MATHEMATICS (PART – I)
MODEL QUESTION PAPER
(With Full Solution and Marking Scheme)

Time : 2 Hours]   **[Total Marks : 40**

Note : *(i) **All** questions are compulsory.*

    *(ii) Use of calculator is **not** allowed.*

    (iii) The numbers to the right of the questions indicate full marks.

    (iv) In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.

    (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :   **4**

  (i) To solve $x + y = 3$; $3x - 2y = 4$ by determinant method, find D,

    (A) -1 (B) 1 (C) -5 (D) -1

  (ii) If the roots of $x^2 + kx + k + 3 = 0$ are real and equal, what is the value of k?

    (A) -6 or 2 (B) 6 or -2 (C) 4 or -2 (D) -4 or 2

  (iii) If for an A.P., $d = -4$, then $t_{20} - t_{15} = ?$

    (A) -15 (B) 15 (C) 20 (D) -20

  (iv) A coin is tossed three times. What is the probability of getting at least two tails?

    (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{4}$ (C) $\dfrac{3}{8}$ (D) $\dfrac{5}{8}$

Q. 1. (B) Solve the following subquestions :   **4**

  (i) If $15x + 17y = 31$ and $17x + 15y = 21$, find the value of $(x - y)$.

  (ii) For an A.P., 8th term is 17. Write the equation relating a and d.

  (iii) Write the quadratic equation $3x^2 = 10x + 7$ in the standard form and write the values of a and b.

  (iv) If $P(A) = \dfrac{3}{5}$ and $n(S) = 40$, what is $n(A)$?

Q. 2. (A) Complete and write *any two* activities from the following :   4

(i) A card is drawn from a well-shuffled pack of 52 playing cards. Find the probability of the event that the card drawn is a face card.

Suppose S is the sample space.

$\therefore n(S) = 52$

Event A : Card drawn is a face card.

There are $\boxed{}$ face cards.

$\therefore n(A) = \boxed{}$

$P(A) = \dfrac{\boxed{}}{n(S)}$ ... (Formula)

$\therefore P(A) = \dfrac{12}{52}$ $\therefore P(A) = \boxed{}$.

(ii) Complete the following activity to solve the simultaneous equations $3x + 2y = 31$ and $7x - 2y = 39$.

Adding the given equations,

$3x + 2y = 31$ ... (1)

$7x - 2y = 39$ ... (2)
_____

$10x \quad = \boxed{}$ $\therefore x = \boxed{}$

Substituting the value of x in equation (1),

$21 + 2y = 31$ $\therefore 2y = \boxed{}$

$\therefore y = \boxed{}$

(iii) The first term of an A.P. is 5 and the common difference is 10. Complete the following activity to find the sum of first 10 terms of the A.P.

Here, $a = 5$, $d = 10$, $S_{10} = ?$

$S_n = \dfrac{n}{2} \left[\boxed{} \right]$ ... (Formula)

$\therefore S_{10} = \dfrac{10}{2} \left[10 + \boxed{} \right]$ ... (Substituting the values)

$= 5 \times \boxed{}$

$= \boxed{}$.

Q. 2. (B) Solve *any four* subquestions from the following : 8

(i) Find the value of the determinant $\begin{vmatrix} \dfrac{7}{3} & \dfrac{5}{3} \\[2mm] -\dfrac{3}{2} & -\dfrac{1}{2} \end{vmatrix}$.

(ii) Solve the quadratic equation $x^2 - 15x + 36 = 0$ by factorisation method.

(iii) A two-digit number is formed from the digits 2, 3, 5, 7 without repetition. What is the probability that the number formed is a prime number?

(iv) Find the 21st term of the A.P. 3, 7, 11, 15, ...

(v) One root of the quadratic equation $kx^2 - 14x - 5 = 0$ is 5. Find the value of k.

Q. 3. (A) Complete and write *any one* activity from the following : 3

(i) Complete the following activity to solve the quadratic equation $x^2 - 10x - 2 = 0$ using the formula method :

Here, $a = 1$, $b = -10$, $c = -2$.

$$b^2 - 4ac = \boxed{}^2 - 4 \times 1 \times (-2)$$

$$= \boxed{} + 8$$

$$= \boxed{}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-10) \pm \sqrt{\boxed{}} \times \sqrt{3}}{2 \times 1}$$

$$= \frac{10 \pm \boxed{} \sqrt{3}}{2}$$

$$= 5 \pm \boxed{}$$

(ii) Complete the following activity to solve simultaneous equations $5x + 3y = -11$ and $x + 2y = -5$ using Cramer's rule :

$$5x + 3y = -11 \quad \text{... (1)} \qquad x + 2y = -5 \quad \text{... (2)}$$

$$D = \begin{vmatrix} \boxed{} \end{vmatrix} = 7; \quad D_x = \begin{vmatrix} -11 & 3 \\ -5 & 2 \end{vmatrix} = \boxed{}; \quad D_y = \begin{vmatrix} \boxed{} \end{vmatrix} = \boxed{};$$

$$x = \frac{D_x}{D} = \boxed{}; \quad y = \frac{D_y}{D} = \boxed{}.$$

Q. 3. (B) Attempt *any two* subquestions from the following : 6

   (i) Solve the simultaneous equations $x + y = 4$ and $2x - y = 5$ graphically.

   (ii) In a two-digit natural number, the digit at the units place is equal to the square of the digit at the tens place. If 18 is added to the number, the digits get interchanged. Find the number.

   (iii) The 13th term of an A.P. is 39 and the 23rd term is 69. Find the 18th term of this A.P.

   (iv) One ticket is drawn at random from a bag containing 20 tickets numbered 1 to 20. Find the probability that the number on the ticket is (a) the prime number (b) multiple of 4 (c) divisible by 5.

Q. 4. Attempt *any two* subquestions from the following : 8

   (i) Two jars contain mixture of acid and water. In one jar quantity of acid is double than the quantity of water, while in other jar the quantity of water is three times the quantity of acid.

   How many litres of mixture from each jar should be taken to form a new mixture of 15 litres such that it contains 50% water and 50% acid.

   (ii) Around a square pool, there is a footpath of width 2 m. If the area of the footpath is $\dfrac{5}{4}$ times that of the pool, find the area of the pool.

   (iii) All the face cards of heart are removed from the pack of 52 playing cards and the remaining cards are reshuffled. A card is drawn at random. Find the probability of getting (a) a red face card (b) a black face card (c) a red card (d) a black card.

Q. 5. Attempt *any one* subquestion from the following : 3

   (i) $y - 4$ $\boxed{\text{I am a rectangle}}$ $x - 21$

$$2x - 3y + 5$$

$$x + y - 35$$

$$\downarrow$$

$\boxed{\text{Find the values of } x \text{ and } y} \rightarrow \boxed{\text{Find my area and perimeter}}$

   (ii) Write the quadratic equation $x(\sqrt{3}x + \sqrt{2}) = 2\sqrt{3}$ in standard form. Find the value of the discriminant. Write the nature of its roots.

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MATHEMATICS (PART-I)
QUESTION PAPER 1

Time : 2 Hours]   **[Total Marks : 40**

Note : *(i) All questions are compulsory.*

      *(ii) Use of calculator is **not** allowed.*

      (iii) The numbers to the right of the questions indicate full marks.

      (iv) In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.

      (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

Q. 1. (A) **For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :**   **4**

    (i) The first term of an A.P. is 1 and the nth term is 20. If $S_n = 399$, what is n ?

      (A) 42   (B) 38   (C) 21   (D) 19

    (ii) A die is rolled. What is the probability of getting an even number on the upper face ?

      (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{3}$ (C) $\dfrac{1}{4}$ (D) $\dfrac{3}{4}$

    (iii) Find the value of $\begin{vmatrix} 5 & 3 \\ -7 & -4 \end{vmatrix}$.

      (A) 41   (B) -41 (C) 1   (D) -1

    (iv) Which of the following equations has roots 3 and 5 ?

      (A) $x^2 + 3x + 5 = 0$ (B) $x^2 - 15x + 8 = 0$

      (C) $x^2 + 8x - 15 = 0$ (D) $x^2 - 8x + 15 = 0$

(B) Solve the following subquestions :   **4**

    (i) Find the values of a and b for the quadratic equation $5x^2 - 7 = -6x$.

    (ii) One coin and one die are thrown simultaneously. What is the number of sample points?

    (iii) Write the co-ordinates of point of intersection of Y-axis and a line parallel to X-axis at a distance of 5 units below it.

    (iv) What is the sum of first 10 natural numbers?

Q. 2. (A) Complete and write *any two* activities from the following :

(i) Complete the following activity to solve the simultaneous equations :

$11x + 6y = 4330$ and $22x - 6y = 5240$.

Adding the given equations,

$11x + 6y = 4330$ ... (1)

$22x - 6y = 5240$ ... (2)

$33x \quad = \boxed{} \quad \therefore x = \boxed{}$

Substituting the value of x in equation (1),

$11 \times 290 + 6y = 4330 \quad \therefore 6y = \boxed{} \quad \therefore y = \boxed{}$

(ii) Complete the following activity to find the fourth term from the end of the A.P. $-11, -8, -5, ..., 49$.

Reversing the terms of the given A.P., we get, $49, ..., -5, -8, -11$.

This is an A.P. We have to find the fourth term i.e. t_4

Here, $a = t_1 = \boxed{}$, $d = \boxed{}$, $t_4 = ?$

$t_n = \boxed{}$ ... (Formula)

$\therefore \quad t_4 = 49 + (4-1) \times (-3)$

Simplifying, $t_4 = \boxed{}$

(iii) In a class of 48 students, 4 students use spectacles. Complete the following activity to find the probability of a student, selected at random, not wearing spectacles.

The total number of students in the class is 48.

$\therefore n(S) = \boxed{}$

Let A be the event that a student not wearing spectacles.

Then $n(A) = \boxed{}$ $\therefore P(A) = \boxed{\dfrac{}{}}$ ... (Formula)

$\therefore P(A) = \boxed{\dfrac{}{}}$

(B) Solve *any four* subquestions from the following :   8

(i) If $x = 5$ and $y = 3$ is the solution of $3x + ky = 3$, find the value of k.

(ii) Solve : $5x^2 - 22x - 15 = 0$

(iii) Find three numbers between 17 and 27 such that they are in A.P with 17 and 27.

(iv) 26 cards each bearing one English letter are kept in a box. One card is drawn at random. What is the probability that the card drawn is a vowel card?

(v) Find the value of the discriminant (Δ) for the quadratic equation $x^2 - 6x - 5 = 0$.

Q. 3. (A) Complete and write *any one* activity from the following : 3

    (i) The difference between the ages of a mother and her daughter is 24 years. The sum of the reciprocals of their ages is $\dfrac{1}{9}$. Complete the following activity to find mother's age.

Let the mother's present age be x years.

Then the daughter's present age is $\boxed{}$ years.

The reciprocal of mother's age is $\boxed{-}$.

The reciprocal of daughter's age is $\dfrac{1}{x-24}$.

From the given condition,

$$\frac{1}{x}+\frac{1}{x-24}=\boxed{-}$$

Simplifying, $18x-\boxed{}=x^2-24x$

$\therefore x^2-\boxed{}x+216=0$

Factorising, $(x-36)(x-6)=0$

$\therefore x=36$ or $x=6$

$x=6$ is $\boxed{}$, because the mother's present age cannot be 6 years.

Mother's present age is 36 years.

    (ii) A person got a job with salary ₹ 1,80,000 per year. He was given ₹ 10,000 increment per year. Complete the following activity to find the number of years (n), when his salary will be ₹ 2,50,000.

Here, $a=$ ₹ 1,80,000, $d=\boxed{}$, $t_n=$ ₹ $\boxed{}$, $n=?$

$t_n=\boxed{}$ ... (Formula)

$\therefore 250000=180000+(n-1)\times10000$

$\therefore (n-1)\times10000=\boxed{}$

$\therefore n-1=\boxed{}$ $\therefore n=\boxed{}$.

(B) Attempt *any two* subquestions from the following : 6

    (i) Solve the simultaneous equations $3x-y=2$ and $2x-y=3$ graphically.

    (ii) Solve the quadratic equation $x^2-12x+32=0$ using formula.

    (iii) A bag contains 3 red, 3 white and 3 green balls of the same size. One ball is taken out of the bag at random, what is the probability that the ball picked up is (1) red (2) either white or green.

    (iv) Amit saves ₹ 400 in the first month, ₹ 500 in the second month, in the third month ₹ 600 and so on.

    How much will be his total savings in 21 months?

Q. 4. Attempt *any two* subquestions from the following :   8

(i) A jet plane covers 4500 km in some time. If the regular speed is decreased by 150 km/h, it takes one and half hours more to complete the journey. Find the original speed of the jet plane.

(ii) Find four consecutive terms in an A.P. whose sum is 36 and the product of the 2nd and the 4th is 105. The terms are in ascending order.

(iii) Two dice are rolled simultaneously. Find the probability (a) of event *A* that the sum of the digits on the upper faces is a prime number. (b) of event *B* that the sum of the digits on the upper faces is a multiple of 5.

Q. 5. Attempt *any one* subquestion from the following :   3

(i) If $\begin{vmatrix} 2 & -y \\ 1 & x \end{vmatrix} = 16$ and $\begin{vmatrix} 3 & 2 \\ y & x \end{vmatrix} = 3$, form two simultaneous equations from the given determinants and solve.

(ii) 2 years ago, my age was $4\frac{1}{2}$ times the age of my son then. 6 years ago, my age was twice the square of the age of my son then. Find the present age of my son.

MATHEMATICS (PART-I)
QUESTION PAPER 2

Time : 2 Hours]   **[Total Marks : 40**

Note : (i) *All questions are compulsory.*

      (ii) *Use of calculator is **not** allowed.*

      (iii) *The numbers to the right of the questions indicate full marks.*

      (iv) *In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.*

      (v) *For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.*

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :   **4**

     (i) What is the probability of the event that a number chosen from 1 to 50 is an odd number?

         (A) 30%   (B) 80%   (C) 100%   (D) 50%

     (ii) If the numbers $x-1, x+3, 3x-1, \ldots$ are in A.P., then find the value of x.

         (A) -2 (B) 4   (C) 2   (D) -4

     (iii) What is the value of k for which the quadratic equation $3x^2 - kx + k = 0$ has equal roots?

         (A) 6   (B) -6 (C) -12 (D) 12

     (iv) What is the value of D_x for the simultaneous equations $3x + 2y + 11 = 0$ and $7x - 4y = 9$?

         (A) 62   (B) -62 (C) 26   (D) -26

(B) Solve the following subquestions :   **4**

     (i) What is the common difference (d) of the A.P. 7, 1, -5, -11, ...?

     (ii) If two coins are tossed. Write the sample space and the number of sample points $n(S)$.

     (iii) If $5x + 4y = 13$ and $4x + 5y = 14$, find the value of $(x - y)$.

     (iv) Write the quadratic equation $x + \dfrac{3}{x} = 7$ in standard form.

2. (A) Complete and write any two activities from the following : 4

(i) Solve the following simultaneous equations by eliminating variable y.

$x + y = 4$ ... (1) and $2x - y = 2$ ... (2)

Adding equations (1) and (2),

$x + y = 4$ ... (1)

$2x - y = 2$ ... (2)

$\overline{}$

$3x = \boxed{}$ $\therefore x = \boxed{}$.

Substituting value of x in equation (1), we get

$\boxed{} + y = 4$ $\therefore y = \boxed{}$

(ii) The 17th term of an A.P. is 7 more than the 10th term. Find the common difference (d).

Let the first term of the A.P. be a and the common difference d.

$t_n = \boxed{}$ ... (Formula)

$\therefore t_{17} = a + (17 - 1) d$ ... (Substituting the values)

$\therefore t_{17} = a + 16d$ ... (1)

Similarly, $t_{10} = \boxed{}$ ... (2)

From the given condition and from (1) and (2),

$a + 9d + 7 = \boxed{}$

Solving, $d = \boxed{}$.

(iii) Six faces of a die are shown in the following figure :

A B C D E A

The die is rolled once. To find the probability that 'C' appears on upper face, fill in the boxes.

$S = \boxed{}$ $\therefore n(S) = \boxed{}$

Let A be the event that C appears on upper face.

$A = \{C\}$ $\therefore n(A) = \boxed{}$

$\therefore P(A) = \dfrac{n(A)}{n(S)} = \boxed{\dfrac{}{}}$.

(B) Solve *any four* subquestions from the following : 8

(i) Find the value of the determinant $\begin{vmatrix} 2 & 3 \\ \frac{1}{2} & -\frac{1}{2} \end{vmatrix}$.

(ii) Write the following quadratic equation in the form $ax^2 + bx + c = 0$, then write the values of a, b and c.

$2y = 10 - y^2$.

(iii) The first term of an A.P. is -5 and the 6th term is 45. Find S_6.

(iv) A box contains 5 red, 8 blue and 3 green pens. What is the probability that the pen picked up is blue?

(v) Solve : $x^2 - 8x + 15 = 0$

Q. 3. (A) Complete and write *any one* activity from the following : 3

(i) The coordinates of the point of intersection of the lines $ax + by = 9$ and $bx + ay = 5$ are $(3, -1)$. Complete the following activity to find the values of a and b.

$ax + by = 9 \qquad \ldots (1) \qquad bx + ay = 5 \qquad \ldots (2)$

The coordinates of the point of intersection are $(3, -1)$.

Substitute $x = 3$ and $y = -1$ in equations (1) and (2).

$3a - \boxed{} = 9 \qquad \ldots (3) \qquad \boxed{} - a = 5 \qquad \ldots (4)$

Multiplying equation (3) by 3,

$\boxed{} - 3b = \boxed{} \qquad \ldots (5)$

Adding equations (4) and (5),

$$\begin{array}{rl} 3b - a = 5 & \quad \ldots (4) \\ -3b + 9a = 27 & \quad \ldots (5) \\ \hline \boxed{} = 32 & \quad \therefore a = 4 \end{array}$$

Substituting $a = 4$ in equation (4),

$3b - 4 = 5 \qquad \therefore 3b = \boxed{} \qquad \therefore b = 3$

(ii) Complete the following activity to find the sum of all natural numbers between 1 and 81 divisible by 6.

The natural numbers between 1 and 81 divisible by 6 are 6, 12, 18, ..., 78.

Here, $a = t_1 = 6$, $d = 6$, $t_n = 78$, $n = ?$, $S_n = ?$

$t_n = \boxed{} \qquad \ldots \text{(Formula)}$

$\therefore 78 = 6 + \boxed{} \qquad \ldots \text{(Substituting the values)}$

$\therefore 78 = \boxed{}$

$\therefore n = 13$

$S_n = \dfrac{n}{2} \boxed{} \qquad \ldots \text{(Formula)}$

$\therefore S_{13} = \dfrac{13}{2} \times \boxed{}$

$\therefore S_{13} = \boxed{}.$

(B) Attempt *any two* subquestions from the following :   6

   (i) A sum of ₹ 7680 is paid off in 12 instalments. Each instalment is ₹ 20 less than the preceding one. Find the amount of the first and the last instalments.

   (ii) The sum of two numbers is 88. If the greater number is divided by the smaller, the quotient is 5 and the remainder is 10. Find the numbers.

   (iii) A two-digit number is formed from the digits 0, 1, 2, 3, 4. Repetition of the digits is allowed. Find the probability that the number so formed is (1) a prime number, (2) a multiple of 4, (3) a multiple of 11.

   (iv) The sum of the squares of two consecutive even natural numbers in 724. Find the numbers.

Q. 4. Attempt *any two* subquestions from the following :   8

   (i) Sunil takes 5 days more than Anil to complete a certain work. 4 days after starting the work, Anil left the work. The remaining work was done by Sunil in 5 days. Find how many days each will take to complete the work.

   (ii) The ages of students in a group are in A.P. having common difference of 3 months. The age of the youngest student in a group is 12 years. Sum of ages of all the students in a group are 375 years. Find the number of students in the group.

   (iii) A train crosses an electric pole in 5 seconds and a railway bridge of 600 m long in 35 seconds. Find the speed of the train in km/h and length of the train.

Q. 5. Attempt *any one* subquestion from the following :   3

   (i) Draw the graph of $x + y = 6$ which intersects the X-axis and the Y-axis at the points A and B respectively. Find the length of seg AB. Also find the area of $\triangle$AOB, where O is the point of origin.

   (ii) A businessman bought some items for ₹ 2000. He kept 10 items for himself and sold the remaining at a profit of ₹ 25 per item. From the amount he received in this deal, he could buy 15 more items. Find the original price of each item.

MATHEMATICS (PART-I)
QUESTION PAPER 3

Time : 2 Hours]   **[Total Marks : 40**

Note : *(i) All questions are compulsory.*

      *(ii) Use of calculator is **not** allowed.*

      (iii) The numbers to the right of the questions indicate full marks.

      (iv) In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.

      (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :   **4**

     (i) The graphs of the lines $2x + ky = 16$ and $x - 4y = 8$ coincides, then find the value of k.

         (A) -2 (B) -4 (C) -8 (D) 4

     (ii) Which of the following is the value of the discriminant for $\sqrt{2}x^2 - 5x + \sqrt{2} = 0$?

         (A) -5 (B) 17   (C) $\sqrt{2}$ (D) $2\sqrt{2} - 5$

     (iii) What is the sum of the first 20 terms of an A.P., if $a = 4$ and $t_{20} = 36$?

         (A) 40   (B) 200   (C) 400   (D) 800

     (iv) Which number cannot represent a probability?

         (A) 15%   (B) $\frac{2}{3}$ (C) 0.7   (D) 1.5

(B) Solve the following subquestions :   **4**

     (i) Write the equation $3x = 4y - 12$ in the general form.

     (ii) What are the roots of the quadratic equation $x^2 = 9$?

     (iii) Write the 100th term of the A.P. 2, 2, 2, ...

     (iv) If $P(A) = \frac{3}{4}$, $n(A) = 39$, find $n(S)$.

Q. 2. (A) Complete and write *any two* activities from the following : 4

(i) Complete the following activity to draw the graph of $2x + y = 6$.

x	-5	
y		0
(x, y)		

(ii) Complete the following activity to find three-digit natural numbers divisible by 5.

Three-digit natural numbers divisible by 5 are 100, 105, 110, ..., 995.

Here, $a = 100$, $d = \boxed{}$, $t_n = 995$

$t_n = \boxed{}$ ... (Formula)

$\therefore 995 = 100 + (n-1) \times 5$

$\therefore 995 = \boxed{}$

$\therefore n = \boxed{}$.

(iii) A die is rolled. A is an event of getting an even number on its upper face.

$S = \boxed{}$

$\therefore n(S) = \boxed{}$

A is the event of getting an even number.

$\therefore A = \boxed{}$

$\therefore n(A) = \boxed{}$

(B) Solve *any four* subquestions from the following : 8

(i) Determine the nature of the roots for the quadratic equation
$\sqrt{3}x^2 + \sqrt{2}x - 2\sqrt{3} = 0$.

(ii) A card is drawn from a well-shuffled pack of 52 playing cards. Find the probability of event A that the card drawn is a spade.

(iii) Solve : $2x - 3y = 9$; $2x + y = 13$.

(iv) How many natural numbers from 10 to 250 are divisible by 4?

(v) Find the value of k, if the roots of the quadratic equation $3x^2 - kx + 48 = 0$ are real and equal.

Q. 3. (A) Complete and write *any one* activity from the following : 3

(i) The sum of the first 41 terms of an A.P. is 5125. Complete the following activity to find the 21st term.

$S_n = S_{41} = 5125$,

Let the first term of the A.P. be a and the common difference d.

$$S_n = \frac{n}{2}\left[2a + \boxed{}\right] \qquad \text{... (Formula)}$$

$$\therefore S_{41} = \frac{41}{2}\left[2a + \boxed{}\right] \qquad \text{... (Substituting the values)}$$

$$\therefore 5125 = \frac{41}{2}(2a + 40d)$$

$$\therefore 5125 = 41 \times \boxed{}$$

$$\therefore a + 20d = \boxed{}$$

$$\therefore a + 20\,d = 125 \qquad \text{... (1)}$$

Now, 21st term is t_{21}.

$$t_n = \boxed{} \qquad \text{... (Formula)}$$

$$\therefore t_{21} = a + (21 - 1)\,d$$

$$\therefore t_{21} = a + 20\,d$$

$$\therefore t_{21} = \boxed{} \qquad \text{... [From (1)]}$$

(ii) Complete the following activity to solve the simultaneous equations $3x - 2y = 3$ and $2x + y = 16$ by Cramer's rule.

$$D = \begin{vmatrix} 3 & -2 \\ 2 & 1 \end{vmatrix} = \boxed{}, \quad D_x = \begin{vmatrix} 3 & -2 \\ 16 & 1 \end{vmatrix} = 35, \quad D_y = \begin{vmatrix} \\ \end{vmatrix} = \boxed{},$$

$$x = \frac{D_x}{D} = \boxed{}, \quad y = \boxed{} = \boxed{}.$$

(B) Attempt _any two_ subquestions from the following : 6

(i) In a factory, the ratio of salary of skilled and unskilled workers is 5 : 3. Total salary of one day of both of them is ₹ 720. Find the daily wages of skilled and unskilled workers.

(ii) □ABCD is a parallelogram. Measure of $\angle A$ is thrice the measure of $\angle B$. Find measures of $\angle A$ and $\angle B$.

(iii) A card is drawn from a well-shuffled pack of 52 playing cards. Find the probability that the card drawn is (1) a diamond card (2) a face card (3) a black card.

(iv) The sum of three consecutive terms of an A.P. is 36 and their product is 1140. Find the terms. (Consider the terms to be in descending order.)

Q. 4. Attempt *any two* subquestions from the following : 8

(i) A cottage industry produces a certain number of potteries in a day. It was found that the cost of production of each article was ₹ 5 more than twice the number of potteries produced in a day. If the cost of production on that day was ₹ 168, find the number of potteries produced.

(ii) How many terms of the A.P. 16, 14, 12, ... are needed to give the sum 60? Explain why do we get two answers.

(iii) Draw the graph representing the equations $x - y = 1$ and $2x + 3y = 12$ on the same graph paper. Find the area of the triangles formed by these lines, the X-axis and the Y-axis.

Q. 5. Attempt *any one* subquestion from the following : 3

(i) Construct a word problem on simultaneous linear equations in two variables (on age, rupees, metres, speed, etc.), so that the value of one variable will be 18.

(OEQ)

(ii) With the help of the flowchart given below, solve the equation $x^2 + 2\sqrt{2}x - 6 = 0$ using the formula method :

Solution :

```
┌─────────────────────────────────────────────────┐
│ Compare the given equation with the standard form. │
│       Write the values of a, b, c.                 │
└─────────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────────┐
│         Find the value of b² − 4ac.                │
└─────────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────────┐
│      Write the formula to solve the equation.      │
└─────────────────────────────────────────────────┘
                      ↓
┌─────────────────────────────────────────────────┐
│ Substitute the values in the formula and find the roots. │
└─────────────────────────────────────────────────┘
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MATHEMATICS (PART-I)
QUESTION PAPER 4

Time : 2 Hours]   **[Total Marks : 40**

Note : *(i) All questions are compulsory.*

     *(ii) Use of calculator is **not** allowed.*

     (iii) The numbers to the right of the questions indicate full marks.

     (iv) In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.

     (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :   **4**

    (i) One root of the quadratic equation is $3 - 2\sqrt{5}$, then find other.

      (A) $2 + 3\sqrt{5}$ (B) $3 - 2\sqrt{5}$ (C) $3 + 2\sqrt{5}$ (D) $2 - 3\sqrt{5}$

    (ii) What is the probability of the event that a number chosen from 1 to 100 is a prime number?

      (A) $\dfrac{1}{4}$ (B) $\dfrac{1}{5}$ (C) $\dfrac{6}{25}$ (D) $\dfrac{13}{50}$

    (iii) What is the degree of the determinant $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$?

      (A) 1   (B) 3   (C) 4   (D) 2

    (iv) For an A.P., the first term is 4 and the last term (t_n) is 31. The sum of all the terms is 420. What is the value of n?

      (A) 12   (B) 24   (C) 10   (D) 20

(B) Solve the following subquestions :   **4**

    (i) Form a quadratic equation whose roots are 3 and -4.

    (ii) A die is rolled. A is the event of getting an odd number. Write the event A.
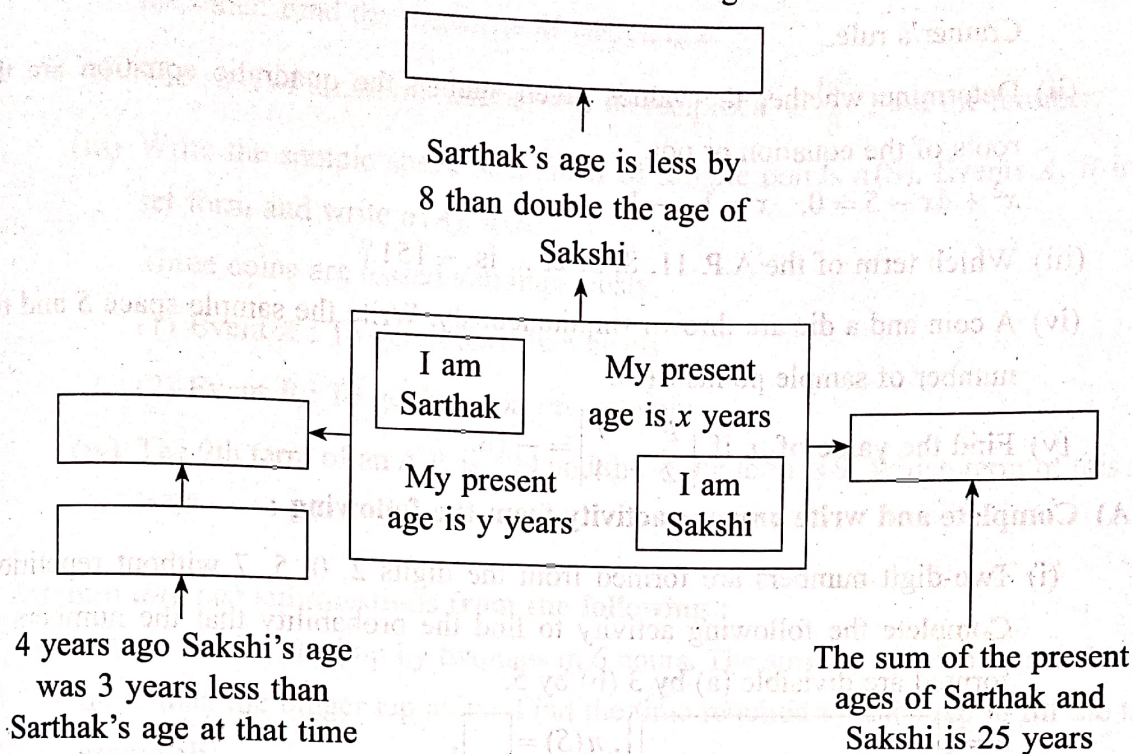
    (iii) If for an A.P., $t_2 = 4$ and $d = -2$, then what is the value of a?

    (iv) For drawing the graph of $2x - 3y = 3$, if the value of x is -3, what is the value of y?

Q. 2. (A) Complete and write _any two_ activities from the following : 4

(i) Frame the equations from the information given and write them in the boxes.

$$\boxed{}$$

↑

Sarthak's age is less by 8 than double the age of Sakshi

↑

$$\boxed{}\quad\leftarrow\quad\boxed{\text{I am Sarthak}}\quad\boxed{\begin{array}{c}\text{My present}\\ \text{age is } x \text{ years}\end{array}}\quad\rightarrow\quad\boxed{}$$

$$\boxed{\begin{array}{c}\text{My present}\\ \text{age is } y \text{ years}\end{array}}\quad\boxed{\text{I am Sakshi}}$$

$$\boxed{}$$

↑

4 years ago Sakshi's age was 3 years less than Sarthak's age at that time

↑

The sum of the present ages of Sarthak and Sakshi is 25 years

(ii) Complete the following activity to find the sum of natural numbers between 1 and 140 which are divisible by 4.

The numbers between 1 and 140 divisible by 4 are 4, 8, 12, ..., 136

Here, $a = 4$, $d = 4$, $t_n = 136$

$t_n = a + (n-1)\,d$ ... (Formula)

$\therefore 136 = \boxed{} + (n-1) \times 4$

$\therefore n = \boxed{}$

$S_n = \dfrac{n}{2}\,\boxed{}$ ... (Formula)

$\therefore S_{34} = \dfrac{34}{2}\,[8 + (34-1) \times 4]$

$\therefore S_{34} = \boxed{}$

(iii) In a game of chance, a spinning arrow comes to rest at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8.
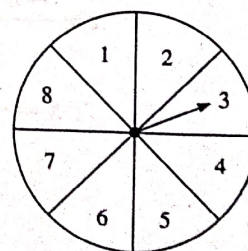
All these are equally likely outcomes.

To find the probability that it will rest at 8, fill in the boxes. Complete the given activity to get the answer.

$S = \boxed{}$ $\therefore n(S) = 8.$

Let A be the event that arrow points at the number 8.

$\therefore A = \boxed{}$ $\therefore n(A) = \boxed{}$ $P(A) = \dfrac{n(A)}{n(S)} = \boxed{\dfrac{}{}}.$

(B) Solve _any four_ subquestions from the following : 8

(i) Find D for solving the simultaneous equations $3x - 4y = 10$; $4x + 3y = 5$ using Cramer's rule.

(ii) Determine whether the values given against the quadratic equation are the roots of the equation or not.

$x^2 + 4x - 5 = 0$. $x = 1, -1$.

(iii) Which term of the A.P. 11, 8, 5, 2, ... is -151 ?

(iv) A coin and a die are thrown simultaneously. Write the sample space S and the number of sample points $n(S)$.

(v) Find the value of p, if $\begin{vmatrix} p & 7 \\ 2 & 4 \end{vmatrix} = -18$.

Q. 3. (A) Complete and write _any one_ activity from the following : 3

(i) Two-digit numbers are formed from the digits 2, 0, 5, 7 without repetition. Complete the following activity to find the probability that the numbers so formed are divisible (a) by 3 (b) by 5.

$S = \left\{ \boxed{} \right\}$, $n(S) = \boxed{}$,

Event A : The numbers formed are divisible by 3.

$A = \{27, 57, 72, 75\}$

$\therefore n(A) = \boxed{}$, $P(A) = \dfrac{n(A)}{n(S)} = \boxed{\dfrac{}{}}$.

Event B : The numbers formed are divisible by 5.

$B = \{20, 25, 50, 70, 75\}$

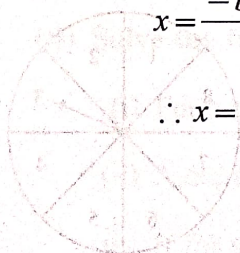$\therefore n(B) = \boxed{}$, $P(B) = \dfrac{n(B)}{n(S)} = \boxed{\dfrac{}{}}$.

(ii) Complete the following activity to solve the equation $5x^2 + 13x + 8 = 0$ using formula.

Here, $a = 5$, $b = 13$, $c = 8$.

$b^2 - 4ac = \boxed{} - 4 \times 5 \times \boxed{}$

$= \boxed{} - \boxed{} = 9$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \dfrac{-13 \pm \sqrt{\boxed{}}}{2 \times 5}$

$\therefore x = \dfrac{-13 \pm 3}{10}$ $\therefore x = \boxed{}$ or $x = \dfrac{-8}{5}$

(B) Attempt *any two* subquestions from the following : 6

    (i) Two angles are complementary. If measure of one angle is more by 50° than the other. Find the measures of each angle.

    (ii) The sum of a natural number and its reciprocal is $\frac{65}{8}$. Find the number.

    (iii) Write the sample space S, number of sample points $n(S)$. Events A, B in the set form and write $n(A)$, $n(B)$.

    Three coins are tossed simultaneously.

        (1) Event A : To get at least two heads

        (2) Event B : To get head on second coin.

    (iv) The 9th term of an A.P. is 499 and the 499th term is 9. Which term of this A.P. is 0?

Q. 4. Attempt *any two* subquestions from the following : 8

    (i) A tank can be filled up by two taps in 6 hours. The smaller tap alone takes 5 hours more than the bigger tap alone. Find the time required by each tap to fill the tank separately.

    (ii) Find the A.P. whose 1st term is 100 and the sum of the first six terms is 5 times the sum of the next six terms.

    (iii) Solve the simultaneous equations $2x + y = 8$; $y = \dfrac{1+x}{2}$ graphically.

Q. 5. Attempt *any one* subquestion from the following : 3

    (i) The area of a rectangle reduces by 20 m², if its length is increased by 1 m and the breadth is reduced by 2 m. The area increases by 12 m², if the length is reduced by 3 m and the breadth is increased by 4 m. Find the dimensions of the rectangle.

    (ii) Solve : $4y^2 + \dfrac{6}{y^2} = 11$.   [Hint : Substitute x for y^2]

MATHEMATICS (PART-I)
QUESTION PAPER 5

Time : 2 Hours]   **[Total Marks : 40**

Note : (i) *All questions are compulsory.*

(ii) *Use of calculator is **not** allowed.*

(iii) *The numbers to the right of the questions indicate full marks.*

(iv) *In case of MCQ's [Q. No. 1(A)], only the first attempt will be evaluated and will be given credit.*

(v) *For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.*

Q. 1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the letter of the alphabet of it :   **4**

(i) If for an A.P., $S_{15} = 147$ and $S_{14} = 123$, find t_{15}.

(A) 24   (B) 23   (C) 47   (D) 46

(ii) What is the value of D, for solving simultaneous equations $x + y = 3$; $3x - 2y - 4 = 0$ by determinant method?

(A) 5   (B) 1   (C) -5 (D) -1

(iii) A die is rolled. What is the probability that the number appearing on the upper face is less than 3?

(A) $\dfrac{1}{6}$ (B) $\dfrac{1}{3}$ (C) $\dfrac{1}{2}$ (D) 0

(iv) One of the roots of the equation $x^2 + mx - 5 = 0$ is 2. Find m.

(A) -2 (B) $-\dfrac{1}{2}$ (C) 2   (D) $\dfrac{1}{2}$

(B) Solve the following subquestions :   **4**

(i) Find the value of x in the equation $3x + y = 7$, if $y = 1$.

(ii) Find the value of discriminant of the quadratic equation $5m^2 - m = 0$.

(iii) Two coins are tossed simultaneously. Write the sample space S and the number of sample points $n(S)$.

(iv) What is the 6th term of the A.P. 12, 9, 6, ...

Q. 2. (A) Complete and write *any two* activities from the following :   **4**

(i) Complete the following activity to solve the simultaneous equations $2x + y = 19$ and $2x - 3y = -3$ by Cramer's rule.

$$D = \begin{vmatrix} 2 & 1 \\ 2 & -3 \end{vmatrix} = \boxed{}, \quad D_x = \begin{vmatrix} 19 & 1 \\ -3 & -3 \end{vmatrix} = \boxed{}, \quad D_y = \begin{vmatrix} 2 & 19 \\ 2 & -3 \end{vmatrix} = \boxed{},$$

$$x = \boxed{}, \quad y = \frac{11}{2}.$$

(ii) Complete the following activity to find the number of terms in the A.P. 1, 3, 5, ..., 149.

Here, $a = 1$, $d = \boxed{}$, $t_n = 149$

$t_n = a + \boxed{}$ ... (Formula)

$\therefore 149 = \boxed{}$ ... (Substituting the values)

$\therefore 149 = 2n - \boxed{}$ $\therefore n = 75.$

(iii) There are 15 tickets bearing the numbers 1 to 15 in a bag. One ticket is drawn at random from the bag. Complete the following activity to find the probability of event A, that the ticket drawn bears a number multiple of 5.

$S = \boxed{}$ $\therefore n(S) = 15$

A is the event that the ticket drawn bears a number multiple of 5.

$\therefore A = \boxed{}$ $\therefore n(A) = \boxed{}$

$$P(A) = \frac{n(A)}{n(S)} \qquad \therefore P(A) = \boxed{\frac{}{}} = \frac{1}{5}.$$

(B) Solve *any four* subquestions from the following :   **8**

(i) Solve the simultaneous equations $5x + 2y = -3$; $x + 5y = 4$.

(ii) Solve : $2y^2 + 27y + 13 = 0$.

(iii) Find the 27th term of the A.P. 9, 4, -1, -6, ...

(iv) Two coins are tossed simultaneously. Find the probability of getting at least one head.

(v) Find the value of the determinant $\begin{vmatrix} 2\sqrt{3} & -9 \\ 2 & 3\sqrt{3} \end{vmatrix}$.

Q. 3. (A) Complete and write *any one* activity from the following :   **3**

(i) One of the roots of the quadratic equation $kx^2 - x - 12 = 0$ is $\frac{3}{2}$. Complete the following activity to find the value of k.

Substitute $x = \frac{3}{2}$ in the given quadratic equation.

$\therefore k \boxed{} - \frac{3}{2} - 12 = 0 \qquad \therefore \boxed{} - \frac{3}{2} - 12 = 0$

$\therefore 9k - 6 - \boxed{} = 0$ ... (Multiplying by 4)

$\therefore 9k = \boxed{}$ $\therefore k = \boxed{\frac{}{}}$ $\therefore k = \boxed{}.$

(ii) Two-digit numbers are formed from the digits 0, 1, 2, 3, 4 without repetition. Complete the following activity to find the probability that the number so formed is a prime number.

The sample space

$$S = \left\{ \boxed{} \right\}, \ n(S) = \boxed{},$$

Let A be the event that the number so formed is a prime number.

Then $A = \left\{ \boxed{} \right\}, \ n(A) = \boxed{}$

$$P(A) = \boxed{\dfrac{}{}} \quad \text{... (Formula)} \qquad \therefore \ P(A) = \boxed{\dfrac{}{}}$$

(B) Attempt *any two* subquestions from the following : **6**

(i) Solve the simultaneous equations $4x + 3y - 4 = 0$ and $6x = 8 - 5y$ using Cramer's rule.

(ii) With the help of the flowchart given below solve the equation $x^2 + 2\sqrt{5}x + 5 = 0$ using the formula :

Find the values of a, b, c by comparing $x^2 + 2\sqrt{5}x + 5 = 0$ with $ax^2 + bx + c = 0$	→	Find the value of $b^2 - 4ac$	→	Write the formula for solving quadratic equation	→	Substitute the values in the formula and solve.
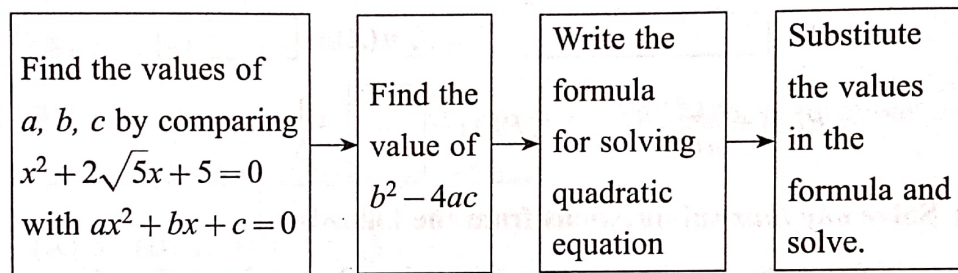
(iii) If two coins are tossed, find the probability of (1) getting no tail (2) getting no head (3) getting at least one tail.

(iv) Find the sum of all numbers from 150 to 200 which are divisible by 8.

Q. 4. Attempt *any two* subquestions from the following : **8**

(i) Solve : $\dfrac{x^{2002} + 10x^{2001}}{10x^{2000}} = 957.9$.

(ii) The sum of the 3rd and 7th terms of an A.P. is 32 and their product is 220. Find the sum of first twenty-one terms of the A.P. (Take the value of d positive.)

(iii) Find the values of a and b for which simultaneous equations $x + 2y = 1$ and $(a - b)x + (a + b)y = a + b - 2$ have infinitely many solutions.
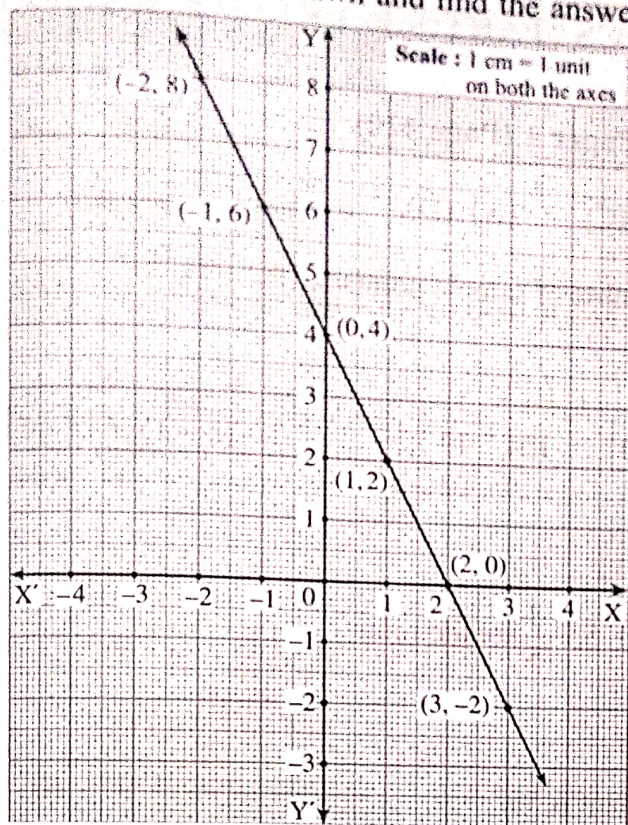
Q. 5. Attempt *any one* subquestion from the following : **3**

(i) To solve simultaneous equations $2x + y = 4$ and $6x + 3y = 12$ graphically, following are the ordered pairs.

$2x + y = 4$

x	-1	0	2
y	6	4	0
(x, y)	$(-1, 6)$	$(0, 4)$	$(2, 0)$

$6x + 3y = 12$

x	-2	1	3
y	8	2	-2
(x, y)	$(-2, 8)$	$(1, 2)$	$(3, -2)$

Observe the graph drawn and find the answers to the questions.

Scale : 1 cm = 1 unit on both the axes

(1) Whether the graphs of both the equations are different or same?

(2) What are the relations between the coefficients of x, coefficients of y and constant terms in both the equations?

(3) What conclusion can you draw when two equations are given but the graph is only one line?

(ii) If the speed of a car is increased by 12 km/h, it takes 40 minutes less to cover a distance of 240 km. Find the original speed of the car.