

**Marking Scheme**  
**Strictly Confidential**  
**(For Internal and Restricted use only)**  
**Secondary School Examination, 2026 (2<sup>nd</sup> Board Examination)**  
**SUBJECT NAME: Mathematics Basic**  
**(Q.P. CODE / Set No. 241/430(B))**

**General Instructions: -**

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>1</b>  | You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.                                                                                                                                                                                                                                                                         |
| <b>2</b>  | <b>“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. It’s leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC.”</b>                                                                                                                                                                                             |
| <b>3</b>  | Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one’s own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. <b>However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.</b> |
| <b>4</b>  | The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>5</b>  | The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.                                                                                                                                                                                                                   |
| <b>6</b>  | Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS ‘X’ be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. <b>This is most common mistake which evaluators are committing.</b>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>7</b>  | If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>8</b>  | If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>9</b>  | If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note <b>“Extra Question”</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>10</b> | No marks to be deducted for the cumulative effect of an error. It should be penalized only once.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>11</b> | A full scale of marks (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>12</b> | Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number                                                                                                                                                                                                                                                                                                                                                                                         |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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|           | of questions in question paper.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>13</b> | <p>Ensure that you do not make the following common types of errors committed by the Examiner in the past: -</p> <ul style="list-style-type: none"> <li>• Leaving answer or part thereof unassessed in an answer book.</li> <li>• Giving more marks for an answer than assigned to it.</li> <li>• Wrong totaling of marks awarded on an answer.</li> <li>• Wrong transfer of marks from the inside pages of the answer book to the title page.</li> <li>• Wrong question wise totaling on the title page.</li> <li>• Wrong totaling of marks of the two columns on the title page.</li> <li>• Wrong grand total.</li> <li>• Marks in words and figures not tallying/not same.</li> <li>• Wrong transfer of marks from the answer book to online award list.</li> <li>• Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)</li> <li>• Half or a part of answer marked correct and the rest as wrong, but no marks awarded.</li> </ul> |
| <b>14</b> | While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>15</b> | Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>16</b> | The Examiners should acquaint themselves with the guidelines given in the “ <b>Guidelines for spot Evaluation</b> ” before starting the actual evaluation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>17</b> | Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>18</b> | The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

# Set 430(B)

## MARKING SCHEME MATHEMATICS (Basic)

### SECTION A

*This section has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.* *20×1=20*

1. If HCF (p, 8) = 4 and LCM (p, 8) = 24, then p is :

- (A) 8 (B) 3  
(C) 12 (D) 18

Ans: (C) 12 1

2. If one zero of the polynomial  $p(x) = 3x^2 - 10x + 3$  is  $\frac{1}{3}$ , then the other zero is :

- (A)  $-\frac{1}{3}$  (B)  $\frac{1}{3}$   
(C) 3 (D) -3

Ans: (C) 3 1

3. The value of p for which the pair of linear equations  $3x - 2y + 5 = 0$  and  $px + 4y - 10 = 0$  will have infinitely many solutions, is :

- (A) 6 (B) -6  
(C) 9 (D) -9

Ans: (B) -6 1

4. The value of 'a' for which the quadratic equation  $(a + 1)x^2 + 2(a - 1)x + (a - 2) = 0$  has real and equal roots, is :

- (A) 2 (B) 3  
(C) 0 (D) -3

Ans: (B) 3 1

5. If P(3, 1), Q(-1, 3) and R(3, 5) are the vertices of a  $\Delta PQR$ , then  $\Delta PQR$  is a/an :

- (A) equilateral triangle  
(B) scalene triangle  
(C) isosceles triangle  
(D) right triangle

|                                                                                                                                                                                                                                                                                                                                          |   |
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| Ans: (C) isosceles triangle                                                                                                                                                                                                                                                                                                              | 1 |
| <p><b>6.</b> The ratio in which the point P(− 4, 7) divides the line segment joining the points A(− 1, 1) and B(− 6, 11), is :</p> <p>(A) 2 : 3 (B) 2 : 1</p> <p>(C) 3 : 1 (D) 3 : 2</p>                                                                                                                                                 |   |
| Ans: (D) 3 : 2                                                                                                                                                                                                                                                                                                                           | 1 |
| <p><b>7.</b> In a triangle PQR, <math>\angle Q = 90^\circ</math> and <math>QS \perp PR</math>. If <math>PR = 9</math> cm and <math>PS = 3</math> cm, then <math>QS</math> is equal to :</p> <p>(A) <math>3\sqrt{2}</math> cm (B) <math>2\sqrt{3}</math> cm</p> <p>(C) <math>2\sqrt{2}</math> cm (D) <math>3\sqrt{3}</math> cm</p>        |   |
| Ans: (A) $3\sqrt{2}$ cm                                                                                                                                                                                                                                                                                                                  | 1 |
| <p><b>8.</b> The length of the second diagonal of a rhombus, whose side is 10 cm and one of the diagonals is 12 cm, is :</p> <p>(A) 20 cm (B) 8 cm</p> <p>(C) 24 cm (D) 16 cm</p>                                                                                                                                                        |   |
| Ans: (D) 16 cm                                                                                                                                                                                                                                                                                                                           | 1 |
| <p><b>9.</b> Two circles touch each other externally at point P. AB is a common tangent to the circles, touching them at A and B. The measure of <math>\angle APB</math> is :</p> <p>(A) <math>90^\circ</math> (B) <math>60^\circ</math></p> <p>(C) <math>45^\circ</math> (D) <math>30^\circ</math></p>                                  |   |
| Ans: (A) $90^\circ$                                                                                                                                                                                                                                                                                                                      | 1 |
| <p><b>10.</b> PA and PB are tangents drawn to a circle with centre O and radius 5 cm, from a point P, at a distance of 13 cm from O. The area of quadrilateral OAPB is equal to :</p> <p>(A) <math>30 \text{ cm}^2</math> (B) <math>60 \text{ cm}^2</math></p> <p>(C) <math>120 \text{ cm}^2</math> (D) <math>50 \text{ cm}^2</math></p> |   |
| Ans: (B) $60 \text{ cm}^2$                                                                                                                                                                                                                                                                                                               | 1 |
| <p><b>11.</b> <math>(3 \cot^2 60^\circ + \operatorname{cosec}^2 45^\circ - \cot^2 30^\circ)</math> is equal to :</p> <p>(A) 3 (B) 2</p> <p>(C) 1 (D) 0</p>                                                                                                                                                                               |   |
| Ans: (D) 0                                                                                                                                                                                                                                                                                                                               | 1 |
| <p><b>12.</b> If <math>\cos \theta = \frac{1}{2}</math>, the value of <math>\frac{2}{1 + \tan^2 \theta}</math> is :</p> <p>(A) 2 (B) 1</p> <p>(C) <math>\frac{1}{2}</math> (D) <math>\frac{3}{2}</math></p>                                                                                                                              |   |

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| Ans: (C) $\frac{1}{2}$                                                                                                                                                                                                                                                                                                                                  | 1 |
| <p><b>13.</b> The area of a sector of a circle is one-twelfth of the area of a complete circle. The central angle of the sector is :</p> <p>(A) <math>30^\circ</math> (B) <math>36^\circ</math><br/>(C) <math>45^\circ</math> (D) <math>60^\circ</math></p>                                                                                             |   |
| Ans: (A) $30^\circ$                                                                                                                                                                                                                                                                                                                                     | 1 |
| <p><b>14.</b> A chord PQ of a circle of radius 20 cm subtends a right angle at the centre. Taking <math>\pi = 3.14</math>, the area of the minor segment is :</p> <p>(A) <math>214 \text{ cm}^2</math> (B) <math>114 \text{ cm}^2</math><br/>(C) <math>314 \text{ cm}^2</math> (D) <math>200 \text{ cm}^2</math></p>                                    |   |
| Ans: (B) $114 \text{ cm}^2$                                                                                                                                                                                                                                                                                                                             | 1 |
| <p><b>15.</b> A solid is in the shape of a hemisphere surmounted by a right circular cone of same radius. If the surface areas of the two parts are equal, then the ratio of the radius to the height of the conical part is :</p> <p>(A) <math>1 : 1</math> (B) <math>\sqrt{3} : 1</math><br/>(C) <math>1 : \sqrt{3}</math> (D) <math>1 : 3</math></p> |   |
| Ans: (C) $1 : \sqrt{3}$                                                                                                                                                                                                                                                                                                                                 | 1 |
| <p><b>16.</b> Two solid spheres each of radius 3 cm, are dropped into a cylindrical vessel of radius 4 cm containing water. If the spheres are submerged completely, then the height (in cm) to which the water in the cylinder rises is :</p> <p>(A) 4 (B) 4.5<br/>(C) 4.25 (D) 4.15</p>                                                               |   |
| Ans: (B) 4.5                                                                                                                                                                                                                                                                                                                                            | 1 |
| <p><b>17.</b> A number is chosen at random from the first thirty natural numbers. The probability of getting a prime number is :</p> <p>(A) <math>\frac{1}{30}</math> (B) <math>\frac{11}{30}</math><br/>(C) <math>\frac{3}{10}</math> (D) <math>\frac{1}{3}</math></p>                                                                                 |   |
| Ans: (D) $\frac{1}{3}$                                                                                                                                                                                                                                                                                                                                  | 1 |

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| <p><b>18.</b> Two dice are thrown simultaneously. The probability of getting 6 as a product of the two numbers obtained, is :</p> <p>(A) <math>\frac{1}{12}</math> (B) <math>\frac{5}{36}</math></p> <p>(C) <math>\frac{1}{9}</math> (D) <math>\frac{1}{6}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |
| <p>Ans: (C) <math>\frac{1}{9}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>1</p>       |
| <p><i>Questions number 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.</i></p> <p>(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).</p> <p>(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is <b>not</b> the correct explanation of Assertion (A).</p> <p>(C) Assertion (A) is true, but Reason (R) is false.</p> <p>(D) Assertion (A) is false, but Reason (R) is true.</p> <p><b>19.</b> Assertion (A) : For <math>0^\circ \leq \theta &lt; 90^\circ</math>, <math>\sec \theta + \cos \theta \geq 2</math>.</p> <p>Reason (R) : For <math>x &gt; 0</math>, <math>x + \frac{1}{x} \geq 2</math>.</p> |                |
| <p>Ans: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>1</p>       |
| <p><b>20.</b> Assertion (A) : If the surface area of a sphere is <math>616 \text{ cm}^2</math>, then its diameter is 12 cm.</p> <p>Reason (R) : Surface area of a sphere of radius <math>r</math> is <math>4\pi r^2</math> square units.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |
| <p>Ans: (D) Assertion (A) is false, but Reason (R) is true.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>1</p>       |
| <p style="text-align: center;"><b>SECTION B</b></p> <p><i>This section has 5 Very Short Answer (VSA) type questions carrying 2 marks each.</i> <span style="float: right;"><math>5 \times 2 = 10</math></span></p> <p><b>21.</b> Find the smallest number which when divided by 35, 56 or 84, leaves a remainder of 5 in each case.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |
| <p>Solution: <math>35 = 5 \times 7</math><br/> <math>56 = 2^3 \times 7</math><br/> <math>84 = 2^2 \times 3 \times 7</math><br/> <math>\text{LCM}(35, 56, 84) = 2^3 \times 3 \times 5 \times 7 = 840</math><br/> Required number = LCM + Remainder = <math>840 + 5 = 845</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>1<br/>1</p> |

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| <p><b>22.</b> (a) Find the zeroes of the polynomial <math>p(x) = 4x^2 - 4x + 1</math> and verify the relationship between the zeroes and the coefficients.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) If <math>\alpha, \beta</math> are the zeroes of the quadratic polynomial <math>p(x) = x^2 - 4x - 12</math>, then find the value of <math>\frac{1}{\alpha^2} + \frac{1}{\beta^2}</math>.</p>                                                                                                                                                                                                                                                                                                            |                                                                                            |
| <p>Solution: <math>p(x) = 4x^2 - 4x + 1 = (2x - 1)(2x - 1)</math><br/> Zeroes are <math>= \frac{1}{2}, \frac{1}{2}</math><br/> Sum of zeroes <math>= \frac{1}{2} + \frac{1}{2} = 1 = -\frac{(-4)}{4} = -\frac{b}{a}</math><br/> Product of zeroes <math>= \frac{1}{4} = \frac{1}{4} = \frac{c}{a}</math></p> <p style="text-align: center;"><b>OR</b></p> <p><math>p(x) = x^2 - 4x - 12 = (x - 6)(x + 2)</math><br/> Zeroes are <math>= 6, -2</math><br/> <math>\therefore \frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{5}{18}</math></p>                                                                                                                                                                               | <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p>1</p> |
| <p><b>23.</b> Prove that :</p> $(a \sin \theta + b \cos \theta)^2 + (a \cos \theta - b \sin \theta)^2 = a^2 + b^2.$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                            |
| <p>Solution: LHS <math>= (a \sin \theta + b \cos \theta)^2 + (a \cos \theta - b \sin \theta)^2</math></p> $= a^2 \sin^2 \theta + b^2 \cos^2 \theta + 2ab \sin \theta \cos \theta + a^2 \cos^2 \theta + b^2 \sin^2 \theta - 2ab \sin \theta \cos \theta$ $= a^2(\sin^2 \theta + \cos^2 \theta) + b^2(\sin^2 \theta + \cos^2 \theta)$ $= a^2 + b^2 = \text{RHS}$                                                                                                                                                                                                                                                                                                                                                            | <p>1</p> <p>1</p>                                                                          |
| <p><b>24.</b> Prove that :</p> $(\sec \theta - \operatorname{cosec} \theta)(1 + \tan \theta + \cot \theta) = \tan \theta \sec \theta - \cot \theta \operatorname{cosec} \theta.$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                            |
| <p>Solution: LHS <math>= (\sec \theta - \operatorname{cosec} \theta)(1 + \tan \theta + \cot \theta)</math></p> $= \left( \frac{1}{\cos \theta} - \frac{1}{\sin \theta} \right) \left( 1 + \frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} \right)$ $= \left( \frac{\sin \theta - \cos \theta}{\sin \theta \cos \theta} \right) \left( \frac{\sin \theta \cos \theta + \sin^2 \theta + \cos^2 \theta}{\sin \theta \cos \theta} \right)$ $= \frac{\sin^3 \theta - \cos^3 \theta}{\sin^2 \theta \cos^2 \theta} = \frac{\sin^3 \theta}{\sin^2 \theta \cos^2 \theta} - \frac{\cos^3 \theta}{\sin^2 \theta \cos^2 \theta}$ $= \tan \theta \sec \theta - \cot \theta \operatorname{cosec} \theta = \text{RHS}$ | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p>                   |

- 25.** (a) The perimeter of a sector of circle of radius 5.6 cm is 27.2 cm. Find the area of the sector.

**OR**

- (b) A chord of length 10 cm is drawn in a circle of radius  $5\sqrt{2}$  cm. Find the area of the minor segment of the circle.  
(Use  $\pi = 3.14$ )

Solution: (a) Perimeter of a sector = 27.2 cm

$$\frac{\theta}{360} \times 2\pi r + 2r = 27.2$$

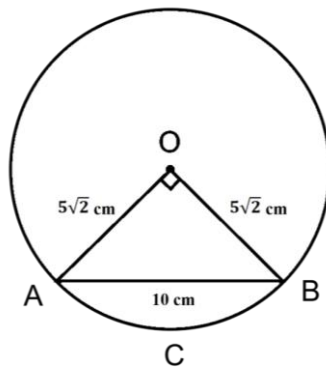
$$\frac{2\pi r \theta}{360} = 16$$

$$\text{Area of the sector} = \frac{2\pi r \theta}{360} \times \frac{r}{2} = 16 \times \frac{5.6}{2}$$

$$= 44.8 \text{ cm}^2$$

**OR**

(b)



Since  $(10)^2 = (5\sqrt{2})^2 + (5\sqrt{2})^2$   
 $\therefore \triangle AOB$  is an isosceles right-angled triangle  
 So,  $\theta = 90^\circ$

$$\text{Area of the minor segment} = \frac{90}{360} \times 3.14 \times (5\sqrt{2})^2 - \frac{1}{2} \times 5\sqrt{2} \times 5\sqrt{2}$$

$$= 14.25 \text{ cm}^2$$

### SECTION C

*This section has 6 Short Answer (SA) type questions carrying 3 marks each.*  $6 \times 3 = 18$

- 26.** Prove that  $\sqrt{5}$  is an irrational number.

Solution: Let  $\sqrt{5}$  be a rational number such that  $\sqrt{5} = \frac{p}{q}$ , where p and q are co-prime integers and  $q \neq 0$ .

$$\sqrt{5}q = p$$

$$5q^2 = p^2$$

5 divides  $p^2 \Rightarrow$  5 divides p as well

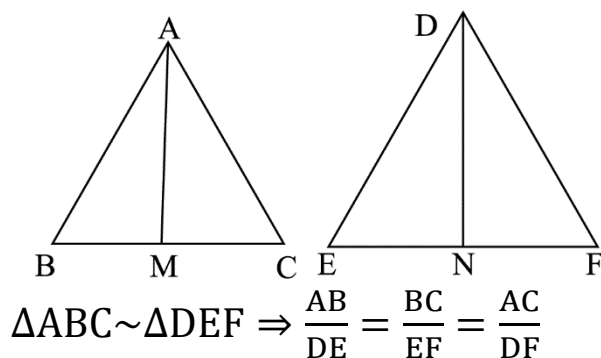
Let  $p = 5m$  (for some integer m)



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| $5q^2 = 25m^2$<br>$q^2 = 5m^2$<br>5 divides $q^2 \Rightarrow$ 5 divides $q$ as well<br>$p$ and $q$ have a common factor 5, which is a contradiction as $p$ and $q$ are co-prime integers.<br>$\therefore$ our assumption is wrong<br>Hence, $\sqrt{5}$ is an irrational number.                                                                                                                                                                                                                                                                         | $\frac{1}{2}$<br><br><br>$\frac{1}{2}$<br><br>$\frac{1}{2}$               |
| <p><b>27.</b> (a) Solve the following pair of linear equations :</p> $7(y + 3) - 2(x + 2) = 14, \quad 4(y - 2) + 3(x - 3) = 2$ <p style="text-align: center;"><b>OR</b></p> <p>(b) Two places A and B are 100 km apart on a highway. A car starts from A and another from B at the same time. If they move in the same direction, they meet in 5 hours, and if they move in opposite directions, they meet in 1 hour and 15 minutes. Find the speed of each car.</p>                                                                                    |                                                                           |
| Solution: (a) $\left. \begin{array}{l} 7y - 2x = -3 \\ 4y + 3x = 19 \end{array} \right\}$<br>On Solving, we get $x = 5$ and $y = 1$ <p style="text-align: center;"><b>OR</b></p> <p>(b) Let <math>x</math> km/h be the speed of the car starting from point A and <math>y</math> km/h be the speed of the car starting from point B.</p> $5x - 5y = 100$ $\frac{5}{4}x + \frac{5}{4}y = 100 \Rightarrow x + y = 80$ On solving we get, $x = 50$ and $y = 30$<br>The speed of the car starting from A is 50 km/h and the car starting from B is 30 km/h. | $\frac{1}{2} + \frac{1}{2}$<br><br>$1 + 1$<br><br><br><br><br>1<br>1<br>1 |
| <p><b>28.</b> The first and the last terms of an AP are <math>-5</math> and <math>95</math> and the sum of all terms of the AP is <math>2295</math>. Find the number of terms in the AP and the common difference.</p>                                                                                                                                                                                                                                                                                                                                  |                                                                           |
| Solution: $a = -5, a_n = 95$ and $S_n = 2295$<br>$S_n = 2295 = \frac{n}{2}(-5 + 95)$ $n = 51$ Now, $a_n = 95$<br>$-5 + 50d = 95$<br>$d = 2$                                                                                                                                                                                                                                                                                                                                                                                                             | $1\frac{1}{2}$<br><br>$\frac{1}{2}$<br><br>$\frac{1}{2}$<br>$\frac{1}{2}$ |

- 29.** If AM and DN are medians of triangles ABC and DEF respectively, where  $\Delta ABC \sim \Delta DEF$ , then prove that  $\frac{AB}{DE} = \frac{AM}{DN}$ .

Solution:



$$\frac{AB}{DE} = \frac{2BM}{2EN} = \frac{BM}{EN} \text{ and } \angle B = \angle E$$

$\Rightarrow \Delta AMB \sim \Delta DNE$  (By SAS Similarity Criterion)

$$\frac{AB}{DE} = \frac{AM}{DN}$$

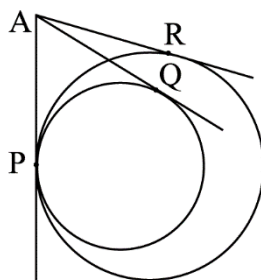
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- 30.** Two circles touch internally at a point P. From a point A on the common tangent at P, tangent segments AQ and AR are drawn to the two circles. Prove that  $AQ = AR$ .

Solution:



As tangents drawn from an external point are equal in length

$$AP = AQ \dots\dots\dots (i)$$

$$\text{and } AP = AR \dots\dots\dots (ii)$$

From Eq. (i) and Eq. (ii)

we get,  $AQ = AR$

1

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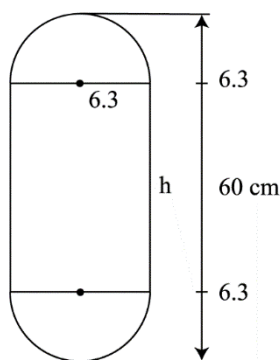
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- 31.** (a) A solid is composed of a cylinder with hemispherical ends. If the whole length of the solid is 60 cm and the radius of each of its hemispherical ends is 6.3 cm, find the cost of polishing its surface at the rate of ₹ 10 per  $\text{cm}^2$ .

**OR**

- (b) A wooden article was made by scooping out a right circular cone of height 7 cm from each end of a solid cylinder of height 21 cm. If the radius of the cylinder, as well as the base of each cone is 6 cm, find the volume of the wood left in the article.

Solution: (a)



Height of the cylindrical part =  $60 - 6.3 - 6.3 = 47.4$  cm

TSA of the solid = CSA of Cylinder +  $2 \times$  CSA of Hemispheres

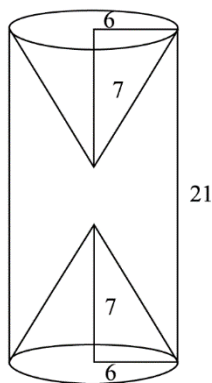
$$= 2 \times \frac{22}{7} \times 6.3 \times (47.4 + 2 \times 6.3)$$

$$= 2376 \text{ cm}^2$$

Cost of polishing the surface of the solid = ₹ 10  $\times$  2376 = ₹ 23,760

**OR**

(b)



$$\text{Volume of cylinder} = \frac{22}{7} \times 6 \times 6 \times 21$$

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| $= 2376 \text{ cm}^3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                                                                                |
| Volumes of two cones $= 2 \times \frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 7$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                  |
| $= 528 \text{ cm}^3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                                                                                |
| Remaining volume $= 2376 - 528 = 1848 \text{ cm}^3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1                                                                                |
| <p style="text-align: center;"><b>SECTION D</b></p> <p><i>This section has 4 Long Answer (LA) type questions carrying 5 marks each.</i> <span style="float: right;"><math>4 \times 5 = 20</math></span></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |
| <p><b>32.</b> (a) Find the value of 'a' for which the quadratic equation <math>x^2 - 6x + 3 \frac{(a+9)}{(a+1)} = 0</math>, <math>a \neq -1</math>, has real and equal roots.</p> <p>Hence, find the roots of the equation.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) A motor boat whose speed is 12 km/h in still water goes 45 km downstream and comes back upstream in a total of 8 hours. Find the speed of the stream.</p>                                                                                                                                                                                                                                                                  |                                                                                  |
| <p>Solution: (a) <math>x^2 - 6x + 3 \frac{(a+9)}{(a+1)} = 0</math></p> <p>For real and equal roots, <math>D = 0</math></p> $36 - 12 \frac{(a+9)}{(a+1)} = 0$ $a = 3$ <p>Now, <math>x^2 - 6x + 9 = 0</math></p> $(x - 3)(x - 3) = 0$ $x = 3, 3$ <p style="text-align: center;"><b>OR</b></p> <p>(b) Let x km/h be the speed of the stream</p> <p>Since the speed of the boat in still water is 12 km/h</p> <p><math>\therefore</math> Downstream speed <math>= (12 + x) \text{ km/h}</math></p> <p>and Upstream speed <math>= (12 - x) \text{ km/h}</math></p> <p>ATQ, <math>\frac{45}{12+x} + \frac{45}{12-x} = 8</math></p> $x^2 = 9$ $x = 3$ <p>Hence, speed of the stream <math>= 3 \text{ km/h}</math></p> | <p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p> |

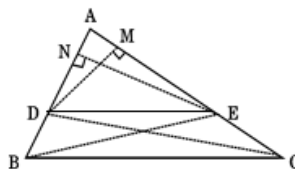
33. (a) A line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points. Prove that it divides the other two sides in the same ratio.

**OR**

- (b) D is the mid-point of the side BC, of a  $\Delta ABC$ . If E is a mid-point of AD, and BE, when produced, meets AC in F, prove that  $AF = \frac{1}{3}AC$ .

Solution:

(a) Given, To prove, Construction



Given: In  $\Delta ABC$ ,  $DE \parallel BC$

To Prove:  $\frac{AD}{DB} = \frac{AE}{EC}$

Construction: Draw  $DM \perp AC$ ,  $EN \perp AB$ , join BE and CD

$$\text{Proof : } \frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DBE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB} \dots\dots\dots(i)$$

$$\frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DCE)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \dots\dots\dots(ii)$$

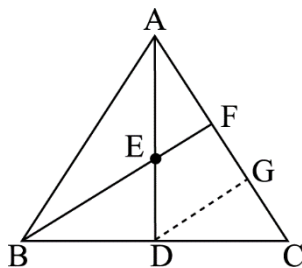
As  $\Delta DBE$  and  $\Delta DCE$  lie on the same base and between same parallels BC and DE

$$\therefore \text{ar}(\Delta DBE) = \text{ar}(\Delta DCE) \text{ or } \frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DBE)} = \frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DCE)} \dots\dots\dots(iii)$$

$$\text{From (i), (ii) and (iii), we get } \frac{AD}{DB} = \frac{AE}{EC}$$

**OR**

(b)



Const. Draw  $DG \parallel BF$

$$\text{In } \Delta BCF, \frac{BD}{CD} = 1 = \frac{FG}{GC} \Rightarrow CG = FG \dots\dots(i)$$

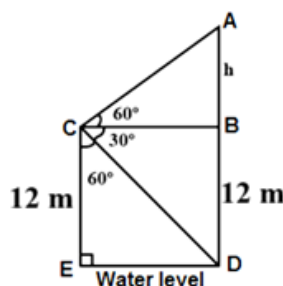
In  $\Delta ADG$ , E is the mid point and  $EF \parallel DG$

$$\frac{AE}{ED} = 1 = \frac{AF}{FG} \Rightarrow AF = FG \dots\dots(ii)$$

|                                                                                             |                                                                                                  |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <p>From Eq. (i) and Eq. (ii)</p> $AF = FG = CG$ <p>i.e. <math>AF = \frac{1}{3}AC</math></p> | <p><math>1\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|

- 34.** A man standing on the deck of a ship which is 12 m above the water level, observes the angle of elevation of the top of a hill as  $60^\circ$  and the angle of depression of the base of the hill as  $30^\circ$ . Calculate the distance of the hill from the ship and the height of the hill.

Solution:



In  $\triangle ABC$

$$\tan 60^\circ = \frac{h}{BC}$$

$$BC = \frac{h\sqrt{3}}{3}$$

$$\text{Now, } BC = ED = \frac{h\sqrt{3}}{3}$$

In  $\triangle CED$

$$\tan 30^\circ = \frac{12}{ED}$$

$$ED = 12\sqrt{3}$$

$$\therefore \text{Distance of hill from ship} = 12\sqrt{3} \text{ m}$$

$$\frac{h\sqrt{3}}{3} = 12\sqrt{3} \Rightarrow h = 36$$

$$\therefore \text{Height of the hill} = h + 12 = 48 \text{ m}$$

- 35.** Find the mean and the median of daily wages of the workers from the following data :

| Wage/day (in ₹) | Number of workers |
|-----------------|-------------------|
| 250 – 300       | 15                |
| 300 – 350       | 40                |
| 350 – 400       | 50                |
| 400 – 450       | 60                |
| 450 – 500       | 45                |
| 500 – 550       | 40                |
| 550 – 600       | 15                |

Solution:

| Wages/day<br>(in ₹) | Number of<br>Workers | $x_i$          | Cumulative<br>Frequency | $u_i$ | $f_i u_i$ |
|---------------------|----------------------|----------------|-------------------------|-------|-----------|
| 250-300             | 15                   | 275            | 15                      | -3    | -45       |
| 300-350             | 40                   | 325            | 55                      | -2    | -80       |
| 350-400             | 50                   | 375            | 105                     | -1    | -50       |
| 400-450             | 60                   | <b>A = 425</b> | 165                     | 0     | 0         |
| 450-500             | 45                   | 475            | 210                     | 1     | 45        |
| 500-550             | 40                   | 525            | 250                     | 2     | 80        |
| 550-600             | 15                   | 575            | 265                     | 3     | 45        |
| <b>Total</b>        | <b>N = 265</b>       |                |                         |       | <b>-5</b> |

Correct  
Table  
2

Median class = 400 – 450

$$\text{Median} = 400 + \frac{132.5-105}{60} \times 50 = 422.92$$

∴ The median wages = ₹ 422.92

$$\text{Mean} = 425 + \frac{(-5)}{265} \times 50 = 424.06$$

∴ The mean wages = ₹ 424.06

1½

1½

### SECTION E

*This section has 3 case study based questions carrying 4 marks each.*

$$3 \times 4 = 12$$

#### Case Study – 1

**36.** Yogesh started saving money for his new project. He started saving ₹ 200 in the first month, ₹ 250 in the second month, ₹ 300 in the third month and so on. He continues to save in this manner for quite some time.

Based on the above information, answer the following questions :

- (i) Show that the pattern of savings followed by him forms an AP. 1
- (ii) In which month would he save ₹ 1,000 ? 1
- (iii) (a) Determine the total amount saved in the first 20 months. 2

**OR**

- (iii) (b) How many months will he take to save a total amount of ₹ 21,450 ? 2

Solution: (i) 200, 250, 300, ..... form an A. P., with  $d = 50$

(ii)  $a_n = 200 + (n - 1)50 = 1000$   
 $n = 17$

In 17<sup>th</sup> month, he would save ₹ 1,000

(iii) (a)  $S_{20} = \frac{20}{2} (2 \times 200 + 19 \times 50)$

Total amount saved in the first 20 months = ₹13,500

**OR**

1

1

1

1

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(iii) (b) <math>S_n = 21450</math><br/> <math>\frac{n}{2}(2 \times 200 + (n - 1) \times 50) = 21450</math><br/> <math>n^2 + 7n - 858 = 0</math><br/> <math>n = 26, -33</math> (Rejected)<br/> Yogesh will take 26 months to save a total amount of ₹ 21,450</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>1<br/>1</p>                                                                                                                                                 |
| <p style="text-align: center;"><b>Case Study – 2</b></p> <p><b>37.</b> By drawing two mutually perpendicular lines on a plane, we can mark the position of any point on the plane. The horizontal direction is commonly called the x-axis and the vertical direction is commonly called the y-axis. Read the following passage and answer the questions that follow, using the above information :<br/> In a classroom, four students Aneesh, Bijender, Chaman and Dinesh are sitting at A(1, 6), B(4, 9), C(7, 6) and D(4, 3), respectively. Then a new student Ravi joins the class. Based on the above information, answer the following questions :</p> <p>(i) Find the distances AC and BD. <span style="float: right;">1</span></p> <p>(ii) Find the mid-points of AC and BD. <span style="float: right;">1</span></p> <p>(iii) (a) Show that ABCD forms a square. <span style="float: right;">2</span></p> <p style="text-align: center;"><b>OR</b></p> <p>(iii) (b) If Ravi wants to sit in the middle of the four students, find the position of Ravi and justify your answer. <span style="float: right;">2</span></p> |                                                                                                                                                                |
| <p><b>Solution:</b></p> <p>(i) AC = BD = 6 units</p> <p>(ii) Mid-Point of AC = (4, 6)<br/> Mid-Point of BD = (4, 6)</p> <p>(iii) (a) <math>AB = \sqrt{(4 - 1)^2 + (9 - 6)^2} = 3\sqrt{2}</math> units<br/> <math>BC = \sqrt{(7 - 4)^2 + (6 - 9)^2} = 3\sqrt{2}</math> units<br/> <math>AC = \sqrt{(7 - 1)^2 + (6 - 6)^2} = 6</math> units<br/> <math>BD = \sqrt{(4 - 4)^2 + (9 - 3)^2} = 6</math> units<br/> Since adjacent sides and diagonals are equal<br/> Hence, ABCD is a square.</p> <p style="text-align: center;"><b>OR</b></p> <p>(iii) (b) Ravi should sit at the point of intersection of the diagonals i.e. (4, 6).<br/> This is equidistant from the 4 students.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><math>\frac{1}{2} + \frac{1}{2}</math><br/><br/> <math>\frac{1}{2}</math><br/> <math>\frac{1}{2}</math><br/><br/> 1<br/><br/> 1<br/><br/> 1<br/><br/> 1</p> |



**Case Study – 3**

**38.** Sunil goes to a store to purchase juice cartons for his house, as some guests are expected to come. The store has 8 cartons of mango juice, 5 cartons of litchi juice, 3 cartons of apple juice and 2 cartons of banana juice. Each carton contains 5 tetrapacks of the juice.

Based on the above information, answer the following questions :

- (i) If Sunil chooses a carton at random, what is the probability of getting a carton of mango juice ? 1
- (ii) What is the probability of selecting a carton which is not of apple juice ? 1
- (iii) (a) Sunil buys 2 cartons of mango juice and 1 carton each of litchi, apple and banana juice. He opens them and places all tetrapacks on a table after mixing the packs. Find the probability of selecting a tetrapack of litchi juice or banana juice at random, by a guest. 2

**OR**

- (iii) (b) Find the probability of selecting a tetrapack of apple juice or banana juice at random, by a guest. 2

|               |                                                                       |   |
|---------------|-----------------------------------------------------------------------|---|
| Solution: (i) | $P(\text{a carton of mango juice}) = \frac{4}{9}$                     | 1 |
| (ii)          | $P(\text{a carton which is not of apple juice}) = \frac{5}{6}$        | 1 |
| (iii) (a)     | $P(\text{a tetrapack of litchi juice or banana juice}) = \frac{2}{5}$ | 2 |
| <b>OR</b>     |                                                                       |   |
| (iii) (b)     | $P(\text{a tetrapack of apple juice or banana juice}) = \frac{2}{5}$  | 2 |