CLASS XII
MATHEMATICS (041)

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 of 4 marks each with sub-parts.

SECTION A (Multiple Choice Questions)
Each question carries 1 mark

1. If $A = \begin{bmatrix} 3 & 2 & \lambda \\ 1 & 4 & 0 \\ 2 & 1 & 5 \end{bmatrix}$ is a singular matrix, then the value of λ is:

(a) $\lambda=5$

(b) $\lambda\neq5$

(c) $\lambda=50/7$

(d) $\lambda\neq-5$

2. If A = $[a_{ij}]$ is a square matrix of order 3 such that A.adj A=[7 0 0 0 7 0 0 0 7], then the value of |A|+|adj A| is

(a) 7 (b) 56 (c) 343 (d) 350

3. If A is the set of cities, and a relation R on set A is defined as R={(x,y): xand y are directly connected by a road}, then relation R is:
(a) Reflexive but not symmetric
(b) Symmetric but not transitive
(c) Reflexive and transitive
(d) Equivalence

4. If A is a square matrix of order 2 such that ∣A∣=3, then the value of ∣2A∣ is:

(a) 6

(b) 12

(c) ±12

(d) 24

5. If α *and* β *are roots of equation* $|2x\ x\ 3\ x| = 5$, then value of $\alpha + \beta$ is

(a) 2/3 (b) -5/2 (c) 3/2 (d) -2/5

6. If the function f(x)=∣x−1∣+∣x+2∣ is not differentiable at p and q, then the value of p+q is:

(a) 1

(b) -1
(c) 0
(d) 3

7. If $x = a(sint - tcost) and\ y = a(cost + tsint)$, then $value\ of\ \frac{dy}{dx}\ at\ t = \frac{\pi}{4}\ is$

(a) 1 (b) $\sqrt{3}$ (c) $1/\sqrt{3}$ (d) -1

8. If $\int \frac{sinx}{sin(x-a)} dx = Ax + B\ log|sin(x - a)| + C$ then the value of $A^2 + B^2$ is

(a) 2x (b) 0 (c) 1 (d) π

9. The direction cosine of a line equally inclined to the axes is?

(a) 1, 1, 1 (b) ±1, ±1,±1 (c) $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$ (d) 1, 0, 0

10. Let A and B be two events. If P(A)=0.3, P(A) P(B)=0.5, P(A ∪ B)=0.7, then P(A|B) is:
(a) 0.4
(b) 0.6
(c) 0.2
(d) 0.5

11. If m is the order and n is the degree of given differential equation,

$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^5 + x^4 = 0$ then what is the value of m + n

(a) 5 (b) 9 (c) 4 (d) 7

12. If $sin^{-1}\frac{3}{5} + cos^{-1}\frac{12}{13} = sin^{-1}C$ then C is equal to

(a) 65/66 (b) 24/65 (c) 16/65 (d) 56/65

13. If magnitude of vector $x(\hat{i} + \hat{j} + \hat{k})$ is '**3 units**' then the value of x is

(a) $\frac{1}{3}$ (b)) $\sqrt{3}$ (c) $\pm\frac{1}{\sqrt{3}}$ (d)) $\pm\sqrt{3}$

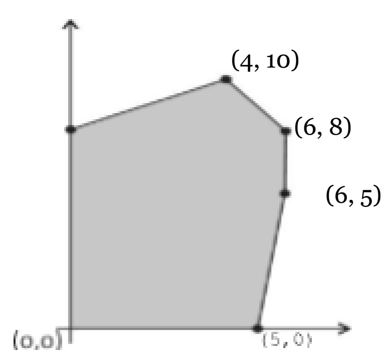
14. The Integrating factor of the differential equation (x log x)$\frac{dy}{dx}$+y=2 log x ,is given by

(a)log(log x) (b)e^x (c) log x (d)x

15. The direction ratio of the line $\frac{3-2x}{4} = \frac{y+5}{3} = \frac{6-z}{6}$ is

(a) 4, 3, 6 (b) 2, 3, - 6 (c) 2, -3, 6 (d) – 2, -3, -6

16. The feasible solution for a LPP is shown in given figure. Let Z=3x-4y be the objective function. Minimum of Z occurs at



(a) (0,0)
(b) (0,8)
(c) (5,0)

(d) (4,10)

17. The corner points of feasible solution region determined by the system of linear constraints are (0, 10), (5, 5), (15,15), (0,20). Let $Z = px + qy$, where p, q> 0. Condition on p and q so that the maximum of Z occurs both the point (5,5) and (0,10) is

(a) p = 2q (b) p = q (c) q = 2p (d) q = 3p

18. If a line makes angles α,β,γ with the coordinate axes respectively, then the value of $\cos^2\alpha+\cos^2\beta+\cos^2\gamma$ will be:

(a) 2
(b) −1
(c) 1
(d) 0

ASSERTION- REASON BASED QUESTIONS

In the following questions a statement of Assertion (A) is followed by a statement of Reason (R).

Choose the correct answer out of the following choices.

(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, R is false.
(d) A is false, R is true.

19. **Assertion (A)**:
$If\ matrix[7\ -3\ -3\ -1\ 1\ 0\ -1\ 0\ 1]\ is\ inverse\ of\ matrix[1\ 3\ 3\ 1\ p\ 3\ 1\ 3\ 4]\ then\ p = 3$

Reason (R): $AA^{-1} = I$

20. **Assertion (A):** $f(x) = \{x^2 + 1\ ,x\leq 1\ 2x\ \ \ ,x > 1$ is continuous at x=1

Reason (R): LHL and RHL at x=1 both are equal and also equal to f(1).

SECTION-B

This section comprises of very short answer type question (VSA) of 2 marks each.

21.Find the principal value of $tan^{-1}tan(\frac{17\pi}{6})$

OR

Find the domain and range of $cos^{-1}(2x - 1)$?

22. If $x^m y^n = (x + y)^{m+n}$, then find $\frac{dy}{dx}$.

OR

$y = (sinx)^{\log x},\ find\ dy/dx$

23. A man 1.6 m tall walks at a rate of 0.3 m/sec away from a street light that is 4m above the ground. At what rate is the tip of the shadow moving?

24. Show that the function $(x) = tan^{-1}(sinx + cosx)$, $x > 0$ is always an strictly increasing

function in $(0, \frac{\pi}{4})$

OR

Find the intervals in which $f(x) = x^3 + \frac{1}{x^3}$, $x \neq 0$ is (i) increasing (ii) decreasing.

25. Two friends, Raj and Simran, are walking along two sides of a rectangular agricultural field. The adjacent sides are represented by vectors a=2i+3j+k and b=i−j+4k. Find the area of the field.

SECTION C

(This section comprises of short answer type question (SA) of 3 marks each)

26. If

$x = a \sin sin\, 2t, \quad y = a(\cos cos\, 2t + \log log\, \tan tan\, t), \qquad find\ \frac{d^2y}{dx^2}\ at\ t = \pi/6$

27. Solve the differential equation: y (1 + e^x) dy = (y + 1) e^x dx.

OR

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

28. Evaluate $\int \frac{x^2}{(x^2+1)(x^2+4)} dx$

OR

Evaluate $\int \frac{1}{\sqrt{(a-x)(x-b)}} dx$ where a>b

29. If P(2, -3,4) , Q(3,6, -5) and R (5,0,7) be the vertices of a triangle then find the area of triangle.

30. Solve the following linear programming problem graphically:

Minimise & Maximise Z = 200x + 500y

Subject to constraints: $x + 2y \geq 10$, $3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$;

OR

Solve graphically:

Maximise Z = 3x + 9y

Subject to the constraints: $x + 3y \leq 60$, $x + y \geq 10$, $x \leq y$, $x \geq 0$, $y \geq 0$

31. For two events A and B If $P(A) = \frac{1}{2}$ $P(AUB) = \frac{2}{3}$ $and\ P(A \cap B) = \frac{1}{6}$, then find the value of

$(i) P(A/B)$. $(ii) P(A'/B)$. (1+2)

SECTION D

(This section comprises of long answer-type question (LA) of 5 marks each)

32. If A = [2 3 1 − 3 2 1 5 − 4 − 2] , find A^{-1} and use it to solve the system of equations:

2x – 3y + 5z = 11, 3x + 2y – 4z = - 5,   x + y – 2z = - 3

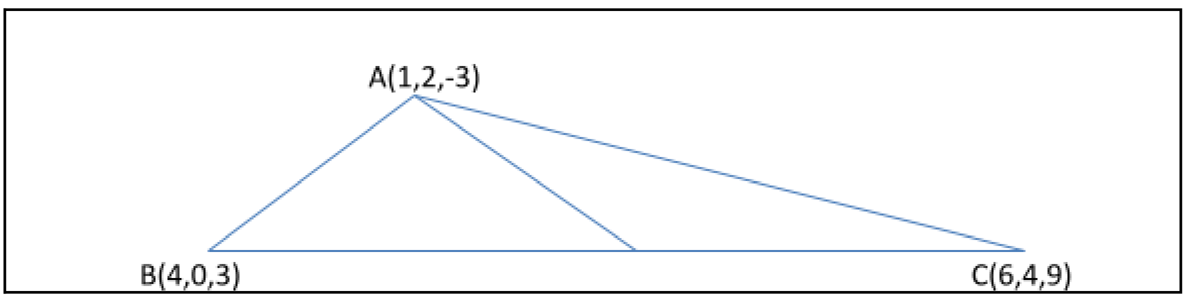
33. $\int_{-1}^{2}\left|x^{3} - x\right|dx$

OR

Evaluate: $\int_{0}^{\frac{\pi}{2}}(2x - 2x)dx$

34. Using integration find the area of region bounded by
$2x - y + 2 = 0,\ x = -2,\ x = 3\ and\ x\ axis.$

35. If A(1,2,-3) , B(4,0,3) and C(6,4,9) be the vertices of triangle ABC . If AD be the median then Find (i)Equation of side BC
(ii) Equation of Median AD
(iii)Angle between AD and BC.   (2+3 marks)



OR

Find equation of line which passes through (1, 1, 1) and perpendicular to both the following lines

$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x+2}{1} = \frac{3-y}{-2} = \frac{z+1}{4}$.

SECTION E

(CASE STUDY BASED QUESTIONS)

36. **Case-Study I-** *Function $f: A \rightarrow B$ is said to be one − one if different elements of domain A have different images in codomain B*

also above function is said to be if all the elements of codomain B are images of some elements of domain A
Based on above information answer the following

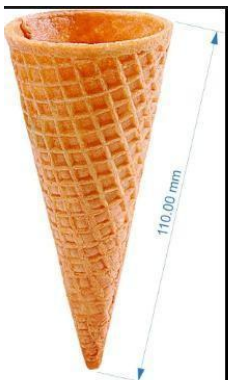
(a)$Function\ f: R \rightarrow R\ defined\ as\ f(x) = x^{2} + 1$, check whether function is one one and onto.

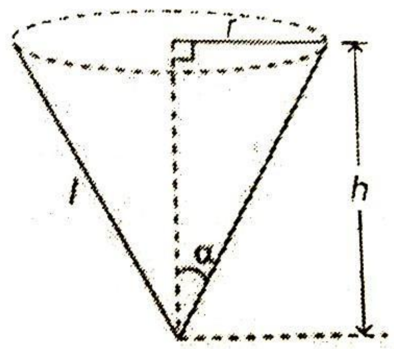
(b)$If\ function\ f: R \rightarrow Y\ defined\ as\ f(x) = 4x^{2} - 3$ is onto function then find codomain **Y**.

OR

$(b) function\ f: R \rightarrow R\ defined\ as\ f(x) = 2x - 5$, check whether function is bijective, justify your answer.

37. **Case-Study II-** Priyanka is very fond of ice cream cone. She selected an ice cream cone as shown in the figure. She wants to calculate the criteria for maximum volume of cream in cone. Help her by answering the following questions





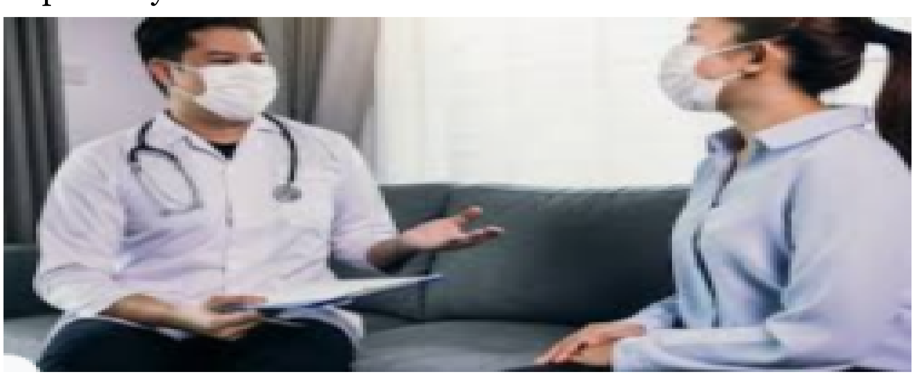
(a) If α is the semi vertical angle of cone. Find radius and height of cone when slant height is 110 mm
1

(b) Find volume of cone as a function of α
1

(c) Find value of α for maximum volume of cream.
2

38. **Case-Study III - Read the text carefully and answers the questions:**

A doctor is to visit a patient. From the past experience, it is known that the probabilities that he will come by cab, metro, bike or by any other means of transport are respectively 0.3, 0.2, 0.1, and 0.4. The probabilities that he will be late are 0.25, 0.3, 0.35, and 0.1 if he comes by cab, metro, bike and by any other means of transport respectively.



(a) When doctor visits a patient find the probability that he will be late.
2

(b) When the doctor arrives late, what is the probability that he came by metro? 2

OR

(c) When the doctor arrives late, what is the probability that he came by other means of transport?

2