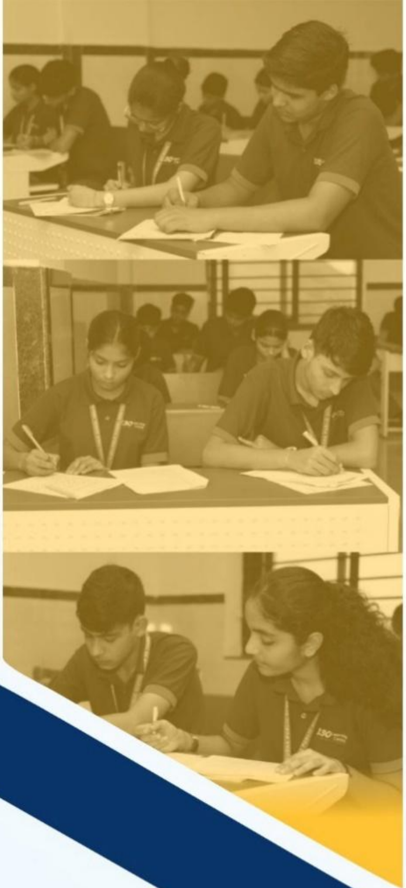

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# SAMPLE TEST PAPER
# XII MATHS

## i30 Learning Centre

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**Read the following instructions very carefully and strictly follow them:**

**(i)** This Question paper contains 38 questions. All questions are compulsory.

**(ii)** This Question paper is divided into five Sections - A, B, C, D and E.

**(iii)** 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.

**(iv)** In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type Questions, carrying 2 marks each.

**(v)** In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, Carrying 3 marks each.

**(vi)** In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.

**(vii)** In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.

**(viii)** 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.

**(ix)** Use of calculators is not allowed.

**SECTION-A**

**(This section comprises of multiple choice questions (MCQs) of 1 mark each)**

1. If A is a square matrix of order 3, with |A|=9, then the value of |2.adj. A| is

A) 162 B) 648 C) 1458 D) 5832

2. If matrix $\begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then the value of a+b+c is

A) 5 B) -5 C) 4 D) -4

3. The function $y = x^2 e^{-x}$ is decreasing in the interval

A) $(0, 2)$ B) $(2, \infty)$ C) $(-\infty, 0)$ D) $(-\infty, 0) \cup (2, \infty)$

4. If A and B are invertible matrices of order 3, |A|=2 and $|(AB)^{-1}| = \frac{-1}{6}$. Then |B| is

A) 6 B) 2 C) 3 D) -3

5. If $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and $A_{ij}$ is cofactor of $a_{ij}$, then the value of $\Delta$ is given by

A) $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33}$ B) $a_{11}A_{11} + a_{12}A_{21} + a_{13}A_{31}$

C) $a_{21}A_{11} + a_{22}A_{12} + a_{23}A_{13}$ D) $a_{11}A_{11} + a_{21}A_{21} + a_{31}A_{31}$

6. The value of $\tan^{-1}\frac{1}{\sqrt{3}} + \sin^{-1}(-1) + \cos^{-1}\frac{1}{2}$ is

A) $2\pi$ B) $\frac{\pi}{2}$ C) $\pi$ D) 0

7. The degree of the differential equation $[1 + \frac{dy}{dx}]^{3/2} = \frac{d^2y}{dx^2}$ is

A) 1 B) 3 C) 2 D) not defined

8. If A and B are independent events such that P(B/A)= $\frac{2}{5}$ then P(B') is

A) $\frac{3}{5}$ B) $\frac{2}{5}$ C) $\frac{1}{5}$ D) $\frac{4}{5}$

9. If $|\vec{a}| = 10$, $|\vec{b}| = 2$, and $\vec{a}.\vec{b} = 12$, then the value of $|\vec{a} \times \vec{b}|$ is

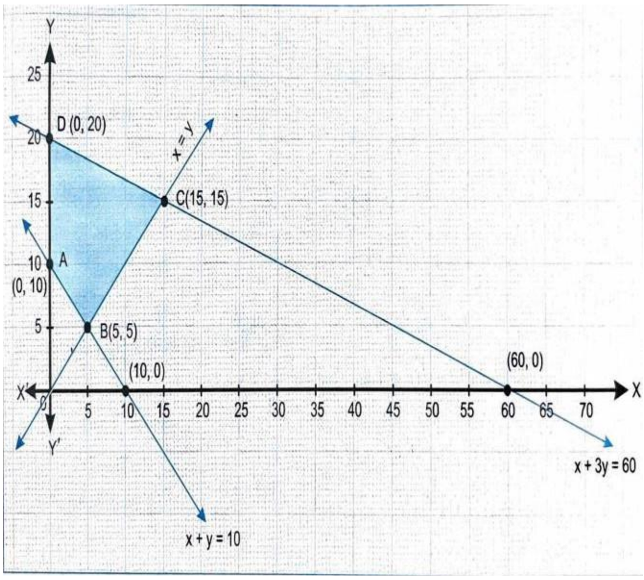
A) 5 B) 10 C) 14 D) 16

10. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}.\vec{b}$=0 and $\vec{a} \times \vec{b}$=0, then

A) either $\vec{a} = 0$ or $\vec{b} = 0$ B) $\vec{a}$ is parallel to $\vec{b}$

C) $\vec{a}$ is perpendicular to $\vec{b}$ D) none of these

11. Based on the given shaded region as feasible region in the graph, at which Point(s) is the objective function $Z = 3x + 9y$ maximum




A) point B B) point C C) Point D D) Every point on the line segment CD

12. If $f(a + b - x) = f(x)$, then $\int_a^b xf(x)dx$ is equal to

A) $\frac{a+b}{2}\int_a^b f(b - x)\,dx$ B) $(a + b)\int_a^b f(x)\,dx$ C) $\frac{a+b}{2}\int_a^b f(x)dx$ D) $\frac{b-a}{2}\int_a^b f(x)dx$

13. $\int \frac{cos2x-1}{cos2x+1}dx$ is equal to

A) $x - tanx + c$ B) $-cotx - x + c$ C) $x + tanx + c$ D) $cotx - x + c$

14. The solution of differential equation $log\left(\frac{dy}{dx}\right) = ax + by$ is

A) $\frac{e^{by}}{b} = \frac{e^{ax}}{a} + c$ B) $\frac{e^{ax}}{a} + \frac{e^{-by}}{b} + c = 0$ C) $\frac{e^{-by}}{b} = \frac{e^{ax}}{a} + c$ D) $e^{ax} + e^{by}$ = c

15. The domain of the function defined by f(x) = $sin^{-1}\sqrt{x - 1}$ is

A) [1, 2] B) [-1, 1] C) [0, 1) D) none of these

16. The corner points of the feasible region determined by the set of constraints are P(0, 5), Q(3, 5), R(5, 0) and S(4, 1) and the objective function $Z = ax + 2by$ where a, b > 0, the condition on a and

b such that the maximum Z occurs at Q and S is

A) $a - 5b = 0$ B) $a - 3b = 0$ C) $a - 2b = 0$ D) $a - 8b = 0$

17. The function $f: R \to R$ given by $f(x) = -|x - 1|$ is

A) continuous as well as differentiable at x =1 B) not continuous but differential at x =1

C) continuous but not differential at x =1 D) neither continuous nor differential at x = 1

18. The area of the region bounded by the curve $y = x^2$ and the line y =16 is

A) 37/3 sq units B) 256/3 sq units C) 64/3 sq units D) 128/3 sq units

## ASSERTION-REASON BASED QUESTIONS

***(Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (a), (b), (c) and (d) as given below.)***

(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.

19. Let R be a relation on set A = {a, b, c} given by R= {(a, a), (b, b), (c, c), (a, b), (b, a), (a, c)}

Assertion (A): R is an equivalence relation on A.

Reason (R): R is not symmetric relation on A

20. Consider the function $f(x) = |x - 2| + |x - 5|, x \in R$

Assertion (A): function is continuous and differentiable everywhere.

Reason (R): A differentiable function is always continuous.

## SECTION-B

**(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)**

21. Prove that $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$

22. $If\ (x + y)^{20} = x^{13}y^7, find\ \frac{dy}{dx}$

23. If $(cosx)^y = (cosy)^x$ then find $\frac{dy}{dx}$

**OR**

If x = $a\ cos\theta; y = bsin\theta$, then find $\frac{d^2y}{dx^2}$

24. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 7, |\vec{b}| = 5, |\vec{c}| = 3$ then find the angle between $\vec{b}$ and $\vec{c}$

**OR**

The scalar product of the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of the vectors $\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{c} = p\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to 1. Find the value of p

25. Find a vector of magnitude 2 units, which is perpendicular to both the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$

## SECTION-C

**(This section comprises of 6 short answer (SA) type questions of 3 marks each.)**

26. A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi-vertical angle is $tan^{-1}(0.5)$. Water is poured into it at a constant rate of 5 $m^3$/h. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 4 m.

27. Find the intervals in which the function f(x)= $(x(x-2))^2$ is an increasing function

28. $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{j} - \hat{k}$, find $\vec{c}$ satisfying the equations $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$.

**OR**

The two adjacent sides of a parallelogram are $\vec{a} = 2\hat{i} - 4\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + 2\hat{j} + 3\hat{k}$ .find the unit vectors parallel to its diagonals. Using the diagonals find the area of the parallelogram

29. Evaluate: $\int_{-1}^{2} |x^3 - x| \, dx$

**OR**

Evaluate: $\int \frac{(3sin\theta-2)cos\theta}{5-cos^2\theta-4sin\theta} d\theta$

30. Solve the following LPP graphically:

Minimize Z = 5x+10y

S.t.

$x + 2y \leq 120$

$x + y \geq 60$

$x - 2y \geq 0$

$x, y \geq 0$

31. The probability of solving the specific problem independently by the persons' A and B are 1/2 and 1/3 respectively. In case, if both the persons try to solve the problem independently, then calculate the probability that the problem is solved

**OR**

Solve the differential equation $(1 + y^2) + (x - e^{\tan^{-1} y}) \frac{dy}{dx} = 0$.

**SECTION-D**

**(This section comprises of 4 long answer (LA) type questions of 5 marks each.)**

32. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 2 \\ -3 & 1 & -1 \end{bmatrix}$, find $A^{-1}$ and hence solve the system of linear equations

$2x + y - 3z = 13$

$3x + 2y + z = 4$

$x + 2y - z = 8$

33. Using integration, find the area of region bounded by line $y = \sqrt{3}\,x$, the curve $y = \sqrt{4 - x^2}$ and y-axis in first quadrant

34. If $y = (x + \sqrt{1 + x^2})^n$ then show that $(1+x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = n^2y$

**OR**

Find a and b if the function given by f(x) = $\begin{cases} ax^2 + b, if\ x < 1 \\ 2x + 1, if\ x \geq 1 \end{cases}$ is differentiable at x=1

35. Find the length and the coordinate of foot of perpendicular drawn from the point (2, -1, 5) to the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$, also find the image of the point in the line.

**OR**

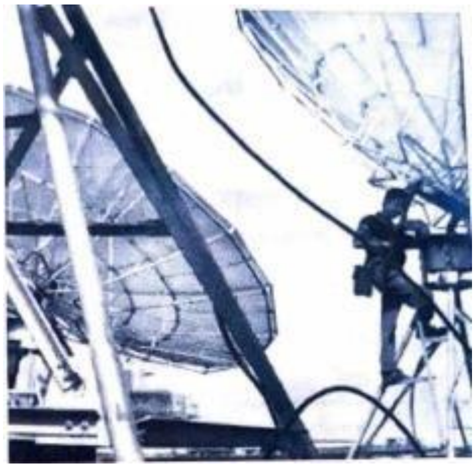
Find the shortest distance between the lines through the points P (6, 2, 2) and Q (-4, 0, -1) in the directions of the vectors having directions ratios 1, -2, 2 and 3, -2, -2 respectively.

**SECTION-E**

**(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each)**

**Case Study-1**

36. A cable network provider in a small town has 500 subscribers and he used to collect RS. 300 per month from each subscriber. He proposes to increase the monthly charges and it is believed from past experience that for every increase of Rs. 1, one subscriber will discontinue the service



Based on the above information, answer the following:

(i) If Rs. x is the monthly increase in subscription amount, then find number of subscribers left.

(ii) Find the total revenue

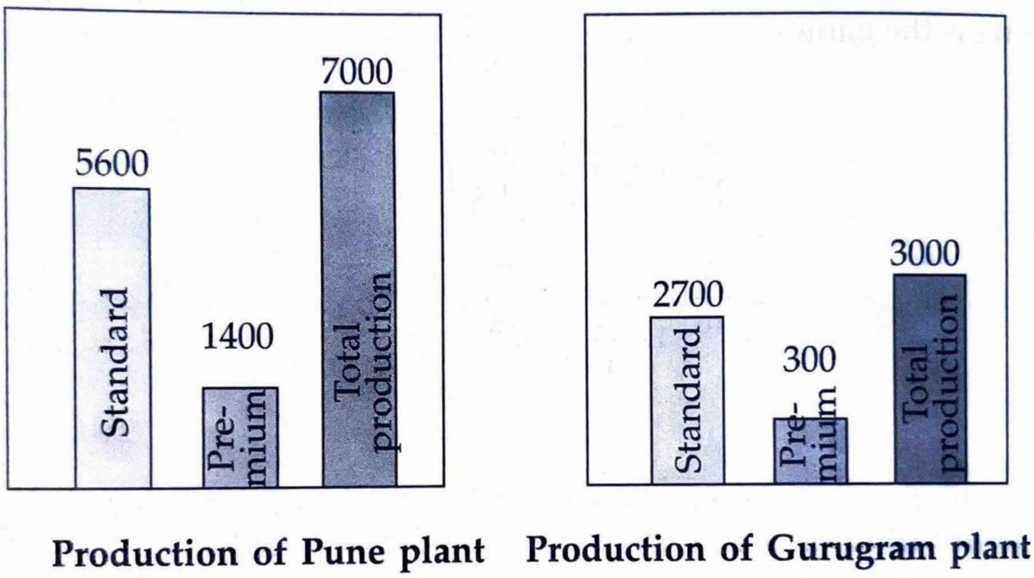
(iii) Find the number of subscribers which gives the maximum revenue

OR

What is the maximum revenue generated

**Case Study-2**

37. An automobile company manufactures scooters at two plants located at Pune and Gurugram. Company manufactured two types of scooters one is standard and other is premium quality model. Production in two plants is shown in the following table given below




A scooter is selected at random and is found to be of standard model.

On the basis of information given in the two tables, answer the following questions.

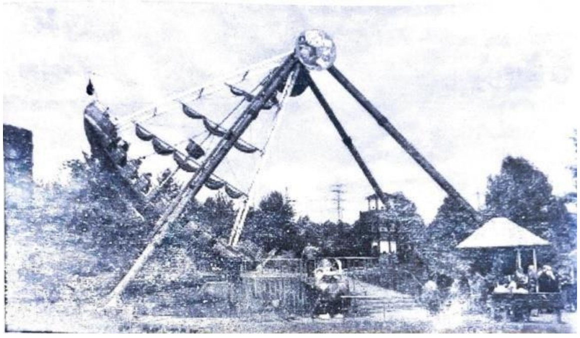
(i) What is the total probability of choosing a scooter of standard model?
(ii) What is the total probability of choosing a scooter of premium model?
(iii) What is the probability that the selected standard model scooter is produced in Pune plant?

OR

(III) What is the probability that the selected standard model scooter is produced in Gurugram plant?

**Case Study-3**

38. Raji visited the exhibition along with her family. The exhibition had a huge swing, which attracted many children. Raji found that the swing traced the path of a parabola given by y = $x^2$



Based on the above information, answer the following:

(i) If $f: R \to R$ be defined by f(x) =$x^2$, then show that f is neither injective nor Surjective.

(ii) If $f: N \to N$ be defined by f(x) =$x^2$, then show that f is injective but not surjective.