

S-2  
MID TERM EXAMINATION-2024  
MATHEMATICS (SET 2)

Time Allowed: 3 Hrs.

Maximum Marks : 80

**General Instructions:**

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 01 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with sub parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E
8. Draw neat figures wherever required. Take  $\pi = 22/7$  wherever required, if not stated.

S.No	SECTION A Section A consists of 20 questions of 1 mark each.
1.	Find the sum of exponents of prime factors in the prime factorization of 196
2.	If $\tan(3x + 30^\circ) = 1$ then find the value of $x$ .
3.	If two positive integers $a$ and $b$ are written as $a = x^3y^2$ and $b = xy^3$ , where $x, y$ are prime numbers, then what is the result obtained by dividing the product of the positive integers by the LCM ( $a, b$ )?
4.	If $\left(\frac{a}{2}, 4\right)$ is the midpoint of the line segment joining the points A $(-6, 5)$ and B $(-2, 3)$ , then what is the value of $a$ ?
5.	The length of the minute hand of the clock is 14 cm. Find the area swept by the minute hand in 15 minutes.
6.	A number $x$ is chosen at random from the numbers $(-3, -2, -1, 0, 1, 2, 3)$ . What will be the probability that $x^2$ is less than or equal to 1?
7.	If $\sum_{i=1}^n f_i = 17$ , $\sum_{i=1}^n f_i x_i = 4p + 63$ and $\bar{x} = 7$ , then find the value of $p$ .
8.	If the probability of winning a game is 0.07, what is the probability of losing it?
9.	For what value of ' $p$ ' the following system of linear equations have no solution $px + 3y = 3$ ; $12x - 6y = 8$



10. What is the perimeter of the sector with radius 10.5 cm and sector angle  $60^\circ$ .
11. What type of straight lines are represented by the following system of equations  
 $2x + 3y = 5$ ;  $4x + 6y = 7$
12. A box contains cards numbered 6 to 55. A card is drawn at random from the box. What is the probability that the drawn card has a number which is a perfect square?
13. For what value of  $p$ , is  $(-4)$  a zero of the polynomial  $x^2 - 2x - (7p + 3)$ ?
14. Find the number of solutions of the following pair of linear equations:  
 $5x - 15y = 8$ ;  $5x - 9y = \frac{24}{5}$
15. Find a quadratic polynomial the sum and the product of whose zeros are 3 and  $(-2)$
16. An arc of length  $20\pi$  cm subtends an angle of  $144^\circ$  at the centre of a circle. Find the radius of the circle.
17. If  $\alpha$  and  $\beta$  are the zeroes of the quadratic polynomial  $p(x) = x^2 - (k - 6)x + (2k + 1)$ , find the value of  $k$ , if  $\alpha + \beta = \alpha\beta$
18. Find the upper limit of the modal class from the given distribution.
- |                   |              |              |              |              |              |              |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Height<br>[in cm] | Below<br>140 | Below<br>145 | Below<br>150 | Below<br>155 | Below<br>160 | Below<br>165 |
| Number of girls   | 4            | 11           | 29           | 40           | 46           | 51           |
19. DIRECTION: In question number 19 and 20, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option
- Statement A (Assertion):** The point which divides the line segment joining the points  $A(1, 2)$  and  $B(-1, 1)$  internally in the ratio 1:2 is  $(\frac{-1}{3}, \frac{5}{3})$
- Statement R (Reason):** The coordinates of the point which divides the line segment joining the points  $A(x_1, y_1)$  and  $B(x_2, y_2)$  in the ratio  $(m_1 : m_2)$  are  $(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2})$
- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.



20. *Statement A (Assertion):* In a right  $\triangle ABC$ , right angled at B, if  $\tan A = \frac{12}{5}$ , then  $\sec A = \frac{13}{5}$ .  
*Statement R (Reason):* For any value of  $\theta$ ,  $1 - \tan^2 \theta = \sec^2 \theta$
- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)  
 (b) Both assertion (A) and reason (R) are true and reason for (R) is not the correct explanation of assertion (A)  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

SECTION B

Section B consists of 5 questions of 2 marks each.

21. A chord of a circle of radius 10 cm, subtends a right angle at the centre of the circle. Find the area of the minor segment. (Take  $\pi = 3.14$ )

22. Determine the value of  $x$  such that  $2\operatorname{cosec}^2 30^\circ + x\sin^2 60^\circ - \frac{3}{4}\tan^2 30^\circ = 10$

OR

If  $5x = \sec \theta$  and  $\frac{5}{x} = \tan \theta$ , find the value of  $5\left(x^2 - \frac{1}{x^2}\right)$

23. If  $\alpha$  and  $\beta$  are the zeroes of the polynomial  $x^2 + 6x + 9$ , then form a polynomial whose zeroes are  $(-\alpha)$  and  $(-\beta)$

OR

Find a quadratic polynomial whose zeros are  $(-9)$  and  $\left(\frac{-1}{9}\right)$

24. Solve for  $x$  and  $y$ :  $y - 4x = 1$ ;  $6x - 5y = 9$

25.  $k$  is a zero of the polynomial  $p(x) = x^2 - 11x + 24$ . If  $k$  is a prime number, then find the value of  $k$ .

SECTION C

Section C consists of 6 questions of 3 marks each.

26. Find the mode of the following frequency distribution:

Class Interval	0 - 15	15 - 30	30 - 45	45 - 60	60 - 75
Frequency	2	3	7	6	6

27. If  $\operatorname{cosec}(A - B) = 2$ ,  $\cot(A + B) = \frac{1}{\sqrt{3}}$ ,  $0^\circ < (A + B) < 90^\circ$ ,  $A > B$ , then find  $A$  and  $B$



28. If  $\alpha$  and  $\beta$  are zeroes of the polynomial  $p(x) = 6x^2 + 11x - 10$ , then find the value of  $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

29. From a deck of 52 playing cards, Jack and King of diamond and Queen and Ace of spade are removed. The remaining cards are mixed and a card is drawn at random. Find the probability that the drawn card is

(i) a red colour card

(ii) a face card

$(1\frac{1}{2} + 1\frac{1}{2})$

OR

A bag contains 20 balls out of which  $x$  balls are red.

(i) If one ball is drawn at random from the bag, find the probability that it is not red.

(ii) If 4 more red balls are put into the bag, the probability of drawing a red ball will be  $\frac{5}{4}$  times the probability of drawing a red ball in the first case. Find the value of  $x$ . (1+2)

30. Find  $x$  and  $y$ , if the mean of the following frequency distribution is 57.6

Class Interval	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120	Total
Frequency	7	$x$	12	$y$	8	5	50

OR

The median of the distribution given below is 35. Find the values of  $x$  and  $y$ , if the sum of the frequencies is 170

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Frequency	10	20	$x$	40	$y$	25	15

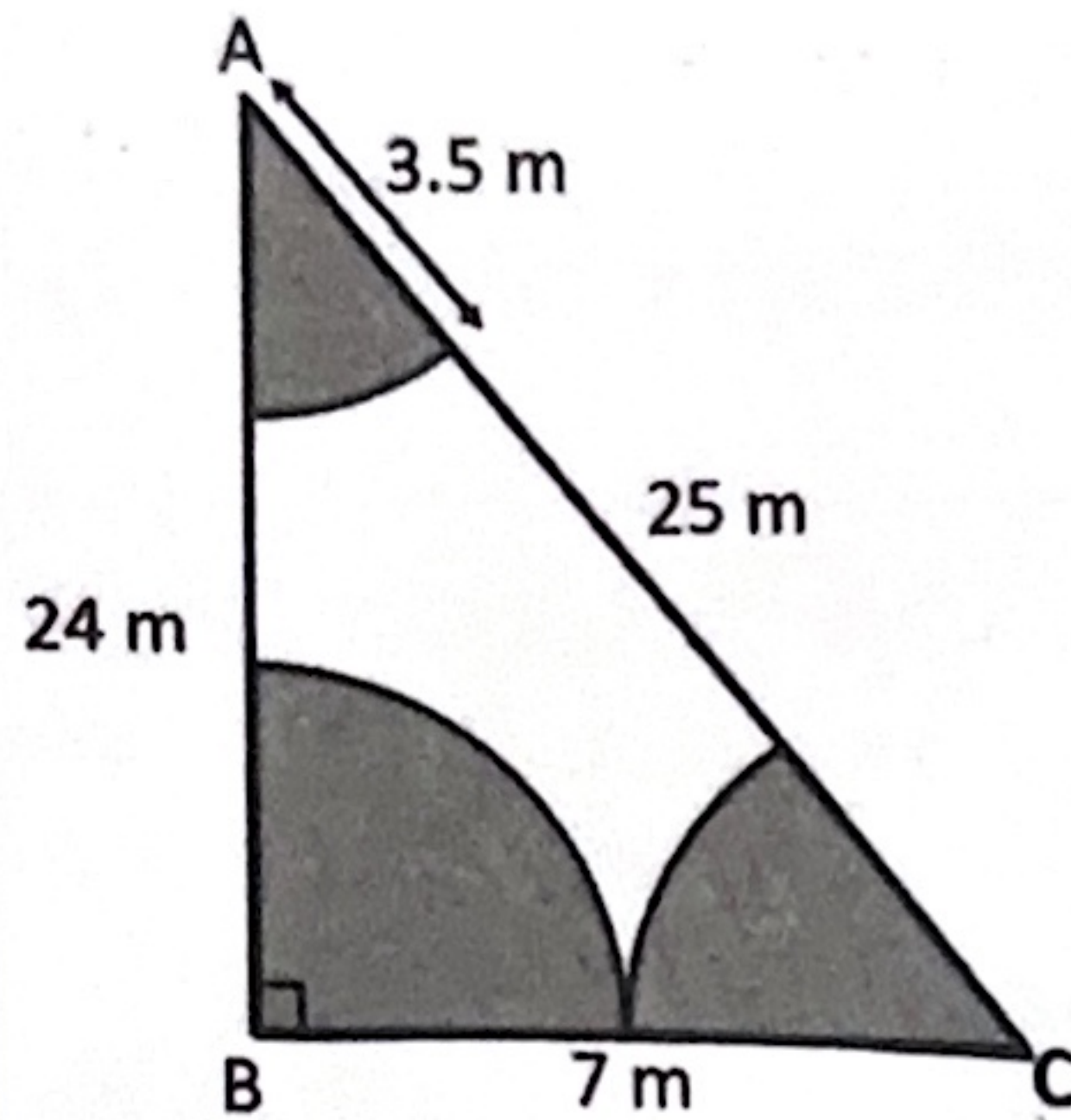
31. Prove that  $\sqrt{5}$  is an irrational number.



## SECTION D

Section D consists of 4 questions of 5 marks each

32. Sides of a right triangular field are 25 m, 24 m and 7 m. At the three corners of the field, a cow, a buffalo and a horse are tied separately with ropes of 3.5 m each to graze in the field. Find the area of the field that cannot be grazed by these animals.



33. The sum of the numerator and the denominator of a fraction is 4 more than twice the numerator. If 3 is added to each of the numerator and the denominator, their ratio becomes 2 : 3. Find the fraction

OR

The sum of a two digit number and the number formed by interchanging its digits is 110. If 10 is subtracted from the original number, the new number obtained is 4 more than 5 times the sum of the digits of the original number. Find the original number.

34. Prove that:

(2+3)

$$(i) \sqrt{\frac{1+\sin\theta}{1-\sin\theta}} + \sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = 2 \sec\theta$$

$$(ii) \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$$

35. Point P divides the line segment joining the points A(-1,3) and B(9,8) such that AP: PB = k:1. If P lies on the line  $x - y + 2 = 0$ , find the value of k. Also find the coordinates of point P.

OR

A(1, -1), B(0,4) and C(-5, 3) are vertices of a  $\Delta ABC$ . Check whether it is a scalene triangle, isosceles triangle or an equilateral triangle. Also, find the length of its median through the vertex A of the  $\Delta ABC$ .



SECTION E

Case study based questions are compulsory.

36.

Two friends were playing a game with two dice. Anju has blue dice and Nitish has grey dice. They decided to throw both the dice simultaneously and note down all the possible outcomes appearing on the top of both the dice.



On the basis of above information, answer the following questions :

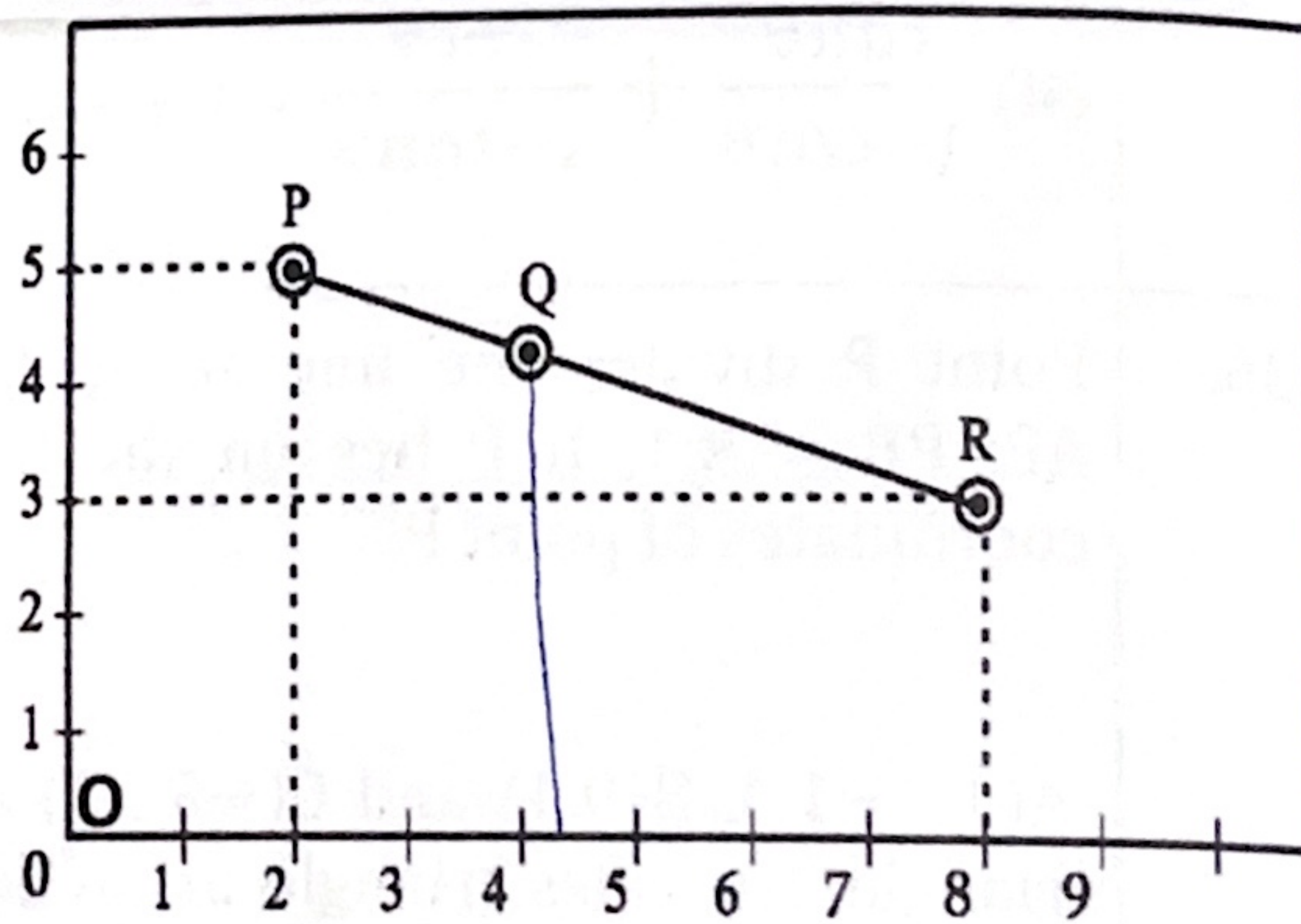
- (i) What is the probability of getting the difference between the numbers obtained on the two dice as zero? (1)
- (ii) Find the probability of getting the sum of the numbers obtained on the two dice as 16 (1)
- (iii) What is the probability that both the numbers are prime numbers?

OR

- (iii) What is the probability that the product of the two numbers is odd? (2)

37.

A group of Class X students goes on a picnic during vacation. There were three different slides and three friends Ajay, Ram and Shyam are sliding in the three slides. The position of the three friends shown by P, Q and R in three different slides are given below. Considering O as the origin, answer the following questions:





- (i) Find the distance PR (1)
- (ii) Find the coordinates of midpoint of PR (1)
- (iii) Find the coordinates of point 'Q' which divides the line segment PR in the ratio 1:2 (2)
- OR
- (iii) Find the coordinates of a point on x-axis which is at equal distance from P and R

38. Student-teacher ratio expresses the relationship between the number of students enrolled in a school and the number of teachers employed by the school. This ratio is important for a number of reasons. It can be used as a tool to measure a teacher's workload as well as the allocation of resources. A Survey was conducted in 100 secondary schools of a state and the following frequency distribution table was prepared:

No. of Students per teacher	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50
No. of Schools	5	15	25	30	15	10

Based on the above information, answer the following questions :

- (i) What is the upper limit of the median class ? (1)
- (ii) What is the upper limit of the modal class ? (1)
- (iii) Find the median of the data
- OR
- (iii) Find the mode of the data (2)