



Unit 05a: Mathematics 1 – (Math A&B)

Assignment – 1

1. Solve the following equations in the set of real numbers :

a. $\frac{2}{3}q^2 + 5q - \frac{17}{3} = 0$

b. $\begin{cases} 16x + 8y + 12 = 0 \\ 10 + 8x + 20y = 0 \end{cases}$

c. $\begin{cases} 3y - 3x^2 = 0 \\ 3x + 3y^2 = 0 \end{cases}$

d. $(4x^2 - 6x)e^{x^2} + 2e^{x^2} = 0$

e. $(\ln x)^2 + 2 \ln x - 1 = 0$

f. $\frac{2}{\sqrt{q}} - 2q = 0$

(18 Marks)

2. The demand equation of a good is given by $p = q^2 + 4q + 20$, if the supply equation is $p = -q^2 - 10q + 176$, determine the equilibrium price and quantity.

(6 Marks)

3. Show that the graphs of the functions $f(x) = x^2 - 2x - 4$ and $g(x) = x - 8$ do not intersect, and sketch both graphs on the same diagram. Determine the positive values of the constant a such that graph of the function $h(x) = ax - 8$ does intersect the graph of $f(x)$.

(16 Marks)

4. A firm is a monopoly for the good it produces. Its average variable cost function is $q^2 + 4$, where q is the quantity it produces, and it has fixed costs of 20. The demand function for its goods is given by $p + q = 20$, where p is the price. Find expressions in terms of q , for the total revenue and the profit. Determine the production level q that gives maximum profit. What is the maximum profit.

(12 Marks)

5. Functions f and g are as follows:

$$f(x) = x^4 + 2x^3 + 2x^2 + 2, \quad g(x) = -x^4 + 2x^3 + 18x^2 + 20.$$

Show that the curves $y = f(x)$ and $y = g(x)$ intersect for exactly two values of x . Find these values of x . (Do not attempt to sketch the curves.)

(8 Marks)

6.

(Profit Functions) A company has a profit function given by

$$\pi(x) = 52x - x^2 - 276$$

where x denotes the quantity produced.

- Complete the square of the function $\pi(x)$.
- Find the x -intercepts and y -intercepts of $\pi(x)$.
- Which value of x gives the highest profit, and what is the amount of this maximum profit?
- Use the above information to sketch the graph of $\pi(x)$.
- Given that the company has a linear cost function, and that it costs \$532 for four units and \$564 for eight units, determine the cost $C(x)$ to produce x units.
- What is the revenue function $R(x)$ for this company?

(24 Marks)

7. Firm X can produce up to 30 items of product A. The profit derived from the manufacturing of x items of product A is given by the profit function

$$\pi(x) = 45x - 350 - x^2.$$

- Sketch the graph of the profit function.
- Find the break-even point.
- Find the value of x for which the profit is maximal, and give the maximal profit level.

(16 Marks)

END of QUESTIONS