

SAMPLE PAPER
CLASS XI
Session (2024-25)
MATHEMATICS(041)

Time Allowed: 3 Hours

Maximum 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) The 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 number **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 of 5 marks each.
- (vii) **Section E** Questions no. **36 to 38** are case 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 2 questions in Section E.
- (ix) Use of calculators is not allowed.

SECTION A		
This section consists of 20 multiple choice questions of 1 mark each. 20 x 1 = 20		
Q1	If $U = \{1, 2, 3, \dots, 40\}$; $P = \{x : x \text{ is divisible by } 2 \text{ and } 3\}$ and $Q = \{x : x = n^2, n \in N\}$ then $n(P) - n(Q)$ is (A) 0 (B) 1 (C) 2 (D) 3	Marks 1
Q2	The greatest value of $(\sin x \cos x)$ is (A) 1 (B) 2 (C) $\sqrt{2}$ (D) $\frac{1}{2}$	1
Q3	Number of 5-digit even numbers that can be formed using the digits 1, 3, 4, 7, 8, if repetition of digit is not allowed, is (A) 500 (B) 60 (C) 48 (D) 24	1
Q4	$i^{25} + i^{36} + i^{42} + i^{55}$ is equal to (A) 0 (B) 2 (C) $2i$ (D) $2 + 2i$	1

Q5	The center and radius of circle $3x^2 + 3y^2 = 7$ is (A) $(0,0) ; \sqrt{7}$ (B) $(0,0) ; \sqrt{3}$ (C) $(0,0) ; \sqrt{\frac{7}{3}}$ (D) $(0,0) ; \frac{7}{3}$	1
Q6	$\lim_{x \rightarrow 0} \frac{x(e^x - 1)}{1 - \cos x}$ (A) 2 (B) 0 (C) 1 (D) $\frac{1}{2}$	1
Q7	The minimum value of $7^{2(1-x)} + 49^x$ is (A) 14 (B) $\frac{2}{7}$ (C) 7 (D) 49	1
Q8	If $\lim_{x \rightarrow -a} \frac{x^7 + a^7}{x+a} = 7$, then the value of a is (A) 1 (B) -1 (C) ± 1 (D) 0	1
Q9	If the variance of the data 2,4,5,6,8,17 is 23.33, then variance 4,8,10,12,16,34 will be (A) 23.23 (B) 25.33 (C) 46.66 (D) 93.32	1
Q10	If the extremities of the diagonal of the base of the cube are $(1,-2,3)$ and $(2,-3,5)$ then the length of the side of cube is (A) $\sqrt{6}$ units (B) $\sqrt{3}$ units (C) $\sqrt{5}$ units (D) $\sqrt{7}$ units	1
Q11	A clock shows 7:20. The angle between the hour hand and minute hand would be : (A) 50° (B) 80° (C) 100° (D) 120°	1
Q12	Given x is a real number satisfying $1 - x > 2x - 5$, x belongs to : (A) $(-\infty, -2)$ (B) $(-\infty, 2)$ (C) $(-2, \infty)$ (D) $(2, \infty)$	1
Q13	If the mean of the data : 2,0,7,-5,8,11,4,-3 is 3, then the mean deviation about mean of the data is (A) 2.5 (B) 5.5 (C) 4.5 (D) 1	1
Q14	If $R = \{(x, y) : x, y \in W, 2x + y = 8\}$ then domain of R is (A) $\{0,1,2,3,4,5\}$ (B) $\{0,1,2,3,4,5,6\}$ (C) $\{0,1,2,3,4\}$ (D) $\{0,1,2,3\}$	1

Q15	If $5 \times 5^{\frac{1}{3}} \times 5^{\frac{1}{9}} \times 5^{\frac{1}{27}} \times \dots = 5^m$, then m is equal to (A) $\frac{3}{2}$ (B) $\frac{2}{3}$ (C) 1 (D) $\frac{3}{4}$	1
Q16	If two complex numbers z_1, z_2 are represented by points (2, -1) and (-3, 4) in the Argand Plane, then $\overline{(z_1 - z_2)}$ is (A) $-1 - 5i$ (B) $5(1 - i)$ (C) $-1 + 5i$ (D) $5(1 + i)$	1
Q17	$\sum_{k=0}^n C(n, k) 3^k$ is equal to (A) 4^{2n} (B) 3^n (C) 4^n (D) 3^{2n}	1
Q18	If E and F are two events associated with a random experiment, having sample space S and $P(E \cup F) = P(E) + P(F)$, then which of the following statements is always true (A) $E \cup F = S$ (B) $P(E) = P(F)$ (C) $P(E \cup F) = 1$ (D) $E \cap F = \phi$	1
<p align="center">ASSERTION-REASON BASED QUESTIONS</p> <p>Q 19 and 20 are Assertion - Reason Based Questions</p> <p>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.</p> <p>(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.</p>		
Q19	<p>ASSERTION (A): Suppose f is a real valued function, the derivative of 'f' at x is given by $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$</p> <p>REASON (R): If $y = f(x)$ is the function, then derivative of 'f' at any x is denoted by $f'(x)$</p>	1
Q20	<p>ASSERTION (A): $C(10, 6) : P(10, 4) = 1 : 12$</p> <p>REASON (R): $C(n, r) = C(n, n - r), 0 \leq r \leq n$</p>	1

SECTION B

In this section there are **5** very short answer type questions of **2** marks each.

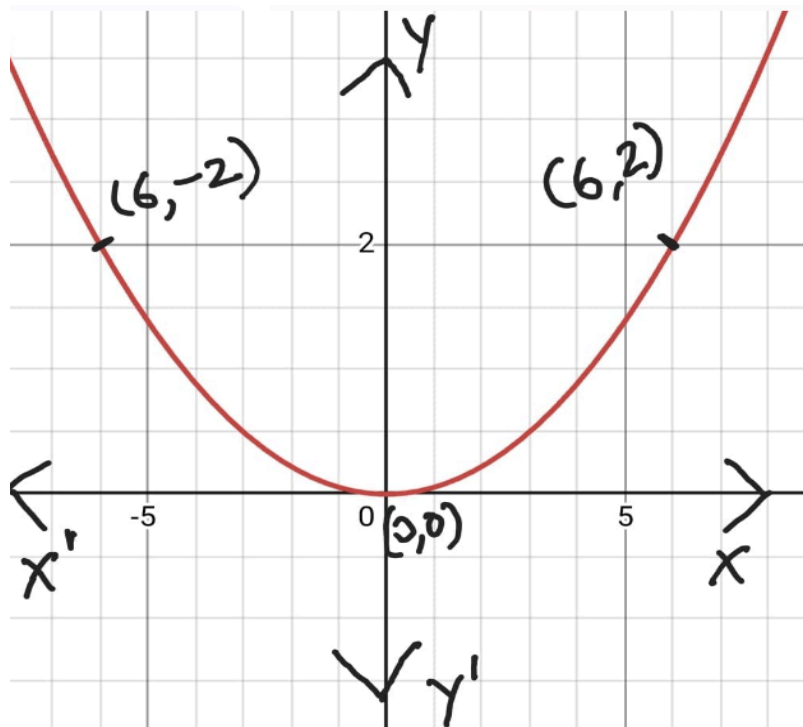
Q21	<p>If $2p + iq = \frac{a+ib}{a-ib}$, then show that $4p^2 + q^2 = 1$</p>	2
Q22	<p>If $U = \{x : x \in \mathbb{N} \text{ and } 1 \leq x \leq 20\}$ $A = \{x : x \in \mathbb{N} \text{ and } 1 \leq x \leq 15\}$ $B = \{x : x \in \mathbb{N} \text{ and } x = 2n - 1, n \leq 5\}$</p> <p>Represent the above sets by a Venn diagram showing set U as a universal set. Write the relation between Set A and Set B.</p>	2
Q23	<p>Evaluate the left hand limit and right-hand limit of the following function</p> $f(x) = \begin{cases} x & \text{if } x \neq 0 \\ x & \text{if } x = 0 \end{cases}$ <p>Does $\lim_{x \rightarrow 0} f(x)$ exist?</p> <p style="text-align: center;">OR</p> <p>If $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function defined</p> $f(x) = \begin{cases} 3x^2 + 9 & \text{if } x \leq \frac{3}{2} \\ 4 + 9x & \text{if } x > \frac{3}{2} \end{cases}$ <p style="text-align: right;">then find the value of $f'(2) - f'(1)$</p>	2
Q24	<p>The figure shows a relation from a set X to a set Y.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>Write the above relation in Roster form. Is the above relation a function? Give reason in support of your answer.</p> <p style="text-align: center;">OR</p> <p>Let $f(x) = 2x^2 + 3x - 5$ and $g(x) = x - 1$. Find $(\frac{f}{g})(x)$. Also find the Domain and Range of Quotient function.</p>	2

Q25	If P is the foot of perpendicular from the point S(6,7,8) on the XY-plane and Q is the mirror image of the point S (6,7,8) in the XY-plane ,find PQ.	2																												
SECTION C In this section there are 6 short answer type questions of 3 marks each.																														
Q26	Find the number of arrangements of the letters of the word SELFIE. In how many of these arrangements there are exactly 2 letters between 2 E's. OR In how many of the distinct permutations of the letters in TELANGANA do the three A's not come together?	3																												
Q27	Draw the graph of $f(x) = x^3$. Hence find its range.	3																												
Q28	Complete the following table for the function $y = 4 \sin x$ <table border="1" style="margin: 10px auto; width: 80%;"> <tr> <td>x</td> <td>0</td> <td>$\frac{\pi}{6}$</td> <td>$\frac{\pi}{3}$</td> <td>$\frac{\pi}{2}$</td> <td>$\frac{2\pi}{3}$</td> <td>$\frac{5\pi}{6}$</td> <td>π</td> <td>$\frac{7\pi}{6}$</td> <td>$\frac{4\pi}{3}$</td> <td>$\frac{3\pi}{2}$</td> <td>$\frac{5\pi}{3}$</td> <td>$\frac{11\pi}{6}$</td> <td>2π</td> </tr> <tr> <td>y</td> <td>0</td> <td>-</td> <td>3.46</td> <td>-</td> <td>3.46</td> <td>-</td> <td>0</td> <td>-</td> <td>-3.46</td> <td>-</td> <td>-3.46</td> <td>-</td> <td>0</td> </tr> </table> Specify the range of the given function in set builder form.	x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{11\pi}{6}$	2π	y	0	-	3.46	-	3.46	-	0	-	-3.46	-	-3.46	-	0	3
x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{11\pi}{6}$	2π																	
y	0	-	3.46	-	3.46	-	0	-	-3.46	-	-3.46	-	0																	
Q29	The water acidity in a pool is considered normal when the average pH reading of three daily measurements is between 8.2 and 8.5. If the first two pH readings are 8.1 and 8.6, find the range of pH value for the third reading that will result in the acidity level being normal. OR Solve the system of inequalities: $4x + 7 > x - 5$ $12 - 7x \geq - 2$ and represent the solutions on the number line	3																												
Q30	Find the derivative of $f(x) = \frac{2x+3}{x-2}$ by first principle.	3																												

Q31

A satellite dish is in the shape of a parabolic surface. Signals from a satellite strike the surface of the dish and are reflected to a single point (the focus) where the receiver is located. The satellite dish shown in the figure has a diameter of 12 meters and a depth of 2 meters. The parabola is positioned in a rectangular coordinate system with its vertex at the origin. How far from the vertex of the dish should the receiver be placed? Also write the equation of the parabolic surface.

3



OR

An arch is in the form of a semi-ellipse. It is 8m wide and 2m high at the centre. Find the height of the arch at a point 1.5 m from one end.

SECTION D

In this section there are 4 long answer type questions of 5 marks each.

Q32

If the image of the point $(4, 3)$ with respect to the line l is $(2, 1)$, then find the equation of the line l . Also, find the value of k if the distance between the above line and the line $3x + 3y + k = 0$ is $\frac{14}{\sqrt{3}}$ units.

OR

A line is such that its segment between the lines $x - 2y - 2 = 0$ and $2x + y - 1 = 0$ is bisected at the point $(1, 3)$. Obtain its equation.

5

Q33

Following table represents the number of persons of different age groups in a locality doing Yoga in the morning:

Age of persons (in years)	10-20	20-30	30-40	40-50	50-60
Number of persons	5	8	8	15	14

Find the mean and the variance of the above data.

OR

The mean and standard deviation of 100 observations were calculated as 40 and 5.1, respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct mean and standard deviation?

5

Q34

Find the coefficient of x^5 in the product $(x + 3)^5(2 - x)^6$.

5

Q35

Given, $A = \{x : -1 < x \leq 5, x \in \mathbb{R}\}$ and

$B = \{x : -4 < x \leq 3, x \in \mathbb{R}\}$

Find:

(i) $A \cap B$

(ii) $A' \cap B$

(iii) $A - B$

Also represent each result on different number lines.

5

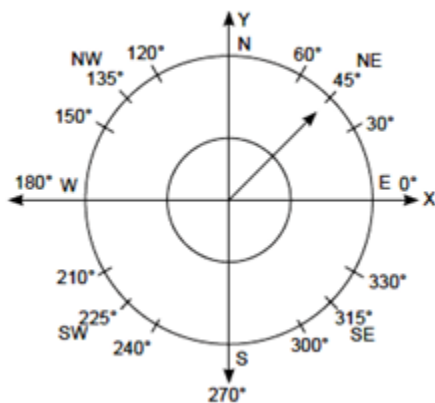
SECTION E

This section comprises 3 case-study/passages-based questions of 4 marks each.

Q36

Magnetic Compass

The figure given below shows the compass. The East direction is along the positive x-axis (0° angle) and North direction is along the +ve y-axis (90° angles). Initially the pointer is pointed towards the NorthEast direction. Pointer is deflected in a magnetic field by some angle.



On the basis of above scenario answer the following questions

- (i) If the pointer moves in an anticlockwise direction by an angle of 90° , then find the value of the sine of the angle made by the pointer from the East direction. 1
- (ii) If the sine and cosine of angle made by a pointer with East direction is $(-\frac{1}{\sqrt{2}})$ then write the direction the pointer shows. 1
- (iii) If the tip of the pointer moves in an anticlockwise direction by an angle of 30° it travels a distance of 11 cm then find the length of the pointer.
- OR
- (iii) Find the degree measure of the angle through which the pointer moves if its length is 10 cm and the tip of the pointer describes an arc of length 22cm. 2

Q37

Chain Reaction

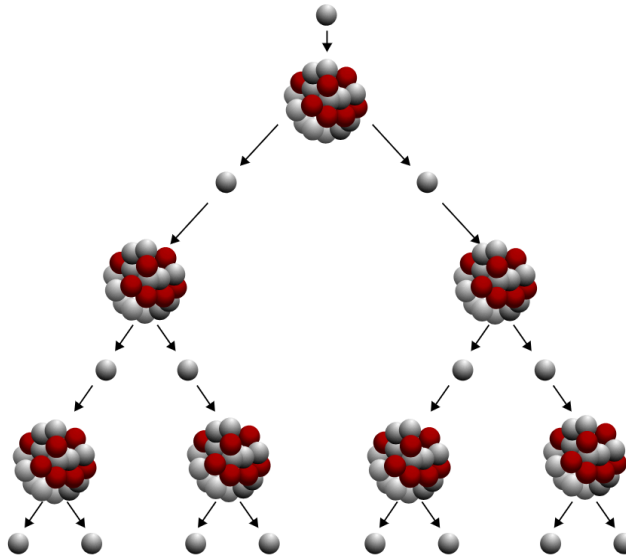
In a nuclear fission chain reaction, a free neutron interacts with the nucleus of an atom and causes that nucleus to split apart into two new, less massive nuclei. The nuclei in turn repeat the process and split into four new nuclei and the process goes on. The picture given below shows the process till 4th generation.

1st Generation

2nd Generation

3rd Generation

4th Generation



On the basis of the above case, answer the following questions.

- (i) Write the number of nuclei formed starting from 1st generation to fourth generation. Identify the sequence so formed.
- (ii) Write the number of nuclei formed in the 10th generation.
- (iii) Find the total number of nuclei formed till 7th generation?

OR

- (iii) If the m th generation has 96 more nuclei than the n th generation, then find the value of m and n .

1

1

2

Q38

Cricket Team Selection

Cricket is a game of uncertainties. Love for the game of cricket is increasing day by day. A state cricket authority needs to select a team of 11 members. They have asked two coaches from a government academy to select the team members based on their experience and performance in the last 15 matches. There are 20 players containing 8 bowlers, 7 batsmen and 5 all-rounders from which to choose.



Answer the following on the basis of above case study.

- (i) What is the probability that a team of 11 must include exactly 4 bowlers ?
- (ii) What is the probability that a team of 11 must include at least 4 all-rounders ?

2
2

Note: Give answers in factorial.