

CBSE Class 12 Applied Mathematics 2025 - Set 465/S - Compartment



Question Paper

Conducted by the Central Board of Secondary Education (CBSE)

Time Allowed: 3 Hours

Maximum Marks: 80

General Instructions

- (i) This question paper contains 38 questions. All questions are compulsory.
- (ii) The question paper is divided into five sections: A, B, C, D and E.
- (iii) Section A: Questions 1–18 are multiple choice questions and Questions 19–20 are assertion–reason questions, carrying 1 mark each.
- (iv) Section B: Questions 21–25 are very short answer questions, carrying 2 marks each.
- (v) Section C: Questions 26–31 are short answer questions, carrying 3 marks each.
- (vi) Section D: Questions 32–35 are long answer questions, carrying 5 marks each.
- (vii) Section E: Questions 36–38 are case-study questions, carrying 4 marks each.
- (viii) There is no overall choice. Internal choice is provided in 2 questions in Section B, 4 questions in Section C, 2 questions in Section D and 3 questions in Section E.
- (ix) Use of calculators is not allowed.

Section A

1.

The smallest positive integer (mod 11) to which 282 is congruent, is:

- (A) 3 (B) 7
(C) 9 (D) 17

2.

A man can row 6 km/h in still water. It takes him twice as long to row up as to row down the river. Then, the speed of the stream is:

- (A) 2 km/h (B) 4 km/h
(C) 6 km/h (D) 8 km/h

3.

If $\frac{|x+1|}{x+1} > 0, x \in R$, then

- (A) $x \in [-1, \infty)$ (B) $x \in (-1, \infty)$
(C) $x \in (-\infty, -1)$ (D) $x \in (-\infty, -1]$

4.

If $P = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $Q = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $P = Q^2$, then x equals:

- (A) ± 1 (B) -1
(C) 1 (D) 2

5.

If A is an invertible matrix, then which of the following is **not** true?

- (A) $|A^{-1}| = |A|^{-1}$ (B) $(A^2)^{-1} = (A^{-1})^2$
(C) $(A')^{-1} = (A^{-1})'$ (D) $|A| \neq 0$

6.

The system of linear equations

$$2x + ky = 7$$

$$3x + 2y = 7$$

will be consistent, if:

- (A) $k = \frac{4}{3}$ (B) $k \neq \frac{4}{3}$
(C) $k \neq \frac{3}{4}$ (D) $k = \frac{3}{4}$

7.

If $y = x^y$, then $\frac{dy}{dx}$ is:

- (A) $x^y(\log x + 1)$ (B) $\frac{y^2}{x(1 + y \log x)}$
(C) $x^y(\log x - 1)$ (D) $\frac{y^2}{x(1 - y \log x)}$

8.

The function $f(x) = a^x$ is increasing on $\mathbb{R}$, if:

- (A) $a > 0$ (B) $a > 1$
(C) $a < 0$ (D) $0 < a < 1$
-

9.

A function $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined as $f(x) = x^3 + 1$.
The function f has:

- (A) no maximum value (B) no minimum value
(C) both maximum and minimum values (D) neither maximum nor minimum value
-

10.

The relation between “Marginal Cost (MC)” and “Average Cost (AC)” of producing 'x' units of a product is:

- (A) $\frac{d}{dx}(AC) = x(MC - AC)$ (B) $\frac{d}{dx}(AC) = x(AC - MC)$
(C) $\frac{d}{dx}(AC) = \frac{1}{x}(MC - AC)$ (D) $\frac{d}{dx}(AC) = \frac{1}{x}(AC - MC)$
-

11.

For a random variable X , $E(X) = 3$ and $E(X^2) = 11$. The variance of X is:

- (A) 8 (B) 5
(C) 2 (D) 1
-

12.

If the mean and standard deviation of a binomial distribution are 12 and 2 respectively, then the value of the parameter p is:

- (A) $\frac{5}{6}$ (B) $\frac{1}{6}$
(C) $\frac{1}{3}$ (D) $\frac{2}{3}$
-

13.

If the variance of a Poisson distribution is 2, then $P(X = 2)$ is:

- (A) $4e^2$ (B) $2e^2$
(C) $\frac{2}{e^2}$ (D) $\frac{4}{e^2}$
-

14.

Normal distribution is symmetric about:

- (A) Variance (B) Co-variance
(C) Mean (D) Standard deviation
-

15.

Using the flat rate method, the EMI to repay a loan of ₹20,000 in $2\frac{1}{2}$ years at an interest rate of 8% per annum is:

- (A) ₹100 (B) ₹700
(C) ₹800 (D) ₹1,000
-

16.

The graph of the inequality $3x + 2y > 6$ is the:

- | | |
|---|--|
| (A) entire XOY plane | (B) whole XOY plane excluding the points on the line $3x + 2y = 6$ |
| (C) half plane that contains the origin | (D) half plane that neither contains the origin nor the points on the line $3x + 2y = 6$ |

17.

The straight line trend is represented by the equation:

- | | |
|-------------------------|-------------------------|
| (A) $y = a + bx$ | (B) $y = a - bx$ |
| (C) $y = na + b \sum x$ | (D) $y = na - b \sum x$ |

18.

If for the purpose of t-test of significance, a random sample of size (n) 34 is drawn from a normal population, then the degree of freedom (N) is:

- | | |
|--------|--------|
| (A) 32 | (B) 33 |
| (C) 35 | (D) 36 |

19.

Assertion (A): Solution set of inequality $|3x - 2| \leq \frac{1}{2}, x \in R$ is $\left[\frac{1}{2}, \frac{5}{6}\right]$.

Reason (R): $|x - a| \leq r \Leftrightarrow x \leq a - r$ or $x \geq a + r$.

- | | |
|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

20.

Assertion (A): Matrix $A = \begin{bmatrix} 0 & -6 & 7 \\ 6 & 5 & -1 \\ -7 & 1 & 0 \end{bmatrix}$ is a skew-symmetric matrix.

Reason (R): A matrix A is skew-symmetric if $A' = -A$.

- | | |
|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

Section B

21(a).

Two pipes P and Q together can fill a tank in 10 minutes. If pipe P takes 15 minutes less than Q to fill the tank alone, then find the time taken by pipe Q to fill the tank alone.

OR

21(b).

In a 200 m race, A beats B by 35 m or 7 seconds. Find the time taken by A to complete the race.

22.

Find the probability distribution of a number of successes in two tosses of a die, where a success is defined as getting a number greater than 4.

23.

Suppose that a 95% confidence interval states that population mean is greater than 100 and less than 300. How would you interpret this statement?

24.

Fill in the blanks:

(a) t-distribution curve is symmetrical about the line _____.

(b) The variable t of t-distribution lies between _____.

(c) The mean of the t-distribution is _____.

(d) The variance of the t-distribution is _____.

25(a).

Find the present value of a perpetuity of ₹4,200 payable at the beginning of each year, if money is worth 5% compounded annually.

OR

25(b).

Find the present value of a perpetuity of ₹5,000 payable at the end of each year, if money is worth 5% compounded annually.

26(a).

Prove that $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$.

OR

26(b).

Prove that $\begin{vmatrix} y+z & z & y \\ z & z+x & x \\ y & x & x+y \end{vmatrix} = 4xyz$.

27.

Find the inverse (if it exists) of the matrix $A =$

$$\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}.$$

28(a).

Prove that the function $f(x) = x^2 - x + 1$ is neither strictly increasing nor strictly decreasing on the interval $(-1, 1)$.

OR

28(b).

Find $\frac{dy}{dx}$, if $y^x + x^y + x^x = a^b$.

29(a).

A person invested ₹5,000 in a fund for 5 years. The value of the investment was ₹4,800 at the end of the second year, ₹6,000 at the end of the third year, ₹6,700 at the end of the fourth year and on maturity, the final investment sold at ₹8,000. Find the CAGR. [Use $(1.6)^{\frac{1}{5}} = 1.098$]

OR

29(b).

The annual depreciation of an asset is ₹50,000 and its scrap value after useful life of 10 years is ₹60,000. Find the original cost of the asset, using linear depreciation method.

30(a).

Find: $\int \frac{dx}{(x+1)^2(x^2+1)}$.

OR

30(b).

Solve the differential equation: $\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$.

31.

Minimise $Z = 5x + 10y$, subject to the constraints
 $x + 2y \leq 120$
 $x + y \geq 60$
 $x - 2y \geq 0$
 $x, y \geq 0$

32.

Solve for x : $1 \leq |x - 2| \leq 3$.

33(a).

A given rectangular area is to be fenced off in a field whose length lies along a straight river. If no fencing is needed along the river, show that the least length of fencing will be required when the length of the rectangular area is twice its breadth.

OR

33(b).

Solve the differential equation: $x \frac{dy}{dx} + 2y = x^2 \log x$.

34(a).

Fit a straight line trend by the method of least squares to the following data and find the trend values.

Year	Sales (in lakh ₹)
2010	65
2012	68
2013	70
2014	72
2015	75
2016	67
2019	73

OR

34(b).

Find the trend values by taking 4-yearly moving averages for the following data.

Year	Sales (in thousand ₹)
2015	108
2016	112
2017	110
2018	120
2019	140
2020	120
2021	100
2022	135

35.

A machine costs a company ₹52,000 and its effective life is estimated to be 25 years. A sinking fund is created for replacing the machine by a new model at the end of its life time, when its scrap realizes a sum of ₹2,500 only. The price of the new model is estimated to be 25% more than the price of the present one. Find what amount should be set aside at the end of each year out of the profits for the sinking fund, if it accumulates at 3.5% per annum compound. [Given: $(1.035)^{25} = 2.3632$]

36.

Case Study – 1

According to an educational board survey, it was observed that class XII students apply at least one to four weeks ahead of college application deadlines. Let X represent the week when an average student applies ahead of a college's application deadline and the probability of the student to get admission in the college $P(X = x)$ is given as follows:

$$P(X = x) = \begin{cases} \frac{kx}{6}, & x = 0, 1 \text{ or } 2 \\ \frac{(1-k)x}{6}, & x = 3 \\ \frac{kx}{2}, & x = 4 \\ 0, & x > 4 \end{cases}$$

where k is a real number.

Based on the above information, answer the following questions:

36(i).

Determine the value of k .

36(ii).

What is the probability that Mahesh will get admission in the college, given that he applied at least 3 weeks ahead of application deadline?

36(iii)(a).

Calculate the mathematical expectation of number of weeks taken by a student to apply ahead of a college's application deadline.

OR

36(iii)(b).

To promote early admissions, the college is offering scholarships to the students for applying ahead of deadline as follows:

₹50,000 for applying 4 weeks ahead

₹20,000 for applying 3 weeks ahead

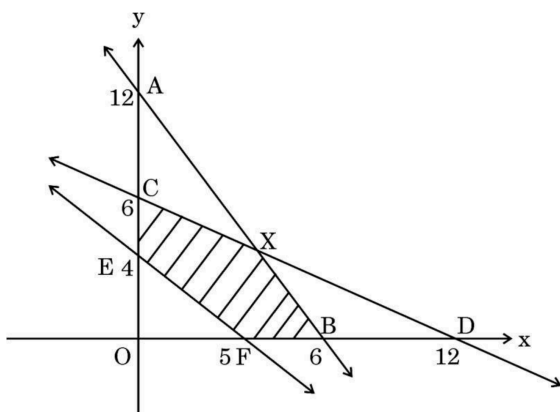
₹12,000 for applying 2 weeks ahead

and ₹9,600 for applying 1 week ahead

Determine the expected scholarship offered by the college.

37. Case Study – 2

The feasible region for an LPP is shown in the graph given below.



Based on the above information, answer the following questions:

37(i).

Determine the equation of CD.

37(ii).

Determine the equation EF

37(iii)(a).

Determine all the constraints for the LPP

OR

37(iii)(b).

Find the maximum value of the objective function $Z = 600x + 400y$.

38.

Case Study – 3

A man took a home loan of ₹40,00,000 from a bank at the interest of 6.75% per annum compounded monthly which is to be amortized by equal payments at the end of each month for 10 years.

Based on the above information, answer the following questions:

38(i).

Find the monthly instalment. [Use $(1.005625)^{-120} = 0.510120$]

38(ii).

Find the principal outstanding at the beginning of 61st month. [Use $(1.005625)^{60} = 1.400115$]

38(iii)(a).

Find the interest amount paid in the 61st instalment.

OR

38(iii)(b).

Find the principal amount paid in the 61st instalment.

- End of Question Paper -