S.R. Study Material

S R SAMPLE PAPER 1

Class 12 - Mathematics

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

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Section A

1. If $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ and f(x) = $2x^2$ - 4x + 5 then f(A) = ? **[1]**

a) $\begin{bmatrix} 19 & -11 \\ -27 & 51 \end{bmatrix}$
b) $\begin{bmatrix} 19 & -32 \\ -16 & 51 \end{bmatrix}$
c) $\begin{bmatrix} 19 & -16 \\ -32 & 51 \end{bmatrix}$
d) None of these

2. The value of $(A^{-1})^T$ is **[1]**

a) A^T
b) $\left(A^T\right)^{-1}$
c) A^{-1}
d) I

3. If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then det (adj(adj A)) is **[1]**

a) 14^3
b) 14
c) 14^4
d) 14^2

4. Let f(x) = $\begin{cases} \left|\tan\left(\frac{\pi}{4} + x\right)\right|^{\frac{1}{x}}, & x \neq 0 \\ k, & x = 0 \end{cases}$ then the value of k such that f(x) holds continuity at x = 0 is **[1]**

a) e^2
b) $\frac{1}{e^2}$
c) e
d) None of these

5. If the direction ratios of a line are proportional to 1, - 3, 2, then its direction cosines are **[1]**

a)
b)

a) $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

b) $-\frac{1}{\sqrt{14}}, -\frac{2}{\sqrt{14}}, -\frac{3}{\sqrt{14}}$

c) $\frac{1}{\sqrt{14}}, -\frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}}$

d) $-\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}}$

6. The solution of $\frac{dy}{dx} = |x|$ is **[1]**

a) y = $\frac{x^2}{2}$ + C

b) y = $\frac{x|x|}{2}$ + C

c) y = $\frac{|x|}{2}$ + C

d) y = $\frac{x^3}{2}$ + C

7. Which of the following statements is correct? **[1]**

a. Every LPP admits an optimal selection.

b. A LPP admits unique optimal solution.

c. If a LPP admits two optimal solutions it has an infinite solution.

d. The set of all feasible solutions of a LPP is not a convex set.

a) Option (d)

b) Option (a)

c) Option (b)

d) Option (c)

8. The area of the quadrilateral ABCD, where A(0,4,1), B (2, 3, -1), C(4, 5, 0) and D (2, 6, 2), is equal to **[1]**

a) 18 sq. units

b) 81 sq. units

c) 9 sq. units

d) 27 sq. units

9. $\int \frac{(\cos 2x - \cos 2\alpha)}{(\cos x - \cos \alpha)} dx = ?$ **[1]**

a) 2sin x + x cos α + C

b) None of these

c) sin x + x cos α + C

d) 2 sin x + 2x cos α + C

10. If A is a square matrix such that A^2 = A, then $(I - A)^3$ + A is equal to: **[1]**

a) I

b) I - A

c) I + A

d) 0

11. In a LPP, the linear inequalities or restrictions on the variables are called **[1]**

a) Limits

b) Inequalities

c) Linear constraints

d) Constraints

12. Show that the points A(1, – 2, – 8), B (5, 0, – 2) and C (11, 3, 7) are collinear, and find the ratio in which B divides AC. **[1]**

a) 3 :2

b) 2 :4

c) 2 : 3

d) 2 :1

13. If $A = \begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A^{-1} exists if. **[1]**

a) λ = 2

b) $\lambda \neq$ -2

c) None of these

d) $\lambda \neq 2$

14. For two mutually exclusive events A and B, P(A) = 0.2 and P$(\bar{A} \cap B)$ = 0.3. What is P(A|(A ∪ B)) equal to? **[1]**

a) $\frac{2}{7}$

b) $\frac{2}{5}$

c) $\frac{2}{3}$

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

15. Find the particular solution for $2xy + y^2 - 2x^2\frac{dy}{dx} = 0;\ y = 2$ when x = 1 **[1]**

a) $y = \frac{2x}{1-\log|x|}\ (x \neq 0, x \neq e)$

b) $y = \frac{3x}{1-\log|x|}\ (x \neq 0, x \neq e)$

c) $y = \frac{2x}{1+\log|x|}\ (x \neq 0, x \neq e)$

d) $y = \frac{5x}{1+\log|x|}\ (x \neq 0, x \neq e)$

16. The scalar product of two nonzero vectors $\vec{a}$ and $\vec{b}$ is denoted by **[1]**

a) $\overrightarrow{ab}$

b) $\vec{a}.\vec{b}$

c) $\overrightarrow{a} \times \overrightarrow{b}$

d) ab

17. The function f(x) = $\begin{cases} \frac{\sin x}{x} + \cos x, & \text{if } x \neq 0 \\ 1, & \text{if } x = 0 \end{cases}$ at x = 0 **[1]**

a) is continuous

b) has removable discontinuity

c) has oscillating discontinuity

d) has jump discontinuity

18. Find the shortest distance between the lines $\vec{r} = (1-t)\,\hat{i} + (t-2)\,\hat{j} + (3-2t)\hat{k}$ and $\vec{r} = (s+1)\,\hat{i} + (2s-1)\,\hat{j} - (2s+1)\hat{k}$ **[1]**

a) $\frac{8}{\sqrt{31}}$

b) $\frac{8}{\sqrt{35}}$

c) $\frac{8}{\sqrt{29}}$

d) $\frac{8}{\sqrt{33}}$

19. **Assertion (A):** f(x) = tan x - x always increases. **[1]**

Reason (R): Any function y = f(x) is increasing if $\frac{dy}{dx}$ > 0.

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):** A function f: N $\rightarrow$ N be defined by $f(n) = \begin{cases} \frac{n}{2} & \text{if } n \text{ is even} \\ \frac{(n+1)}{2} & \text{if } n \text{ is odd} \end{cases}$ for all n $\in$ N; is one-one. **[1]**

Reason (R): A function f: A $\rightarrow$ B is said to be injective if a $\neq$ b then f(a) $\neq$ f(b).

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: $\sin^{-1}x$.... **[2]**

OR

Simplify $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$, 0 < x < $\frac{1}{\sqrt{2}}$.

22. Show that the function f(x) = $x^3 - 3x^2 + 6x - 100$ is increasing on R. **[2]**

23. Find the interval in function f(x) = $6 + 12x + 3x^2 - 2x^3$ is increasing or decreasing. **[2]**

OR

Show that the function f(x) = $x^{100} + \sin x - 1$ is increasing on the interval $\left(\frac{\pi}{2}, \pi\right)$

24. Find the integral of the function $\frac{\cos x}{1+\cos x}$ **[2]**

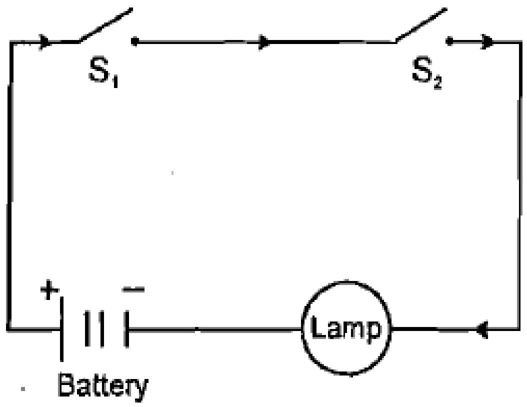
25. A man 2 metres high, walks at a uniform speed of 6 metres per minute away from a lamp post, 5 metres high. **[2]**

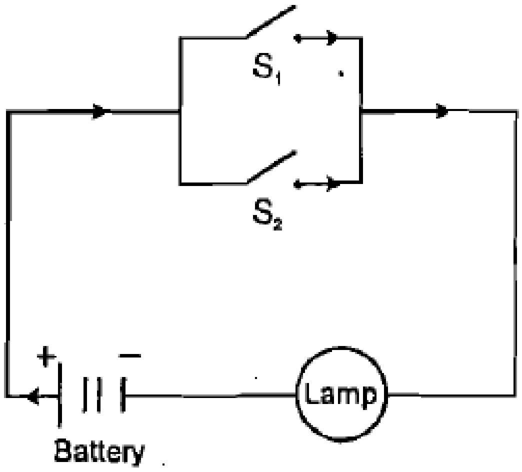
Find the rate at which the length of his shadow increases.

Section C

26. Evaluate the definite integral $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin x+\cos x}{\sqrt{\sin 2x}} dx$ **[3]**

27. If two switches S_1 and S_2 have respectively 90% and 80% chances of working. Find the probabilities that each of the following circuits will work. **[3]**





28. Evaluate: $\int \frac{x^2}{(x^4-1)} dx$. **[3]**

OR

Evaluate the integral: $\int_0^{\pi} \sin^3 x(1+2\cos x)(1+\cos x)^2 dx$

29. Solve the differential equation: $\sin^4 x \frac{dy}{dx} = \cos x$ **[3]**

OR

Find the equation of a curve passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of the x coordinate (abscissa) and the product of the x coordinate and y coordinate (ordinate) of that point.

30. Minimise Z = 13x - 15y, subject to the constraints: $x+y \leq 7, 2x-3y+6 \geq 0, x \geq 0, y \geq 0$. **[3]**

OR

The feasible region for a LPP is shown in Figure. Evaluate Z = 4x + y at each of the corner points of this region. Find the minimum value of Z, if it exists.

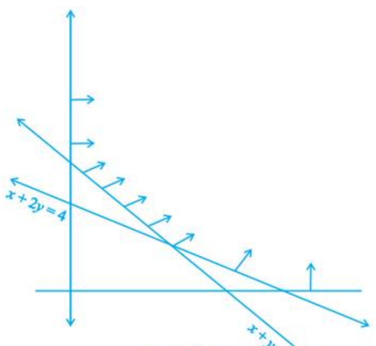


Fig. 12.10

31. If $x=\sin^{-1}\left(\frac{2t}{1+t^2}\right)$ and $y=\tan^{-1}\left(\frac{2t}{1-t^2}\right)$, -1 < t < 1, prove that $\frac{dy}{dx}=1$ **[3]**

Section D

32. Find Smaller area enclosed by the circle $x^2 + y^2 = 4$ and the lines x + y = 2. **[5]**

33. Given, A = {2, 3, 4}, B = {2, 5, 6, 7}. Construct an example of each of the following: **[5]**

   a. an injective mapping from A to B
   b. a mapping from A to B which is not injective

c. a mapping from B to A.

OR

Let A = [-1, 1]. Then, discuss whether the following functions defined on A are one-one, onto or bijective:

i. $f(x) = \frac{x}{2}$

ii. g(x) = |x|

iii. h(x) = x|x|

iv. k(x) = x^2

34. Solve the following system of the linear equations by Cramer's rule: **[5]**

x + y + z + 1 = 0

ax + by + cz + d = 0

$a^2x + b^2y + c^2z + d^2 = 0$

35. Find the equations of the line passing through the point (3, 0, 1) and parallel to the planes x + 2y = 0 and 3y - z = 0. **[5]**

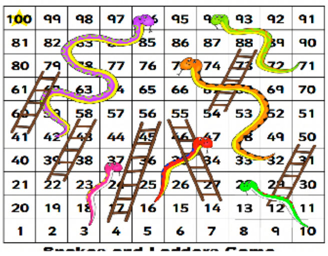
OR

Show that the lines $\vec{r} = (2\hat{i} - 3\hat{k}) + \lambda(\hat{i} + 2\hat{j} + 3\hat{k})$ and $\vec{r} = (2\hat{i} + 6\hat{j} + 3\hat{k}) + \mu(2\hat{i} + 3\hat{j} + 4\hat{k})$ intersect. Also, find their point intersection.

Section E

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

Akshat and his friend Aditya were playing the snake and ladder game. They had their own dice to play the game. Akshat was having red dice whereas Aditya had black dice. In the beginning, they were using their own dice to play the game. But then they decided to make it faster and started playing with two dice together.



Aditya rolled down both black and red die together.

First die is black and second is red.

(i) Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.

(ii) Find the conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.

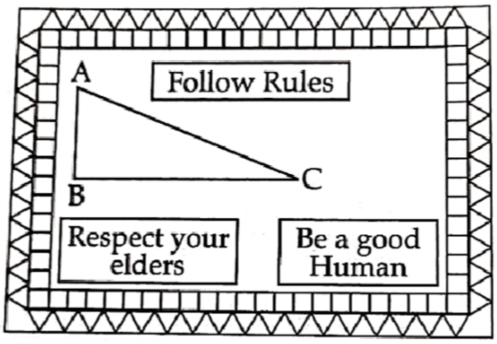
(iii) Find the conditional probability of obtaining the sum 10, given that the black die resulted in even number.

OR

Find the conditional probability of obtaining the doublet, given that the red die resulted in a number more than 4.

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

The slogans on chart papers are to be placed on a school bulletin board at the points A, B and C displaying A (follow Rules), B (Respect your elders) and C (Be a good human). The coordinates of these points are (1, 4, 2), (3, -3, -2) and (-2, 2, 6), respectively.



(i) If $\vec{a}, \vec{b}$ and $\vec{c}$ be the position vectors of points A, B, C, respectively, then find $|\vec{a}+\vec{b}+\vec{c}|$.

(ii) If $\vec{a}=4\hat{i}+6\hat{j}+12\hat{k}$, then find the unit vector in direction of $\vec{a}$.

(iii) Find area of $\triangle$ABC.

OR

Write the triangle law of addition for $\triangle$ABC. Suppose, if the given slogans are to be placed on a straight line, then the value of $|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}|$.

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

A tin can manufacturer designs a cylindrical tin can for a company making sanitizer and disinfectors. The tin can is made to hold 3 litres of sanitizer or disinfector. The cost of material used to manufacture the tin can is ₹100/m^2.

(i) If r cm be the radius and h cm be the height of the cylindrical tin can, then express the surface area as a function of radius (r)

(ii) Find the radius of the can that will minimize the cost of tin used for making can?