CLASS: XII
SUBJECT: MATHEMATICS (041)

UNIT WISE PRACTICE QUESTION PAPER
(UNITS: Inverse Trigonometric functions, LPP and Probability)

Time: 3 Hours **Max. Marks: 80**

General Instructions:

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) Use of calculators is not allowed.

SECTION A **[1×20 = 20]**

<u>This section contains multiple choice question (MCQ) 1 mark each</u>

1.The value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is

(A) $\frac{7\pi}{6}$ (B) $\frac{5\pi}{6}$
(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

2.$\tan^{-1}\sqrt{3}$ - $\cot^{-1}(-\sqrt{3})$ is equal to

A) π B) $\frac{-\pi}{2}$
C) 0 D) $2\sqrt{3}$

3.The value of $\cot(\sin^{-1}x)$ is

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

4.The value of $2\sec^{-1}\sqrt{2} + \sin^{-1}\frac{1}{2}$ is

(A) $\frac{7\pi}{6}$ (B) $\frac{\pi}{6}$

(C) $\frac{5\pi}{6}$ (D) $\frac{2\pi}{3}$

5.If $\sin^{-1} x$= y

(A) $0 \leq y \leq \pi$ (B) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$

(C) 0<y<π (D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

6.Which of the following corresponds to the principal value branch of $\tan^{-1} x$

(A) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (B) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(C) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right) - \{0\}$ (D) $(0, \pi)$

(D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

7.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)[-1,0]

8.The corner points of the feasible region in the graphical representation of a LPP are (2,72),(15,20) and (40,15).If Z=18x+9y be the objective function, then

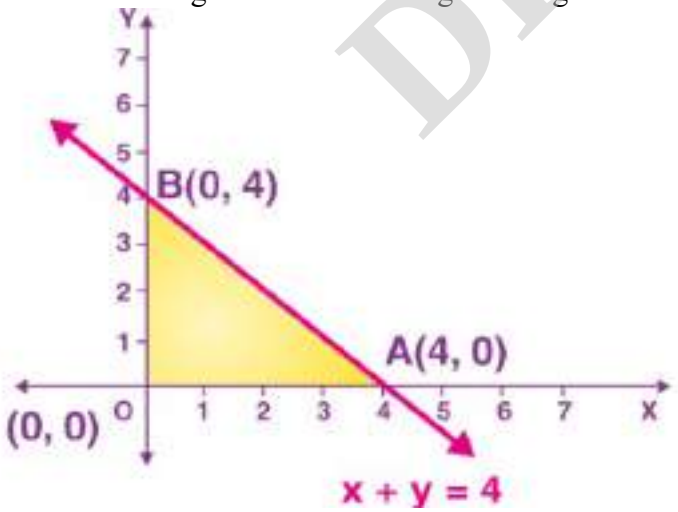
(A) Z is maximum at (2,72),minimum at (15,20)

(B) Z is maximum at (15,20),minimum at (40,15)

(C) Z is maximum at (40,15),minimum at (15,20)

(D) Z is maximum at (40,15),minimum at (2,72)

9.The feasible region of a linear Programming Problem is shown in the figure below



Which of the following are the possible constraints?

(A) x + y >4, x ≥ 0, y ≥ 0

(B) x + y ≤ 4, x < 0, y ≥ 0

(C) x + y ≤ 4, x ≥ 0, y ≥ 0

(D) x + y ≤ 4, x ≥ 0, y < 0

10.In a linear programming problem, feasible region is the region where
(A)All possible solutions satisfying all the constraints of the problems exist.

(B)Only optimal solution exist

(C)Only non-negative solutions exist

(D)None of these

11.In an LPP, if the objective function Z=ax+by has the same maximum value on two corner points of the feasible region ,then the number of points of which Z_{max} occurs is
(A) 0 (B) 2 (C) Finite (D) Infinite

12.Corner points of the feasible region determined by the system of linear constraints are (0,3),(1,1) and (3,0).Let z=px+qy,where p,q>0.Condition on p and qso that the minimum of Z occurs at (3,0) and (1,1) is
(A) p=2q (B) p=$\frac{q}{2}$ (C) p=3q (D) p=q

13.The corner points of the feasible region of an LPP are (0,4),(0.6,1.6) and (3,0). The minimum value of the objective function z = 4x + 6y occurs at
(A) (0.6,1.6) only
(B) (3,0) only
(C) (0.6,1.6) and (3,0) only
(D) at every point of the line segment joining points (3,0) and (0.6,1.6)

14.In a single throw of a die, A = event of getting odd numbers and B = event of getting prime numbers,
A) A and B are independent events
B) A and B are not independent events
C) $\boldsymbol{P(A|B) = \frac{1}{3}}$
D) None of these

15.If for any two events A and B ,P(A)=$\frac{4}{5}$ and P(A∩B) = $\frac{7}{10}$,then P(B/A) is equal to
(A)$\frac{1}{10}$ B) $\frac{1}{8}$
(C)$\frac{7}{8}$ D) $\frac{17}{20}$

16.A bag contains 3 white,4 black and 2 red balls. If 2 balls are drawn at random (without replacement),then the probability that both the balls are white is
(A)$\frac{1}{18}$ B) $\frac{1}{36}$
(C)$\frac{1}{12}$ D) $\frac{1}{24}$

17.Two dice are thrown together. Let A be the given event 'getting 6 on the first die' and B be the event 'getting 2 on the second die', then P$(\boldsymbol{A \cap B})$ is
(A)$\frac{1}{36}$ B) $\frac{7}{4}$
(C)$\frac{9}{20}$ D) None of these

18. Assume that in a family ,each child is equally likely to be a boy or a girl.A family with three children is chosen at random. The probability that the eldest child is a girl given that the family has atleast one girl is

(A)$\frac{1}{2}$ B) $\frac{1}{3}$

(C)$\frac{2}{3}$ D) $\frac{4}{7}$

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.Assertion(A): Two coins are tossed simultaneously.The probability of getting two heads,if it is known that at least one head comes up,is$\frac{1}{3}$.

Reason(R) : Let E and F be two events with a random experiment then P(F/E)=$\frac{P(E\cap F)}{P(E)}$.

20.Assertion(A): Function f:R→ $\boldsymbol{R}$ given by f(x)= sinx is not a bijection.

Reason(R):A function f:A→ $\boldsymbol{B}$ is said to be bijection if it is one – one and on to.

Section B **5 x 2 = 10**

This section contains 5 very short answer type (VSA) of 2 marks each

21.Simplify: $\tan^{-1}\frac{1-\sin\theta}{\cos\theta}$

22. $\tan^{-1}(1)+\cos^{-1}\left(-\frac{1}{2}\right)+\sin^{-1}\left(-\frac{1}{2}\right)$

23.Find the domain of y=$\sin^{-1}(x^2-4)$

OR,

Find the range of f(x) = $2\sin^{-1}x+\frac{3\pi}{2}$, where x∈ $[-1,1]$

24.Maximize Z=3x+4y

Subject to the constraints x+y≤ 4,x≥ 0, y≥ 0.

OR,

Minimize Z=-3x+4y

Subject to the constraints x+2y≤ 8,3x+2y≤ **12**,,x≥ 0, y≥ 0.

25.An unbiased die is thrown twice.Let the event A be 'odd number on the first throw'and B be the event 'odd number on the second throw'.Check the independence of event A and B.

Section C **6 x 3 = 18**

This section contains 6 short answer type (SA) of 3 marks each

26. Solve for x $\sin^{-1}(1-x)-2\sin^{-1}x=\frac{\pi}{2}$

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

28. An instructor has a question bank consisting of 300 easy True / False questions, 200 difficult True / False questions, 500 easy multiple choice questions and 400 difficult multiple choice questions. If a question is selected at random from the question bank, what is the probability that it will be an easy question given that it is a multiple choice question?

OR,

The probability of two students A and B coming to school in time are $\frac{2}{7}$ and $\frac{4}{7}$,respectively. Assuming that the events 'Acoming on time' and 'B coming on time' are independent, Find the probability of only one of them coming to school on time.

29.Probability that at least one of the two events A and B occurs is 0.6.If A and B occur simultaneously with probability 0.3,evaluate $P(\bar{A}) + P(\bar{B})$

OR,

If A and B are two independent events ,then the probability of occurrence of at least one of A and B is given by 1- $P(\bar{A})P(\bar{B})$

30.Determine the maximum value of z =11x+7y subject to the constraints

$2x + y \leq 6, x \leq 2, x \geq 0, y \geq 0$

31.Two dice are thrown together and the total score is noted. The events E,F and G are 'a total score of 4', 'a total score of 9 or more' and 'a total score divisible by 5' respectively.

Calculate P(E), P(F) and P(G) and decide which pairs of events are independent.

OR,

The probability that A hits the target is $\frac{1}{3}$ and the probability that B hits the target ,is $\frac{2}{5}$.If both try to hit the target independently ,find the probability that the target is hit.

Section D **4 x 5 = 20**

This section contains 4long answer type (LA) of 5 marks each

32. It is believed that the the smoke from the candles on the birth day cake would carry wishes and prayers to the Gods and serves as a centrepiece during the parties and acts as a focal point for the celebration. Sharing a slice of cake with friends and family fosters a sense of togetherness and strengthens social bonds.

On the birthday ceremony of Meenu ,Her parent ordered two kinds of cake in a bakery. The ingredients required for baking these cakes are as follows-

one kind of cake requires 200gm of flour and 25 gm of fat, another kind of cake requires 100 gm of flour and 50 gm of fat. Find the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes?

33. As the Bond investing can effectively mitigate risk and offer ones investment portfolio fixed income, capital preservation, and diversification benefits. Therefore, A retired person wants to invest an amount of ₹ 50000. His broker recommends investing in two types of bonds A' and 'B' yielding 10% and 9% return respectively on the invested amount

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He decides to invest at least ₹ 20000 in bond A' and at least ₹ 10000 in bond 'B'.
He also wants to invest at least as much in bond A' as in bond 'B'.
Solve this linear programming problem graphically to maximise his returns.

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34. A and B throw a die alternatively till one of them gets a '6' and wins the game. Find their respective probabilities of winning ,if A starts first

OR,

Manisha,a girl of JNV, likes to decorate her house premise in almost every festivals. This year, in the festival of Deepawali she was decorated her house with lighting the tinny electric bulbs of different four colours purchased from the market.

The coloured of electric balls were packed in four different boxes as shown in the following table:

Box	Green	Yellow	Red	Blue
I	3	4	5	6
II	2	2	2	2
III	1	2	3	1
IV	4	3	1	5

A box is selected at random and then an electric bulb is randomly drawn from the selected box.The colour of the bulb is green, what is the probability that the bulb drawn is from the box III?

35. A card from a Pack of 52 playing cards is lost. From the remaining cards of the pack three cards are drawn at random (without replacement) and are found to be all spades. Find the probability of the lost card being a spade.

OR,

A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

Section E **3 x 4 = 12**

This section contains 3 case study based questions of 4 marks each

36. ***Case study-1***

A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle θ with it .The distance between the foot of the tree to the point where the top touches the grounds is'a' metre.The height of the tree after breaking is 'b' metre

Based on the given information, solve the following questions:

(A)Find the angle $\boldsymbol{\theta}$ in terms of $\boldsymbol{sin^{-1}}$. 1

(B) Find the angle $\boldsymbol{\theta}$ in terms of $\boldsymbol{cos^{-1}}$. 1

(C) If the distance between the foot of the tree where the top touches the ground 5 m and the height of the tree after breaking is 2m. Find the angle made by the broken part of the tree which touches the ground with the standing part of the tree $\boldsymbol{\theta}$ in $\boldsymbol{sin^{-1}}$ 2

Or

If the distance between the foot of the tree where the top touches the ground 5 m and the height of the tree after breaking is 2m. Find the angle made by the broken part of the tree which touches the ground with the standing part of the tree in $\boldsymbol{cos^{-1}}$ 2

37. Case study – 2:

A fruit vendor wants sale a box of oranges which contained 12 good oranges and 3 bad oranges to a customer out of his stall. The box is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, the box is approved for sale, otherwise it is rejected.

Based on the given information, answer the following questions:

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Based on the given information, answer the following questions:

(A) In how many ways 3 oranges (at a time) can be drawn out of the total oranges? 1

(B) How many arrangements of 3 oranges out of the total arrangement contain only good oranges. 1

(C) Find the probability that the box is approved for sale. 2

Or

Find the probability that the box is not approved for sale. 2

38. Case study-3

Nitish is a manufacturer of nuts and bolts. Recently he has installed two latest versions of machines viz machine A and machine B for producing nuts and bolts in his factory. The capacity of doing work of the machines is as follows:

It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts.

How many packages of each should be produced each day so as to maximise his profit, if he operates his machines for at the most 12 hours a day?

Based on the given information, answer the following questions:

(A)If the manufacturer produce x package of nuts and y package of bolts, then write the constraints. 1

(B) If he earns a profit of Rs 17.50 per package on nuts and Rs 7.00 per package on bolts, then express the profit z in terms of x and y. 1

(C) How many packages of each should be produced each day so as to maximise his profit, if he operates his machines for at the most 12 hours a day? Find graphically. 2

Or

What is the maximum profit if he operates his machines for at the most 12 hours a day? Find graphically. 2