



- c) the mid-point of the line segment joining the points (0, 2) and (3, 0) only
- d) every point on the line segment joining the points (0, 2) and (3, 0)
5. The value of a determinant is unaltered if [1]
- two rows are interchanged
  - two columns are interchanged
  - every element in a row (or column) is multiplied by the same number
  - to each element of a row (or a column) is added equi-multiples of the corresponding elements of another row or column.
- a) Option (c) b) Option (d)  
c) Option (b) d) Option (a)
6. The mean of the probability distribution of the number of doublets in 4 throws of a pair of dice is [1]
- $\frac{2}{3}$
  - 1
  - $1\frac{3}{5}$
  - $2\frac{2}{3}$
7. Let X denote the number of times heads occur in n tosses of a fair coin. If  $P(X = 4)$ ,  $P(X = 5)$  and  $P(X = 6)$  are in AP; the value of n is [1]
- 7, 14
  - 10, 14
  - 12, 7
  - 14, 12
8. The degree of the differential equation  $\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$  is [1]
- 1
  - 3
  - 2
  - not defined
9. A cistern is filled in 20 minutes by three pipes A, B and C. The pipe C is twice as fast as B and pipe B is thrice as fast as pipe A. How much time will pipe A alone take to fill the tank? [1]
- 205 minutes
  - 180 minutes
  - 200 minutes
  - 352 minutes
10. If  $A = \begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$ , then  $A^{-1}$  exists if [1]
- $\lambda \neq -2$
  - $\lambda \neq 2$
  - $\lambda = 2$
  - none of these
11. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol is found to be 26%. The quantity of whisky replaced is [1]
- $\frac{2}{5}$  part
  - $\frac{2}{3}$  part
  - $\frac{3}{5}$  part
  - $\frac{1}{3}$  part
12. x and b are real numbers. If  $b > 0$  and  $|x| > b$ , then [1]
- $x \in (-b, b)$
  - $x \in [-\infty, b)$
  - $x \in (-b, \infty)$
  - $x \in (-\infty, -b) \cup (b, \infty)$
13. A man can row a boat in still water at 15 km/hr and speed of water current is 5 km/hr. The distance covered by [1]



OR

A person amortizes a loan of ₹150000 for a new home by obtaining a 10 year mortgage at the rate of 12% compounded monthly. Find

i. EMI.

ii. Total interest paid (Given  $a_{\overline{120}/0.01} = 69.6891$ ).

22. Construct 3-yearly moving averages from the following data: [2]

Year:	2010	2011	2012	2013	2014	2015	2016
Imported cotton consumption in India (in '000 bales):	129	131	106	91	95	84	93

23. Evaluate the definite integral: [2]

$$\int_{-1}^2 f(x) dx, \text{ where } f(x) = \begin{cases} 2x + 1, & x \leq 1 \\ x - 5, & x > 1 \end{cases}$$

24. If A is a square matrix such that  $A^2 = I$ , then find the simplified value of  $(A - I)^3 + (A + I)^3 - 7A$ . [2]

OR

Find the value of x for which the matrix product  $\begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix} \begin{bmatrix} -x & 14x & 7x \\ 0 & 1 & 0 \\ x & -4x & -2x \end{bmatrix}$  equal to an identity matrix.

25. Find the multiplicative inverse of 27 (mod 392). [2]

### Section C

26. A machine costing ₹ 30,000 is expected to have a useful life of 4 years and a final scrap value of ₹ 4000. Find the annual depreciation charge using the straight-line method. Prepare the depreciation schedule. [3]

27. Solve the differential equation:  $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$  [3]

OR

Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.

28. The marginal cost (MC) of producing x units of a commodity in a day is given as  $MC = 16x - 1591$ . The selling price is fixed at ₹9 per unit and the fixed cost is ₹1800 per day. Determine: [3]

i. Cost function

ii. Revenue function

iii. Profit function, and

iv. Maximum profit that can be obtained in a day.

29. The following figures relate to the profits of a commercial concern for 8 years. [3]

Years	2016	2017	2018	2019	2020	2021	2022	2023
Profit (₹)	15,420	15,470	15,520	21,020	26,500	31,950	35,600	34,900

Find the trend of profits by the method of three-yearly moving averages.

30. A random sample of 10 boys had the following I.Q's: 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q. of 100? Find a reasonable range in which most of the mean I.Q. values of samples of 10 boys lie. (Given to  $(0.05) = 2.262$ ) [3]

31. Two cards are drawn simultaneously from a pack of 52 cards. Compute the mean and standard deviation of the number of kings. [3]

OR

The sum of mean and variance of a binomial distribution is 15 and the sum of their squares is 117. Determine the

distribution.

#### Section D

32. Find the minimum value of  $3x + 5y$  subject to the constraints [5]  
 $-2x + y \leq 4$ ,  $x + y \geq 3$ ,  $x - 2y \leq 2$ ,  $x, y \geq 0$

OR

Anil wants to invest at most ₹12000 in Saving Certificates and National Saving Bonds. According to rules, he has to invest at least ₹2000 in Saving Certificates and at least ₹4000 in National Saving Bonds. If the rate of interest on the saving certificate is 8% per annum and the rate of interest on the National Saving Bond is 10% per annum, how much money should he invest to earn maximum yearly income? Find also his maximum yearly income.

33. A die is tossed twice. Success is defined as getting an odd number on a random toss. Find the mean and variance [5]  
of the number of successes.

OR

An urn contains 5 red and 2 black balls. Two balls are randomly drawn without replacement. Find the probability distribution of the black balls drawn. Also, find the mean and variance of the black balls drawn.

34. Solve the following system of linear inequalities graphically: [5]

$$x + y \geq 5$$

$$x - y \leq 3$$

35. Calculate the EMI under **Flat Rate System** for a loan of ₹ 5,00,000 with 10% annual interest rate for 5 years. [5]

#### Section E

36. **Read the following text carefully and answer the questions that follow:** [4]

A tank with a rectangular base and rectangular sides of length  $x$  metre, width  $y$  metre, open at the top is to be constructed so that the depth is 1 m and volume is  $9\text{m}^3$ . If the building of the tank is ₹ 70 per square metre for the base and ₹ 45 per square metre for the sides?



- What is the cost of the base? (1)
- What is the cost of making all the sides? (1)
- If 'C' be the total cost of the tank, then find the value of C. (2)

OR

For what value of  $x$ , C is minimum? (2)

37. **Read the following text carefully and answer the questions that follow:** [4]

An equated monthly installment (EMI) is a set monthly payment provided by a borrower to a creditor on a set day, each month. EMIs apply to both interest and principal each month, and the loan is paid off in full over some years.

#### How is EMI calculated?

There are two ways in which EMI can be calculated. These methods are:

- **The flat rate method:** When the loan amount is progressively being repaid, each interest charge is computed using the original principal amount in the flat rate method.

- **The reducing balance method:** The reducing balance technique, compared to the flat rate method, determines the interest payment according to the outstanding principal.

**Example:**

A loan of ₹250000 at the interest rate of 6% p.a. compounded monthly is to be amortized by equal payments at the end of each month for 5 years.

(Given  $(1.005)^{60} = 1.3489$ ,  $(1.005)^{21} = 1.1104$ )

- Find the size of each monthly payment. (1)
- Find the principal outstanding at beginning of 40th month. (1)
- Find interest paid in 40th payment. (2)

**OR**

Find principal contained in 40th payment. (2)

38. **Read the following text carefully and answer the questions that follow:**

[4]

Two schools Oxford and Navdeep want to award their selected students on the values of sincerity, truthfulness and helpfulness. Oxford wants to award ₹ x each, ₹ y each and ₹ z each for the three respective values to 3, 2 and 1 students respectively with a total award money of 1600. Navdeep wants to spend 2300 to award its 4, 1 and 3 students on the respective values (by giving the same amount to the three values as before). The total amount of the award for one prize on each is ₹ 900.



- What is the value of  $x + y + z$ ? (1)
- What is the value of  $4x + y + 3z$ ? (1)
- What is the value of  $y$ ? (2)

**OR**

What is the value of  $2x + 3y$ ? (2)