**Questions for students**

1. Vectors
2. Vector space $R^{n}$
3. Operations on vectors
4. The expression of vector on other vectors
5. Linear dependency of vectors
6. Matrices
7. Linear operations on matrices
8. Transpose of a matrix
9. Rank of a matrix
10. Inverse matrix
11. Types of matrices
12. Determinants
13. Calculation of determinants
14. Application of properties of determinants for calculation
15. Minors of a matrix
16. Cofactors of a matrix
17. Equalities and inequalities with determinants
18. Finding Eugene values of linear transformation
19. Finding Eugene vectors of linear transformation
20. System of linear equations
21. Homogenous systems
22. Existence of solutions for homogeneous systems
23. Existence of solutions for linear non-homogenous systems
24. Matrix solution of linear systems
25. Cramer’s rule
26. Check if for the function Rolle’s theorem is applied.
27. Determine whether or not the function is continuous at the indicated point. If not, determine whether the discontinuity is a removable discontinuity or an essential discontinuity.
28. Derrivative application: A firm has total cost function. Find the fixed cost FC, and the marginal cost MC.
29. You are given a number c and the graph of a function f. Use the graph to find the limits.
30. Use implicit differentiation to express dy/dx in terms of x and y.
31. Derrivative application: A monopoly has cost function. and its demand curve has equation. What value of q maximises the profit?
32. The graph of f is given in the figure.

(a) At which points is f discontinuous?

(b) For each point of discontinuity found in (a), determine whether f is continuous from the right, from the left, or neither.

(c) Which, if any, of the points of discontinuity found in (a) is removable? Which, if any, is a jump discontinuity?

**33)** Check if for the function theorem is true and find c.

34) Derrivative application: A firm is a monopoly with cost function. The demand equation for its product is given. Work out (a) the inverse demand function; (b) the profit function; (c) the optimal value qm and the maximum profit; (d) the corresponding price.

35) Write an equation for the tangent line at (c, f (c)).

36) Describe the concavity of the function and find the points of inflection (if any)

 37) Derrivative application: Assume that the price/demand relationship for a particular good is given where p is the price ($) per unit and q is the demand per unit of time. Also assume that the fixed costs are given. (a) What is the maximum profit obtainable from this product? (b) What are the marginal cost and marginal revenue functions?

38) Expand the polynomial in terms of degrees of (x+1) (*Hint*: Taylor formula)

**39)** Find the limit

**40)** Derrivative application: The demand function relating price p and quantity x, for a particular product, is given .ind the amount of production, x, which will maximise revenue from selling the good, and state the value of the resulting revenue.

41) Use implicit differentiation to express dy/dx in terms of x and y.

42) Determine whether or not the function is continuous at the indicated point. If not, determine whether the discontinuity is a removable discontinuity or an essential discontinuity.

43) Derrivative application: given an economic model find the optimum time to sell, and verify that it is optimal.

44) Verify that f satisfies the conditions of the mean-value theorem on the indicated interval and find all numbers c that satisfy the conclusion of the theorem.

45) Determine whether or not the function is continuous at the indicated point. If not, determine whether the discontinuity is a removable discontinuity or an essential discontinuity.

46) Derrivative application: A monopolist's average cost function is given. Her demand equation is given. Find expressions for the total revenue and for the profit, as functions of Q. Determine the value of Q which maximises the total revenue. Determine also the value of Q maximising profit.

47) Find the derivative of function using logarithmic differentiation . And then find the extrema of the function (if any).

48) Use implicit differentiation to express dy/dx in terms of x and y.

49) A firm's average cost function is given and the demand function is given. Find expressions for the total revenue and for the profit, as functions of Q. Determine the value of Q which maximises the total revenue and the value of Q which maximises profit.

50) Calculate the limit.

51) For the given marginal cost function find the total cost.

52) A company's marginal cost function is given. Its fixed cost is given. Determine the firm's total cost function, average cost function, and variable cost.

53) The marginal revenue function for a commodity is given and the total cost function for the commodity is also given. Find the revenue function, and determine the maximal profit.

54) For a particular company, the marginal cost is a function of output with given formula. Determine the extra cost which is incurred when production is increased from 2 to 4.

55) A firm's marginal cost function is given. The firm's fixed costs are given. Determine the total cost function.

56) Find the definite integral.

57) Find the integral.

58) Calculate the integral.

59) Calculate the integral.

60) Calculate the integral.

61) A firm's weekly output is given by the production function and the unit costs for capital and labour are given per week, so that the total cost incurred in using k units of capital and l of labour is as follows. Find the minimum cost of producing a weekly output of 5000 and the corresponding values of k and l.

62) A firm manufactures a good from two raw materials, X and Y . The quantity of its good which is produced from x units of X and y of Y is given. If the firm spends no more than $1280 each week on the raw materials, what is its maximum possible weekly production, given that one unit of X costs $16 and one unit of Y costs $1?

63) A monopoly manufactures two goods, X and Y , with the given demand functions

The firm's cost function is given. Find the maximum profit achievable, and the quantities produced of each of X and Y in order to achieve this.

64) A firm manufactures two products, X and Y , and sells these in related markets. Suppose that the firm is the only producer of X and Y and that the inverse demand functions for X and Y are given. Determine the production levels that maximise profit, given the cost function.

65) Use the technique of Lagrange multipliers to find the values of x and y which maximise the function subject to the constraint.

66) A firm manufactures a good from two raw materials, X and Y . The quantity of the good which is produced from x units of X and y of Y is given. Find the minimum cost of producing 100 units of the manufactured good.

67) A consumer buys two goods, X and Y . The price of one unit of X is $1 and the price of one unit of Y is $16. The consumer's utility function, which describes how she values x units of X and y units of Y , is given. Using the method of Lagrange multipliers, find the values of x; y which will maximise the consumer's utility function u(x; y) subject to the constraint on her budget. Use the value of the Lagrange multiplier to estimate the increase in the maximum obtainable utility if the consumer's budget for the goods rises to $1282.

68) A firm has production function and unit capital and labour costs of 6 and 4, respectively, so that the total cost incurred when using k units of capital and l of labour is given. What is the maximum weekly output achievable if the firm spends no more than 1000 a week on capital and labour?

69) A student has a part-time job in a restaurant. For this she is paid $8 per hour. Her utility function for earning $I and spending S hours studying is given.

(The utility function is a measure of the `usefulness' or `worth' to the student of a

certain combination of money and study time.) The total amount of time she spends each week working in the restaurant and studying is given. How should she divide up her time in order to maximise her utility?

70) Find the critical points of the function of two variables and determine, for each, whether it is a local maximum, a local minimum, or a saddle point.

71) A data processing company employs both senior and junior programmers. A particular large project will cost dollars, where x and y represent the number of junior and senior programmers used respectively. How many employees of each kind should be assigned to the project in order to minimise its cost? What is this minimum cost?

72) Prove that the double limit does not exist

73) By definition prove that the series are convergent and find their sum.

74) By definition prove that the series are convergent and find their sum.

75) By definition prove that the series are convergent and find their sum.