

1. Second National Bank offers an account that earns 5% per year, compounded monthly. If a person invests \$20,000 in this account, what will be the value of the account at the end of 10 years? [6]

2. Simplify the following to a form that does not contain radicals or negative exponents.

(a)

$$\left(\frac{2x^{-2}y^7}{x^{-5}y^{-2}}\right)^3$$

[6]

(b)

$$\log_2(8^3)$$

[4]

3. Find the domain of the following functions:

(a) $f(x) = \frac{x+2}{x(x^2+x-2)}$ [4]

(b) $f(x) = \frac{1}{\sqrt{x+4}}$ [4]

4. Evaluate the expression $\frac{f(a+h) - f(a)}{h}$ given that $f(x) = \frac{1}{3x+2}$ and simplify as much as possible. [8]

5. (a) The manufacturers are willing to supply 200 of these products when the price is set at \$50. If the price is increased by \$5, the manufacturers have agreed to supply 40 more. Find the linear supply equation for this product. [6]

- (b) The demand equation for a particular product is known to be $p = -x + 79$. Find the equilibrium point using the demand equation and the supply equation you found in part (a). [6]

6. Given the function $f(x) = -\frac{4}{4-x}$

(a) Evaluate

$$\lim_{x \rightarrow 4^-} f(x)$$

[4]

(b) Evaluate

$$\lim_{x \rightarrow 4^+} f(x)$$

[4]

7. Evaluate:

$$\lim_{x \rightarrow 3} \frac{x^2 - 2x - 3}{x^2 - 8x + 15}$$

[6]

8. The revenue and cost functions for a product are given below. The revenue and cost are given in dollars and x represents the number of units.

$$\text{Revenue: } R(x) = -4x^2 + 24x$$

$$\text{Cost: } C(x) = 12x + 8$$

- (a) What is the profit function, $P(x)$? [3]

- (b) At what production level(s) will the company break even? [6]

- (c) Find the value of x that maximizes the revenue. [5]

9. In the following problems, solve for x . Give an exact answer.

(a) $\ln(x) = 3 \ln(2) - \ln(10) + \ln(5)$

[6]

(b) $9^x 27^{5x-2} = 1$

[6]

(c) $6 \cdot (11^x) - 3 = 15$

[4]

10. In interval notation, state the values of x for which the function $f(x)$ below is continuous.

[8]

$$f(x) = \begin{cases} x^3 & \text{if } x < -1, \\ x & \text{if } -1 \leq x < 9, \\ 2x - 7 & \text{if } x \geq 9 \end{cases}$$

11. Solve the following inequality, and write your answer in interval notation.

[4]

$$2 \leq 9 - 7x < 23$$

FORMULA SHEET, EXAM 1

LINES

Equation of a line through the point (x_1, y_1) with slope m :

$$y - y_1 = m(x - x_1)$$

FORMULAS FOR A QUADRATIC FUNCTION, $f(x) = ax^2 + bx + c$:

Quadratic Equation:

$$f(x) = 0 \text{ if and only if } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Coordinates of the vertex of a parabola:

$$x = \frac{-b}{2a}, \quad y = c - \frac{b^2}{4a}$$

MATHEMATICAL MODELS

Compounding Interest m times a year.

$$\text{Future Value, } F = P(1 + i)^n = P \left(1 + \frac{r}{m}\right)^{mt},$$

$$\text{Present Value, } P = \frac{F}{\left(1 + \frac{r}{m}\right)^{mt}},$$

Continuously compounding interest:

$$\text{Future Value, } F = Pe^{rt},$$

$$\text{Present Value, } P = Fe^{-rt},$$

LOGARITHMS

Properties of Logs:

$$a^{\log_a(x)} = x$$

$$\log_a(a^x) = x$$

$$\log_a(xy) = \log_a(x) + \log_a(y)$$

$$\log_a(x/y) = \log_a(x) - \log_a(y)$$

$$\log_a(x^c) = c \log_a(x)$$