

## REVIEW QUESTIONS—EXAM 2 MATH 104

1. Find  $\frac{dy}{dx}$  for the following expressions  $y$  (do not simplify):

(a)  $y = e^{x^2+x} + \ln(x^3 + 1)$  ; (b)  $y = (2x^3 + e^{-2x} + 3)^4$

(c)  $y = (2x^3 + e^{-2x} + 3)^4$  ; (d)  $y = \frac{e^{3x-1}}{x^{10} + 4}$

(e)  $y = \ln 2 + 6x - e^{-2x}$  ; (f)  $y = e^{2\ln(3x+7)}$

2. Find  $f'(1)$  if  $f(x) = \frac{3x^2 + 2}{4x - 1}$ . Show all your work.

3. Solve the following equations for  $x$ :

(a)  $2 + 2\ln(4x - 1) = 4$

(b)  $16^{x^2} = 4^{9x-4}$

4. Find an equation of the tangent line to the graph of the curve  $y = f(x) = e^{3(x-1)} - 6x$  at the point  $(1, -5)$ .

5 (a) Find an equation of the tangent line to the graph of the curve  $y = \ln x^3 - 6x^2$  at the point  $(1, -6)$ .

(b) Find an equation of the tangent line to the graph of the curve  $y = f(x) = \sqrt{3x^2 - 2}$  at the point  $(-3, 5)$ .

6. (a) At what annual interest rate, compounded continuously, will \$12,000 double in value in 7 years?

(b) How long does it take for \$2500 to triple in value at an annual interest rate of 6.35 percent, compounded continuously?

7. Alice invested \$10,000 in a mutual fund on March 1, 1997. On March 1, 2005, her investment was worth \$14,500. What was the annual rate of growth of this fund assuming continuous compounding?

8. Is the function  $y = \frac{x-1}{e^x}$  increasing or decreasing at  $x = 1$ ?

9. Find the half life of a radioactive material if after one year 99.57 per cent of the initial amount remains.

10. How much money should be deposited into an account paying 5.7 per cent interest compounded quarterly in order to have balance of \$12,000 five years from now?

11. Find the derivatives of the functions:

(a)  $f(x) = \ln(x^2(x-1)^3)$

(b)  $f(x) = \ln\left(\frac{e^x}{1+e^x}\right)$

(c)  $f(x) = \ln\left(e^{5x}\sqrt{e^{2x-1}}\right)$

(d)  $f(x) = \ln\left(\frac{(3x^4 + 2x)^5(x^2 - 7x)}{(x^2 + 8)^{1/3}}\right)$

12. Let  $y = f(x) = 3x^5 - 20x^3$  for  $-\infty < x < +\infty$ .

(a) Find all critical numbers of  $f$ .

(b) List the open intervals on which  $f$  is a decreasing function. (Hint: Chart  $f'(x)$ )

(c) List the open intervals on which  $f$  is an increasing function.

13. Let  $y = x - 3\ln(4x - 6)$  for  $x > 1.50$ .

(a) Find all critical numbers of  $f$ .

(b) List the open intervals on which  $f$  is a decreasing function and the intervals on which  $f$  is an increasing function.

14. If Josh wants to have \$22000 to buy a new vehicle after graduation on May 8, 2010, how much does he need to invest on May 8, 2006 into a certificate of deposit paying 5.75 per cent interest compounded quarterly? (Round off your answer to the nearest cent).

15. If a radioactive substance has a half life of 23 years, how much of a 40 gram mass will remain after 36 years? (Round off your answer to the nearest hundredth of a gram).

16. Suppose that the cost and revenue functions for a certain product are given by  $C(x) = 5.4x - .0003x^2$  and  $R(x) = 9.7x - .002x^2$ , respectively. Determine where the profit function is increasing.