

**FINAL EXAMINATION
MATHEMATICS 914
APPLIED MATHEMATICS – BUSINESS ADMINISTRATION**

December 11, 2006

2:00-5:00 P.M.

STUDENT NAME: _____

EXAMINERS: L. FRAJBERG, V. OHANYAN

INSTRUCTIONS

- **Non-programmable calculators are permitted.**
- **A formula sheet is provided.**
- **SHOW ALL WORK. No marks will be given for trial and error or guess and check.**

Question #	Out of	Mark
1	4	
2	4	
3	12	
4	3	
5	9	
6	8	
7	4	
8	4	
9	12	
10	4	
11	4	
12	4	
13	4	
14	8	
15	8	
16	8	

1. (4marks) Perform the operations and simplify

$$\frac{x-2}{x^2-4x+4} \div \frac{x^2+2x}{x^2+4x+4}$$

2. (4marks) Find the equation of the line passing through the points $P_1(-2, 5)$ and $P_2(4, 17)$

3. (12marks) Solve the following equations (No marks for guess and check)

$$a) \frac{x}{x+2} - \frac{2}{x+3} = \frac{2}{(x+2)(x+3)}$$

$$b) \begin{cases} 3x - 5y = 22 \\ 2x + 3y = 2 \end{cases}$$

Continuation of problem 3

c) $\log_4(3x - 2) = 2$

d) $e^{4x-2} = 793$ (*Answer to 5 decimal places*)

4. (3marks) Express the following as a single logarithm

$$\frac{1}{2}\log(3x+4) - 2\log(4x-2) + 3\log(2x+3)$$

5. (9marks) If $f(x) = 2x^2 - 3x + 4$ and $g(x) = x + 3$

a) Find $2f(-1) - 3g(2)$

Continuation of problem 5

b) Find $f(x+3)$ (simplify the answer)

c) Find the Newton's quotient $\frac{f(x+h)-f(x)}{h}$

6. (8marks) An item has a linear depreciation function. After 10 years its value is \$6000 and after 25 years its value is \$1500.

a) Find the depreciation function which relates its value y to the number of years x which have elapsed.

b) After 20 years how much of its original value is lost?

7. (4marks) If the demand function for an item is given by $p + 2q = 100$ and the corresponding supply function is given by $3p - 4q = 250$, where p is the price and q is the quantity, find the equilibrium price and quantity.

8. (4marks) An item sells for \$150 per unit. The cost of producing x units is given by the equation $C(x) = x^2 + 60x + 800$. Find the levels of sales at which the firm selling the item is breaking even.

9. (12marks) The price of selling of x items is given by $p = 150 - 3x$

a) Find the revenue function $R(x)$

b) Find the level of sales which maximizes the revenue.

c) What is the maximum revenue?

10. (4marks) On September 10th of 2006 you invested \$3211 at 6% simple annual interest rate. If after 18 months you need money and withdraw \$500. How long will it take for you, starting from September 10th of 2006 to have \$4350 in your account?

11. (4marks) How long does it take for \$15000 invested at 7% compounded continuously to grow to 26260.09?

12. (4marks) You invest \$20000 compounded quarterly at 4% per year for a certain number of years. When you retrieve your investment its final value is 29777.27 dollars. For how many years did you invest your money?

13. (4marks) A town establishes a sinking fund to pay off a debt of \$200000 in 10 years by making equal quarterly deposits. If the investment pays 4% compounded quarterly, what must be the size of the deposits? (Answer to the nearest cent).

14. (8marks) You wish to buy a house costing \$400000 by making a down payment of \$50000 and taking out a loan for the balance. You pay off the loan by making monthly payments for the next 15 years. The interest rate on you loan is 12% per year.

a) What will be the size of your payments?

b) How much interest did you pay? (Answer to the nearest cent)

15. (8marks) A gymnasium orders \$75000 worth of equipment and receives a series discount of 25/20/10.

a) Find the net price.

b) Find the single discount rate which is equivalent to the series discount.

16. (8marks) An item is on sale for \$340. This is a 15% mark down of the regular price.

a) Find the regular price

b) Find the mark down

1. $(a + b)^2 = a^2 + 2ab + b^2$
 $(a - b)^2 = a^2 - 2ab + b^2$
 $(a - b)(a + b) = a^2 - b^2$
2. $y - y_1 = m(x - x_1)$
3. $x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
4. $S = P + Prt = P(1 + rt)$
5. $S = P(1 + i)^n = P\left(1 + \frac{r}{m}\right)^{mt}$
6. $S = Pe^{rt}$
7. $APY = \left(1 + \frac{r}{m}\right)^m - 1$
8. $APY = e^r - 1$
9. $S = R \frac{(1 + i)^n - 1}{i}$
10. $A_n = R \frac{1 - (1 + i)^{-n}}{i}$
11. $\log_a(xy) = \log_a x + \log_a y$
 $\log_a(x/y) = \log_a x - \log_a y$
 $\log_a x^n = n \log_a x$
 $\log_a x = y \Rightarrow x = a^y$
12. Net price = (list price) \times (the complement of the discount rate)
13. Net price = (list price) - (discount)
14. The markup equations
 - a) $M = S - C, \quad M = rC, \quad S = (1 + r)C$
 - b) $M = S - C, \quad M = rS, \quad S = (1 - r)C$
15. The markdown equations
 $M = R - S, \quad M = rR, \quad S = (1 - r)R$