S R Study Material

SAMPLE PAPER 2

Class 12 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
9. Use of calculators is not allowed.

Section A

1. A and B are square matrices of same order. If $(A + B)^2 = A^2 + B^2$, then: **[1]**

   a) AB = -BA   b) AB = BA

   c) AB = O   d) BA = O

2. If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then the value of $\left(\frac{24}{x} + \frac{24}{y}\right)$ is: **[1]**

   a) 6   b) 8

   c) 7   d) 18

3. If cos 2θ = 0, then $\begin{vmatrix} 0 & \cos\theta & \sin\theta \\ \cos\theta & \sin\theta & 0 \\ \sin\theta & 0 & \cos\theta \end{vmatrix}^2$ is equal to **[1]**

   a) $\frac{1}{2}$ b) -1

   c) $\frac{-1}{2}$ d) 1

4. The function $f(x) = e^{|x|}$ **[1]**

   a) differentiable everywhere except at x = 0   b) differentiable at x = 0

   c) differentiable everywhere   d) differentiable at x = -1

5. The point of intersection of the line $\frac{x-1}{3} = \frac{y+2}{4} = \frac{z-3}{-2}$ and the plane 2x - y + 3z -1 = 0, is **[1]**

a) (10, -10, -3) b) (10, 10, -3)

c) (10, -10, 3) d) (-10, 10, 3)

6. The order of the differential equation of all circles of given radius a is: **[1]**

a) 4 b) 1

c) 2 d) 3

7. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let F = 4x + 6y be the objective function. Maximum of F – Minimum of F = **[1]**

a) 48 b) 60

c) 42 d) 18

8. If $\vec{a} \cdot \hat{i} = \vec{a} \cdot (\hat{i} + \hat{j}) = \vec{a} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1,$ then $\vec{a}$= **[1]**

a) $\hat{i}$ b) $\overrightarrow{0}$

c) $\hat{j}$ d) $\hat{i} + \hat{j} + \hat{k}$

9. $\int \frac{dx}{\sqrt{4x^2-9}} = ?$ **[1]**

a) $\frac{1}{2}\log|2x + \sqrt{4x^2 - 9}| + C$ b) $\frac{1}{4}\log|x + \sqrt{4x^2 - 9}| + C$

c) $2\log|3x - \sqrt{4x^2 - 9}| + C$ d) $\log|2x + \sqrt{4x^2 - 9}| + C$

10. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to **[1]**

a) 0 b) 6

c) ± 6 d) -6

11. The corner points of the feasible region determined by the system of linear inequalities are (0, 0), (4, 0), (2, 4), and (0, 5). If the maximum value of z = ax + by, where a, b > 0 occurs at both (2, 4) and (4, 0), then: **[1]**

a) 3a = b b) 2a = b

c) a = 2b d) a = b

12. The vector having initial and terminal points as (2,5,0) and (-3,7,4) respectively is **[1]**

a) $\hat{i} + \hat{j} + \hat{k}$ b) $-i + 12j + 4\dot{k}$

c) $5i + 2j - 4k$ d) $-5\hat{i} + 2\hat{j} + 4\hat{k}$

13. The value of the determinant $\Delta = \begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$ is **[1]**

a) -5 b) 4

c) 5 d) 0

14. If A and B are independent events such that 0 < P (A) < 1 and 0 < P (B) < 1, then which of the following is not correct? **[1]**

a) A′ and B′ are independent b) A and B are mutually exclusive

c) A and B′ are independent d) A′ and B are independent

15. General solution of $\frac{dy}{dx} + (\sec x)\, y = \tan x \ \left(0 \leqslant x < \frac{\pi}{2}\right)$ is **[1]**

a) $y(\sec x+\tan x)=\sec x+\tan x-x+C$

b) $y(\sec x-\tan x)=\sec x+\tan x-x+C$

c) $y(\sec x+\tan x)=\sec x-\tan x-x+C$

d) $y(\sec x-\tan x)=\sec x-\tan x-x+C$

16. The unit vector normal to the plane containing $\vec{a}=(\hat{i}-\hat{j}-\hat{k})$ and $\vec{b}=(\hat{i}+\hat{j}+\hat{k})$ is **[1]**

a) $\frac{1}{\sqrt{2}}(-\hat{j}+\hat{k})$

b) $\frac{1}{\sqrt{2}}(-\hat{i}+\hat{k})$

c) $(\hat{j}-\hat{k})$

d) $(-\hat{j}+\hat{k})$

17. If x = a cos nt - b sin nt, then $\frac{d^2x}{dt^2}$ is **[1]**

a) $-n^2x$

b) n^2x

c) -nx

d) nx

18. If the projections of $\overrightarrow{PQ}$ on OX, OY, OZ are respectively 1, 2, 3 and 4, then the magnitude of $\overrightarrow{PQ}$ is **[1]**

a) 13

b) 169

c) 19

d) 144

19. **Assertion (A):** If the circumference of the circle is changing at the rate of 10 cm/s, then the area of the circle changes at the rate 30 cm^2/s, if radius is 3 cm. **[1]**

Reason (R): If A and r are the area and radius of the circle, respectively, then rate of change of area of the circle is given by $\frac{dA}{dt}=2\pi r\frac{dr}{dt}$.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** The f : R $\to$ R given by f(x) = [x] + x is one-one onto. **[1]**

Reason (R): A function is said to be one-one and onto, if each element has unique image and range of f(x) is equal to codomain of f(x).

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Write the interval for the principal value of function and draw its graph: $\sec^{-1}$ x. **[2]**

OR

Write the interval for the principal value of function and draw its graph: $\sin^{-1}$x....

22. Show that the function f(x) = x^2 is strictly increasing function on [0, ∞) **[2]**

23. Find the rate of change of the area of a circle with respect to its radius r when r = 3 cm **[2]**

OR

Find the intervals in which the function f given by f(x) = $2x^2$ - 3x is

i. increasing
ii. decreasing

24. Evaluate: $\int \frac{2x-1}{(x-1)^2}dx$ **[2]**

25. Find the maximum and minimum values of f(x) = sin x in the interval [π, 2π]. **[2]**

Section C

26. Evaluate the definite integral $\int_0^{\frac{\pi}{4}} \frac{\sin x \cos x}{\cos^4 x+\sin^4 x} dx$ **[3]**

27. Bag A contains 3 red and 2 black balls, while bag B contains 2 red and 3 black balls. A ball drawn at random from bag A is transferred to bag B and then one ball is drawn at random from bag B. If this ball was found to be a red ball, find the probability that the ball drawn from bag A was red. **[3]**

28. Evaluate $\int_0^{\pi/2} \frac{\sqrt{\cot x}}{\sqrt{\cot x}+\sqrt{\tan x}} dx$ **[3]**

OR

Evaluate $\int \frac{x+1}{x(1+xe^x)^2} dx$

29. Solve $x^2 \frac{dy}{dx} - xy = 1 + \cos\left(\frac{y}{x}\right), x \neq 0$ and $x = 1, y = \frac{\pi}{2}$ **[3]**

OR

Solve the differential equation: $\frac{dy}{dx}$ + y = cos x

30. Find the maximum value of Z = 7x + 7y subject to the constraints x $\geq$ 0, y $\geq$ 0, x + y $\geq$ 2 and 2x + 3y $\leq$ 6 **[3]**

OR

Solve the Linear Programming Problem graphically:

Maximize Z = 3x + 5y Subject to

x + 2y $\leq$ 20

x + y $\leq$ 15

y $\leq$ 5

x, y $\geq$ 0

31. Find $\frac{dy}{dx}$, If y = $(\cos x)^x + (\sin x)^{1/x}$. **[3]**

Section D

32. Find the area between the curves y = x and y = x^2 **[5]**

33. Let R be relation defined on the set of natural number N as follows: **[5]**

R = {(x, y): x $\in$ N, y $\in$ N, 2x + y = 41}. Find the domain and range of the relation R. Also verify whether R is reflexive, symmetric and transitive.

OR

Let A = R – {3} and B = R – {1}. Consider the function f: A $\Rightarrow$B defined by $f(x) = \left(\frac{x-2}{x-3}\right)$. Is f one-one and onto? Justify your answer.

34. Show that the matrix, $A = \begin{bmatrix} 1 & 0 & -2 \\ -2 & -1 & 2 \\ 3 & 4 & 1 \end{bmatrix}$ satisfies the equation, $A^3 - A^2 - 3A - I_3 = O$. Hence, find A^{-1} **[5]**

35. Find the perpendicular distance of the point (1, 0, 0) from the line $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$. Also, find the coordinates of the foot of the perpendicular and the equation of the perpendicular. **[5]**

OR

Find the shortest distance between the lines given below: $\frac{x-1}{-1} = \frac{y+2}{1} = \frac{z-3}{-2}$ and $\frac{x-1}{1} = \frac{y+1}{2} = \frac{z+1}{-2}$.

Hint: Change the given equation is vector form

Section E

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

Mr. Ajay is taking up subjects of mathematics, physics, and chemistry in the examination. His probabilities of getting a grade A in these subjects are 0.2, 0.3, and 0.5 respectively.

i. Find the probability that Ajay gets Grade A in all subjects. (1)

ii. Find the probability that he gets Grade A in no subjects. (1)

iii. Find the probability that he gets Grade A in two subjects. (2)

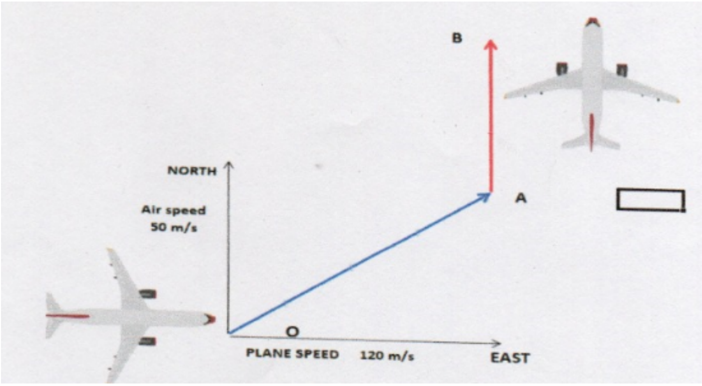
OR

Find the probability that he gets Grade A in at least one subject. (2)

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

A plane started from airport O with a velocity of 120 m/s towards east. Air is blowing at a velocity of 50 m/s towards the north As shown in the figure.

The plane travelled 1 hr in OA direction with the resultant velocity. From A and B travelled 1 hr with keeping velocity of 120 m/s and finally landed at B.



i. What is the resultant velocity from O to A? (1)

ii. What is the direction of travel of plane O to A with east? (1)

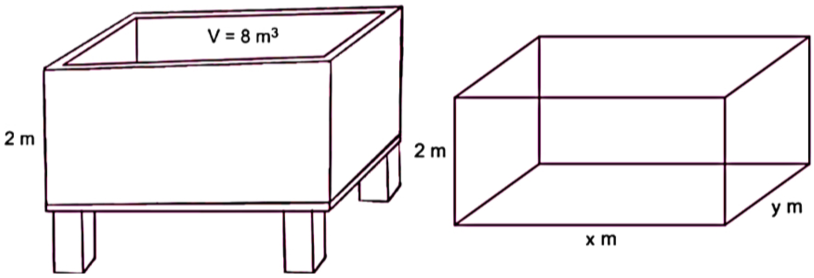
iii. What is the total displacement from O to A? (2)

OR

What is the resultant velocity from A to B? (2)

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

On the request of villagers, a construction agency designs a tank with the help of an architect. Tank consists of a rectangular base with rectangular sides, open at the top so that its depth is 2 m and volume is 8 m^3 as shown below. The construction of the tank costs ₹70 per sq. metre for the base and ₹45 per square metre for sides.



i. Express making cost C in terms of length of rectangle base. (1)

ii. If x and y represent the length and breadth of its rectangular base, then find the relation between the variables. (1)

iii. Find the value of **x** so that the cost of construction is minimum. (2)

OR

Verify by second derivative test that cost is minimum at a critical point. (2)

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