) = (x + 7)(x - 3)$  .

(b)  $g(x) = \frac{x^2 - 3}{\sqrt{x}}$  .

(c)  $h(x) = e^{2x} - 2^x$  .

5) Approximate  $\sqrt{5}$  using

(a) Linear interpolation between  $\sqrt{4}$  and  $\sqrt{9}$ .

(b) The tangent line approximation to  $f(x) = \sqrt{x}$  at  $x = 4$ .

(c) Which method do you expect to give the better answer and why?

6) Consider the function  $f(x) = x^3 - 6x^2 - 15x + 2$ .

(a) Where is  $f(x)$  increasing and decreasing?

(b) Where is  $f(x)$  concave up and concave down?

7) What is the maximum value of the function  $f(x) = -2x^2 + 3x + 7$ ?

8) Albert hits a baseball upwards with an initial velocity of 45 meters per second. Using that acceleration is 10 meters per second per second,

(a) How long is the ball in the air?

(b) What is the maximum height of the ball?

(c) What does the initial velocity need to be for the maximum height to be 200 meters? (Hint: what is the maximum height when the initial velocity is  $v_0$ ?)

9) A rectangular field will have one side made of a brick wall and the other three sides made of wooden fence. Brick wall costs \$20 per meter. Wooden fence costs \$40 for 4 meters. The area of the field is to be 2400 m<sup>2</sup>. What length should the brick wall be to give the lowest total cost of wall plus fence?

10) Consider the line  $f(x) = x - 1$ .

(a) Draw a graph of  $f(x)$ , letting  $x$  lie between  $-4$  and  $4$ .

(b) Calculate  $\int_0^3 f(x) dx$ .