# Marking Scheme
# Strictly Confidential
## (For Internal and Restricted use only)
## Secondary School Examination, 2024
## SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/S/3)

**General Instructions: -**

**1** 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.

**2** **"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."**

**3** 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. **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.**

**4** 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.

**5** 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.

**6** 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. **This is most common mistake which evaluators are committing.**

**7** 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.

**8** 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.

**9** 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 **"Extra Question"**.

**10** No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

**11** A full scale of marks 0-80 (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.

**12** 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 of questions in question paper.

**13** Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
- Leaving answer or part thereof unassessed in an answer book.
- Giving more marks for an answer than assigned to it.
- Wrong totaling of marks awarded on an answer.

| | |
|---|---|
| | • Wrong transfer of marks from the inside pages of the answer book to the title page.<br>• Wrong question wise totaling on the title page.<br>• Wrong totaling of marks of the two columns on the title page.<br>• Wrong grand total.<br>• Marks in words and figures not tallying/not same.<br>• Wrong transfer of marks from the answer book to online award list.<br>• 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.)<br>• Half or a part of answer marked correct and the rest as wrong, but no marks awarded. |
| **14** | 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. |
| **15** | 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. |
| **16** | The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation. |
| **17** | 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. |
| **18** | 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. |

# MARKING SCHEME MATHEMATICS (BASIC) 430/S/3

## SECTION A

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

**1.** If $\sin\theta = (\sqrt{2} - 1)\cos\theta$, then :

(A) $\tan\theta = \sqrt{2} + 1$ (B) $\cot\theta = \sqrt{2} + 1$

(C) $\cot\theta = \sqrt{2} - 1$ (D) $\tan\theta = \sqrt{2}$

| | |
|---|---|
| Answer (B) $\cot\theta = \sqrt{2} + 1$ | 1 |

**2.** If length of an arc of a circle subtending an angle θ at the centre is numerically equal to the area of the sector formed by it, then the radius of the circle is :

(A) 1 unit (B) 2 units

(C) 3 units (D) $\frac{1}{2}$ unit

| | |
|---|---|
| Answer (B) 2 units | 1 |

**3.** There are 16 observations arranged in increasing order of their values in a data. The median will be the value of :

(A) 8th observation

(B) 7th observation

(C) average of 8th and 9th observations

(D) average of 7th and 8th observations

| | |
|---|---|
| Answer (C) average of 8th and 9th observations | 1 |

**4.** If the volume of a sphere of radius R is equal to 16 times the volume of a hemisphere of radius r, then R : r is :

(A) 1 : 2 (B) 2 : 1

(C) 8 : 1 (D) 1 : 8

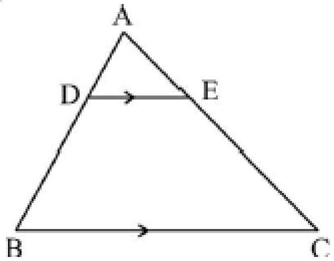
| | |
|---|---|
| Answer (B) 2 : 1 | 1 |

**5.** If $a = 2^7.3^{10}$ and $b = 2^3.3^7$, then HCF (a, b) is :

(A) $2^7.3^{10}$ (B) $2^{10}.3^{17}$

(C) $2^3.3^7$ (D) $2^7.3^7$

| | |
|---|---|
| Answer (C) $2^3.3^7$ | 1 |

| | |
|---|---|
| **6.** If the system of equations $2x + 3y = 5$ and $4x + ky = 10$ has infinitely many solutions, then the value of 'k' is :<br>(A) 1 (B) $\frac{1}{2}$<br>(C) $\frac{3}{2}$ (D) 6 | |
| Answer (D) 6 | 1 |
| **7.** The centre of a circle is at $(2, -3)$. If one end point of the diameter AB is $A(3, -10)$, then the coordinates of B are :<br>(A) $(4, 1)$ (B) $(-4, 1)$<br>(C) $(1, 4)$ (D) $(-1, -4)$ | |
| Answer (C)(1, 4) | 1 |
| **8.** The equation $4x^2 - 25 = 0$ has :<br>(A) no real roots (B) real and equal roots<br>(C) real and distinct roots (D) real roots of same sign | |
| Answer (C) real and distinct roots | 1 |
| **9.** In the given figure, if in $\Delta$ ABC, DE $\parallel$ BC, then which of the following equality holds ?<br> <br>(A) $\frac{AD}{AB} = \frac{AE}{CE}$ (B) $\frac{AD}{AB} = \frac{AE}{AC}$<br>(C) $\frac{AD}{BD} = \frac{AE}{AC}$ (D) $\frac{AD}{AB} = \frac{AC}{AE}$ | |
| Answer (B) $\frac{AD}{AB} = \frac{AE}{AC}$ | 1 |
| **10.** A line which intersects a circle in two distinct points, is called a :<br>(A) chord (B) tangent<br>(C) secant (D) diameter | |
| Answer (C) secant | 1 |

| | |
|---|---|
| **11.** If $\tan A = \frac{3}{4}$, then $\frac{\sin^2 A + \cos^2 A}{\sec A}$ is equal to :<br>(A) $\frac{4}{3}$ (B) $\frac{4}{5}$<br>(C) $\frac{3}{5}$ (D) $\frac{5}{4}$ | |
| Answer (B) $\frac{4}{5}$ | 1 |
| **12.** A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is :<br>(A) 30° (B) 45°<br>(C) 90° (D) 60° | |
| Answer (D) $60^0$ | 1 |
| **13.** When degree measure of an angle subtended by an arc at the centre of a circle is 90°, the area of the corresponding sector of the circle of radius r, is :<br>(A) $\frac{1}{6}\pi r^2$ (B) $\frac{1}{4}\pi r^2$<br>(C) $\frac{1}{2}\pi r^2$ (D) $\pi r^2$ | |
| Answer (B) $\frac{1}{4}\pi r^2$ | 1 |
| **14.** The probability of selecting at random a 2-digit number from the first hundred natural numbers, is :<br>(A) $\frac{9}{100}$ (B) $\frac{9}{10}$<br>(C) $\frac{91}{100}$ (D) $\frac{89}{100}$ | |
| Answer (B) $\frac{9}{10}$ | 1 |

**15.** A number is chosen at random from the numbers – 3, – 2, – 1, 0, 1, 2, 3. The probability that square of this number is less than or equal to 1 is :

(A) $\frac{1}{7}$ (B) $\frac{2}{7}$

(C) $\frac{3}{7}$ (D) $\frac{5}{7}$

| Answer | Marks |
|---|---|
| Answer (C) $\frac{3}{7}$ | 1 |

**16.** The LCM of the smallest odd prime number and greatest 2-digit number, is :

(A) 1 (B) 99

(C) 297 (D) 300

| Answer | Marks |
|---|---|
| Answer (B) 99 | 1 |

**17.** If one root of the quadratic equation $x^2 - 4x + 3 = 0$ is 1, then the other root is :

(A) 4 (B) – 4

(C) 3 (D) – 3

| Answer | Marks |
|---|---|
| Answer (C) 3 | 1 |

**18.** Which of the following is ***not*** the criterion for similarity of two triangles ?

(A) SAS (B) SSS

(C) AAA (D) RHS

| Answer | Marks |
|---|---|
| Answer (D) RHS | 1 |

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(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, but Reason (R) is ***not*** the correct explanation of Assertion (A).

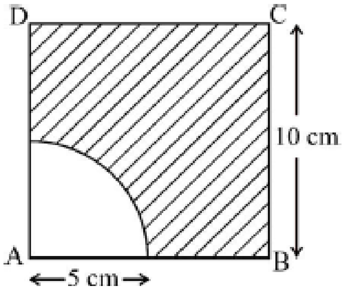
(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

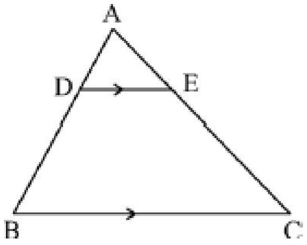
**19.** *Assertion (A) :* The distance of the point (– 3, 5) from the x-axis is 3 units.

*Reason (R) :* Abscissa of a point gives the distance of the point from the y-axis.

| Answer | Marks |
|---|---|
| Answer (D) Assertion (A) is false, but Reason (R) is true. | 1 |

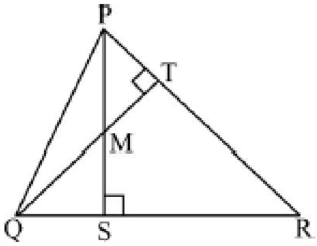
| | |
|---|---|
| **20.** *Assertion (A) :* $2+\sqrt{2}$ is an irrational number.<br>*Reason (R) :* The sum of a non-zero rational number and an irrational number is always an irrational number. | |
| Answer (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). | 1 |
| **SECTION B**<br>*This section has **5** Very Short Answer (VSA) type questions of **2** marks each.* *5×2=10*<br>**21.** In the given figure, ABCD is a square of side 10 cm. A sector of radius 5 cm is cut out from one of the corners. Find the area of the shaded region. (Take π = 3.14)<br><br> | |
| Solution: Area of the shaded region = area of square − area of sector | ½ |
| $= (10)^2 - \frac{90}{360}\pi(5)^2$ | 1 |
| $= 100 - \frac{3.14 \times 25}{4}$ | |
| $= 80.38\ sq.cm$ | ½ |
| **22.** Solve for x and y :<br>$x + \frac{y}{2} = 4$ and $\frac{x}{3} + 2y = 5$ | |
| Solution: On solving the given equations, we get x = 3 and y = 2 | 1+1 |

**23.** (a) In the given figure, ABC is a triangle in which DE ∥ BC, AD = 3 cm, BD = 4 cm and AC = 14 cm. Find the length of AE.



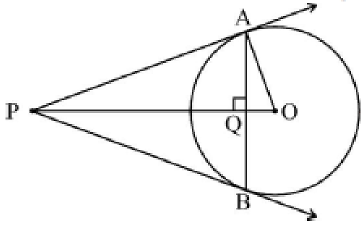
**OR**

(b) In the given figure, PQR is a triangle in which PS and QT are altitudes from P and Q respectively, intersecting each other at M. Prove that Δ QSM ~ Δ PTM.



| | |
|---|---|
| Solution:(a) Let AE = $x$ cm | |
| As DE $\parallel$ BC , $\frac{AD}{DB}=\frac{AE}{EC}$ | 1 |
| $\frac{3}{4}=\frac{x}{14-x}$ | ½<br>½ |
| ⇒ $x$ = 6 cm ⇒ AE =6 cm | |
| **OR** | |
| (b) In Δ QSM and Δ PTM | |
| ∠ QSM = ∠ PTM (each $90^0$ ) | ½ |
| ∠ QMS = ∠ PMT (vertically opposite angles) | ½ |
| ∴ Δ QSM ~ Δ PTM (AA criteria) | 1 |

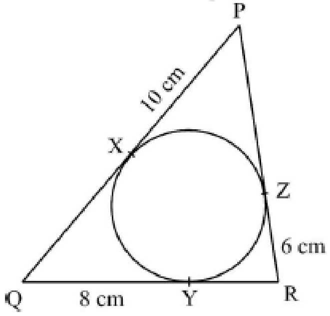
**24.** In the given figure, AB is a chord of length 16 cm of a circle of radius 10 cm. The tangents at A and B meet at P. Find the length of PA.



| | |
|---|---|
| Solution: In Δ OQA | |
| $OQ^2 = 10^2 - 8^2 \Rightarrow OQ = 6cm$ | |
| Let PQ = x cm | |
| $\therefore$ In Δ AQP, $PA^2 = x^2 + 8^2$ | ½ |
| In Δ OAP, $PA^2 = (x+6)^2 - 10^2$ | ½ |
| $\Rightarrow (x+6)^2 - 10^2 = x^2 + 8^2$ | |
| $\Rightarrow$ x= $\frac{32}{3}$ | ½ |
| $\Rightarrow$ PA = $\sqrt{\left(\frac{32}{3}\right)^2 + 8^2} = \frac{40}{3}$ cm | ½ |
| **25.** (a) If $\tan A = \sqrt{3}$, then find the value of $\cos^2 A - \sin^2 A$.<br>**OR**<br>(b) If $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$, find the value of x. | |
| Solution:(a) tan A = $\sqrt{3}$ $\Rightarrow$ A = $60^0$ | ½ |
| $\cos^2 A - \sin^2 A = \cos^2 60^0 - \sin^2 60^0$ | |
| $= \left(\frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2$ | ½+½ |
| $= -\frac{1}{2}$ | ½ |
| **OR** | |
| (b) $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$ | |
| $x\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} - 1 = \frac{\sqrt{3}}{2}$ | 1½ |
| $\Rightarrow x = \frac{2}{\sqrt{3}}$ or $\frac{2\sqrt{3}}{3}$ | ½ |

## SECTION C

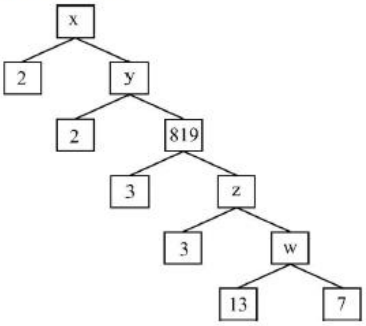
*This section has **6** Short Answer (SA) type questions of **3** marks each.* *6×3=18*

| | |
|---|---|
| **26.** The numbers on a die are replaced by the first six even numbers. The die is rolled once. Find the probability that the number appearing on the die is :<br>(i) greater than 4<br>(ii) divisible by 3<br>(iii) not a multiple of 10 | |
| Solution:(i) P (number greater than 4) $= \frac{4}{6}$ *or* $\frac{2}{3}$ | 1 |
| (ii) P(number divisible by 3) = $\frac{2}{6}$ *or* $\frac{1}{3}$ | 1 |
| (iii) P(number not a multiple of 10) = $\frac{5}{6}$ | 1 |
| **27.** In the given figure, $\Delta$PQR circumscribes the circle. If PX = 10 cm, QY = 8 cm and RZ = 6 cm, then find the perimeter of $\Delta$PQR.<br><br> | |
| Solution: RZ = RY $\Rightarrow$ RY = 6 cm<br>QX = QY $\Rightarrow$ QX = 8 cm<br>PZ = PX $\Rightarrow$ PZ = 10 cm<br>the length of tangents drawn from an external point to a circle are equal | 1 |
| PQ = PX + QX = 18 cm<br>QR = QY + YR = 14 cm<br>PR = PZ +ZR = 16 cm | 1½ |
| Perimeter of $\Delta$ PQR = PQ +QR +PR = 48 cm | ½ |

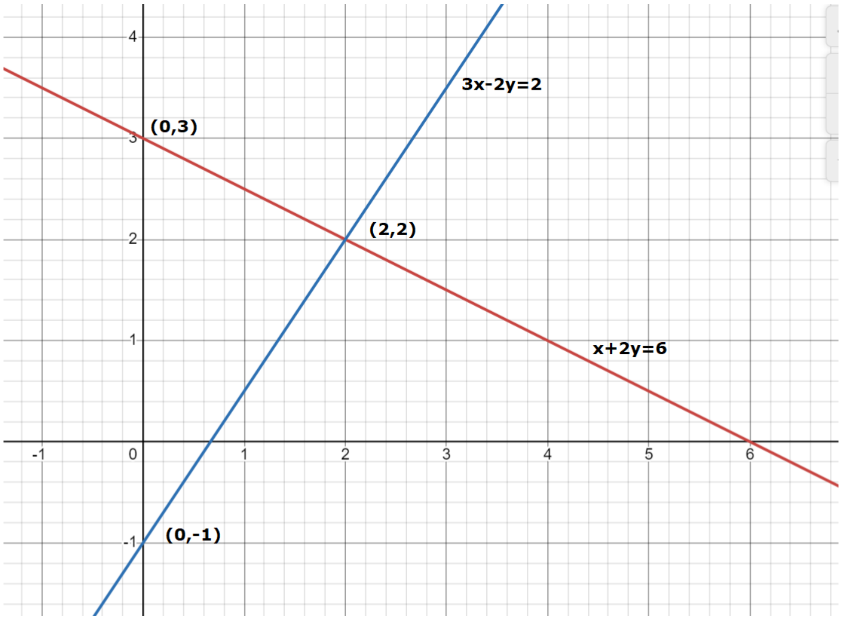
**28.** (a) Prove that $\sqrt{5}$ is an irrational number.

**OR**

(b) Find the values of x, y, z and w in the following factor tree. Also, write the prime factorisation of x.



| | |
|---|---|
| Solution:(a) Let us assume that $\sqrt{5}$ is a rational number. | |
| So it can be expressed in the form p/q where p, q are co-prime integers and $q \neq 0$ | |
| $\sqrt{5} = p/q$ | 1 |
| On squaring both the sides we get, | |
| $\Rightarrow 5 = (p/q)^2$ | |
| $\Rightarrow 5q^2 = p^2$…………………………..(1) | ½ |
| So $p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5 | |
| $\Rightarrow$ p = 5m , for some integer m | |
| $\Rightarrow p^2 = 25m^2$ ……………………………..(2) | |
| From equations (1) and (2), we get, | |
| $5q^2 = 25m^2$ | |
| $\Rightarrow q^2 = 5m^2$ | |
| $\Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 | 1 |
| Hence, p, q have a common factor 5. This contradicts our assumption that they are co-primes. | |
| So, $\sqrt{5}$ is an irrational number. | ½ |
| **OR** | |
| (b) $w = 13 \times 7 = 91$ | ½ |
| $z = 91 \times 3 = 273$ | ½ |
| $y = 2 \times 819 = 1638$ | ½ |
| $x = 1638 \times 2 = 3276$ | ½ |
| $3276 = 2 \times 2 \times 3 \times 3 \times 7 \times 13$ | 1 |

| | |
|---|---|
| **29.** Find the zeroes of the polynomial $4\sqrt{3}\,x^2 + 5x - 2\sqrt{3}$ and verify the relationship between the zeroes and its coefficients. | |
| Solution: $4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$ cm $\Rightarrow (4x-\sqrt{3})(\sqrt{3}x+2) = 0$ | 1 |
| $x = \frac{\sqrt{3}}{4}, -\frac{2}{\sqrt{3}}$ | ½+½ |
| Sum of the zeroes = $\frac{\sqrt{3}}{4} - \frac{2}{\sqrt{3}} = \frac{-5}{4\sqrt{3}} = \frac{-(Coeff.of\ x)}{Coeff.of\ x^2}$ | ½ |
| Product of the zeroes = $\frac{\sqrt{3}}{4} \times \frac{-2}{\sqrt{3}} = \frac{-2\sqrt{3}}{4\sqrt{3}} = \frac{Constant\ term}{Coeff.of\ x^2}$ | ½ |
| **30.** (a) Solve the following system of linear equations graphically :<br>$x + 2y = 6$ and $3x - 2y = 2$<br>Also, write the coordinates of the vertices of the triangle formed by these lines and y-axis.<br>**OR**<br>(b) 16 years ago, at the time of marriage, Ajay was 5 years elder to his wife. The present ages of the wife and Ajay are in the ratio 8 : 9. Find their ages at the time of their marriage. | |
| Solution:(a)<br> | |
| Drawing the graph of x+2y=6 | 1 |
| Drawing the graph of 3x − 2y = 2 | 1 |

| | |
|---|---|
| Solution x=2 and y = 2 | ½ |
| Vertices of the required ∆ are (0,3),(0,-1) and (2,2) | ½ |
| **OR** | |
| (b) Let Ajay's age at the time of marriage be x years | |
| Let wife's age at the time of the marriage be y years | |
| A.T.Q. | |
| x = y +5 ------------------------- (1) | 1 |
| $\frac{y+16}{x+16} = \frac{8}{9}$ $\Rightarrow$ 8x − 9y =16 ------------(2) | 1 |
| Solving (1) and (2) to get | |
| x = 29 and y = 24 | ½+½ |
| ∴ Ajay's age at the time of marriage = 29 years and his wife's age =24 years | |

**31.** Simplify : (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ).

| | |
|---|---|
| Solution: Given expression is | |
| $= \left(\frac{1}{\sin\theta} - \sin\theta\right)\left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$ | 1 |
| $=\left(\frac{1-\sin^2\theta}{\sin\theta}\right)\left(\frac{1-\cos^2\theta}{\cos\theta}\right)\left(\frac{\sin^2\theta+\cos^2\theta}{\cos\theta\,\sin\theta}\right)$ | 1 |
| $= \left(\frac{\cos^2\theta}{\sin\theta}\right)\left(\frac{\sin^2\theta}{\cos\theta}\right)\left(\frac{1}{\cos\theta\,\sin\theta}\right) = 1$ | 1 |

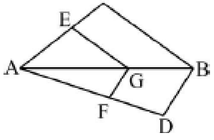
## SECTION D

*This section has **4** Long Answer (LA) type questions of **5** marks each.* *4×5=20*

**32.** If a line is drawn parallel to one side of a triangle intersecting the other sides in distinct points, prove that it divides the other sides in the same ratio.

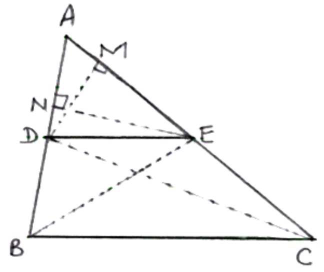
Use the above result to prove the following :

In the given figure, if EG ∥ CB and FG ∥ DB, then prove that $\frac{AE}{EC} = \frac{AF}{FD}$.



Solution (a)Given: In Δ ABC, DE || BC

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



Construction: Join BE, DC and draw DM ⊥ AC and EN ⊥ AB ½

Proof:

$$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2}\times AD\times EN}{\frac{1}{2}\times DB\times EN} = \frac{AD}{DB} \qquad \text{(i)}$$

and $$\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{\frac{1}{2}\times AE\times DM}{\frac{1}{2}\times EC\times DM} = \frac{AE}{EC} \qquad \text{(ii)}$$

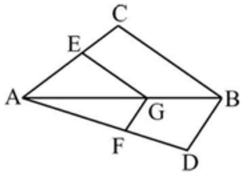
1½

Δ BDE and Δ CDE are on the same base DE and between the same parallels DE and BC.

∴ ar (Δ BDE) = ar (Δ CDE) (iii) ½

From (i), (ii) and (iii) ½

$\frac{AD}{DB} = \frac{AE}{EC}$



In Δ ABC, EG || CB

∴ $\frac{AE}{EC} = \frac{AG}{GB}$ _______ (iv)

In Δ ADB, FG || DB

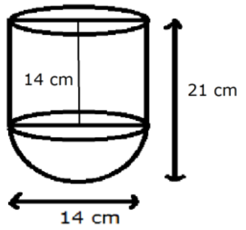
∴ $\frac{AG}{GB} = \frac{AF}{FD}$ _______ (v)

1½

from (iv) and (v) $\frac{AE}{EC} = \frac{AF}{FD}$ ½

**33.** A vessel is in the form of a hemispherical bowl surmounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 21 cm. Find the cost of electroplating the vessel from inside as well as outside @ ₹ 2.50/cm$^2$. (Assuming that thickness of the vessel is negligible)

Solution:



Radius of the hemisphere = $\frac{14}{2}$= 7cm ½

Height of the cylinder = 21 -7 = 14 cm ½

Surface area to be electroplated

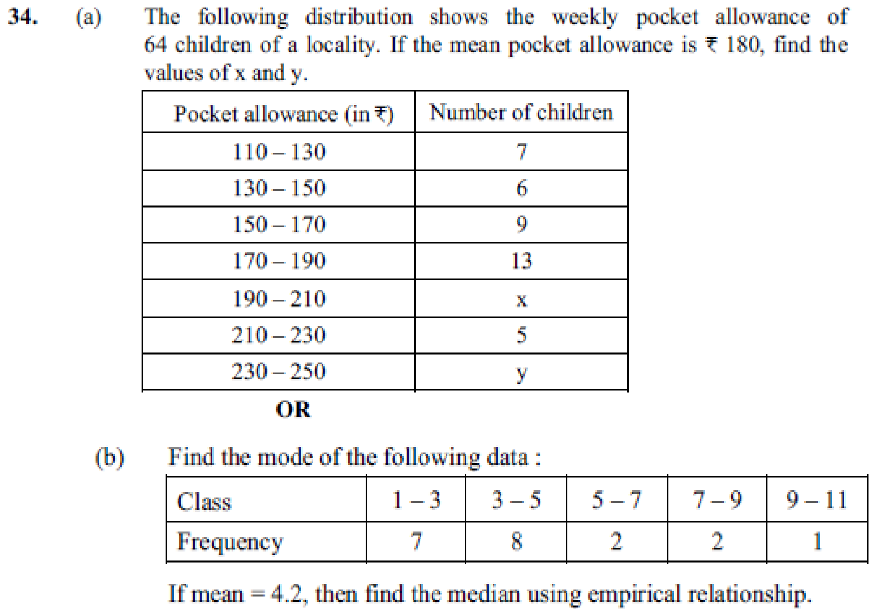
= 2(CSA of hemisphere + CSA of Cylinder) ½

= $2(2\pi r^2 + 2\pi rh)$

= $2\left(2 \times \frac{22}{7} \times 7^2 + 2 \times \frac{22}{7} \times 7 \times 14\right)$ 1+1

= 1848 sq. cm ½

Cost of electroplating the vessel
from inside as well as outside =₹ 2.50 × 1848 = ₹ 4,620 1



**34.** (a) The following distribution shows the weekly pocket allowance of 64 children of a locality. If the mean pocket allowance is ₹ 180, find the values of x and y.

| Pocket allowance (in ₹) | Number of children |
|---|---|
| 110 – 130 | 7 |
| 130 – 150 | 6 |
| 150 – 170 | 9 |
| 170 – 190 | 13 |
| 190 – 210 | x |
| 210 – 230 | 5 |
| 230 – 250 | y |

**OR**

(b) Find the mode of the following data :

| Class | 1 – 3 | 3 – 5 | 5 – 7 | 7 – 9 | 9 – 11 |
|---|---|---|---|---|---|
| Frequency | 7 | 8 | 2 | 2 | 1 |

If mean = 4.2, then find the median using empirical relationship.

Solution:(a)

| Pocket allowance (in ₹) | Number of children ($f_i$) | $x_i$ | $f_i x_i$ |
|---|---|---|---|
| 110 - 130 | 7 | 120 | 840 |
| 130 - 150 | 6 | 140 | 840 |
| 150 - 170 | 9 | 160 | 1440 |
| 170 - 190 | 13 | 180 | 2340 |
| 190 - 210 | x | 200 | 200 x |
| 210 - 230 | 5 | 220 | 1100 |
| 230 - 250 | y | 240 | 240 y |
| | 40+x+y | | 6560 +200x +240y |

2 marks for correct table

A.T.Q.

40 + x +y =64 $\Rightarrow$ x + y = 24 ---------------(1) 1

$$Mean = \frac{\sum f_i x_i}{\sum f_i}$$

$$180 = \frac{6560 + 200x + 240y}{64}$$

$\Rightarrow$ 5x + 6y =124 -------------------------(2) 1

Solving (1) and (2) to get

x = 20 and y = 4 ½ + ½

**OR**

(b)

| Class | Frequency |
|---|---|
| 1 – 3 | 7 |
| 3 -5 | 8 |
| 5 -7 | 2 |
| 7 -9 | 2 |
| 9 -11 | 1 |

Modal class : 3-5

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

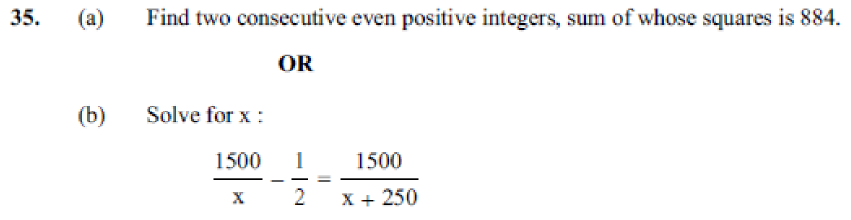
$$Mode = 3 + \frac{8-7}{2\times 8 - 7 - 2} \times 2$$ 2

$$= 3 + \frac{2}{7} = 3.29(approx.)$$ 1

$$3\ Median = Mode + 2\ Mean$$

$$Median = \frac{3.29 + 2\times 4.2}{3}$$ 1½

$$= 3.89(approx.)$$ ½



**35.** (a) Find two consecutive even positive integers, sum of whose squares is 884.

**OR**

(b) Solve for x :

$$\frac{1500}{x} - \frac{1}{2} = \frac{1500}{x+250}$$

Solution: (a) Let the consecutive even positive integers be x and x+ 2 1

A. T. Q. $x^2 + (x+2)^2 = 884$ 1

$\Rightarrow x^2 + 2x - 440 = 0$

$\Rightarrow (x - 20)(x + 22) = 0$ 1½

| | |
|---|---|
| ⇒ x = 20, x= –22 (Rejected)<br>∴ Numbers are 20 and 22 | 1<br>½ |
| **OR** | |
| Solution: (b) $\frac{1500(x+250)-1500(x)}{x(x+250)}=\frac{1}{2}$<br>$\Rightarrow\ x^2+250x-750000=0$<br>$\Rightarrow\ (x-750)(x+1000)=0$<br>⇒ x = 750, x =-1000 | 1½<br>1½<br>1<br>½+½ |

## SECTION E

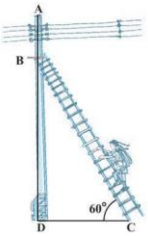
*This section has **3** case study based/source based/passage based/integrated units of assessment of **4** marks each with sub-parts.* *3×4=12*

### Case Study – 1

**36.** A short circuit can happen on electric poles due to several reasons, like

(a) If the insulation is damaged or old, it may allow the hot wires to touch with neutral. This will cause a short circuit.

(b) If there are any loose wire connections or attachments, it will allow the live and neutral wires to touch.



An electrician has to repair an electric fault on a pole of height 5 m. He needs to reach a point 1 m below the top of the pole to undertake the repair work.

Based on the above information, answer the following questions :

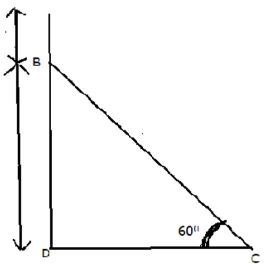
(i) What should be the length of the ladder that he should use which, when inclined at an angle of 60° to the horizontal, enables him to reach the required position ? *2*

(ii) (a) How far from the foot of the pole should he place the foot of the ladder ? *2*

**OR**

(b) What is the length of the ladder if its foot is kept at a distance of 4 m from the foot of the pole ? *2*

Solution:



(i) In $\Delta$BDC , let BC = $x$

$$\sin 60^0 = \frac{4}{x}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{4}{x}$$ 1

$$\Rightarrow x = \frac{8}{\sqrt{3}}\, m \text{ or } \frac{8\sqrt{3}}{3}\, m$$ ½

½

$\therefore$ Length of the ladder = $\frac{8}{\sqrt{3}}\, m \text{ or } \frac{8\sqrt{3}}{3}\, m$

(ii) (a) In $\Delta$ BDC , let DC = $y$

$$\tan 60^0 = \frac{4}{y}$$ 1

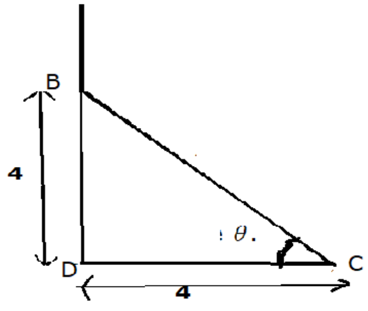
$$\Rightarrow \sqrt{3} = \frac{4}{y}$$ ½

$$\Rightarrow y = \frac{4}{\sqrt{3}}\, m \text{ or } \frac{4\sqrt{3}}{3}\, m$$ ½

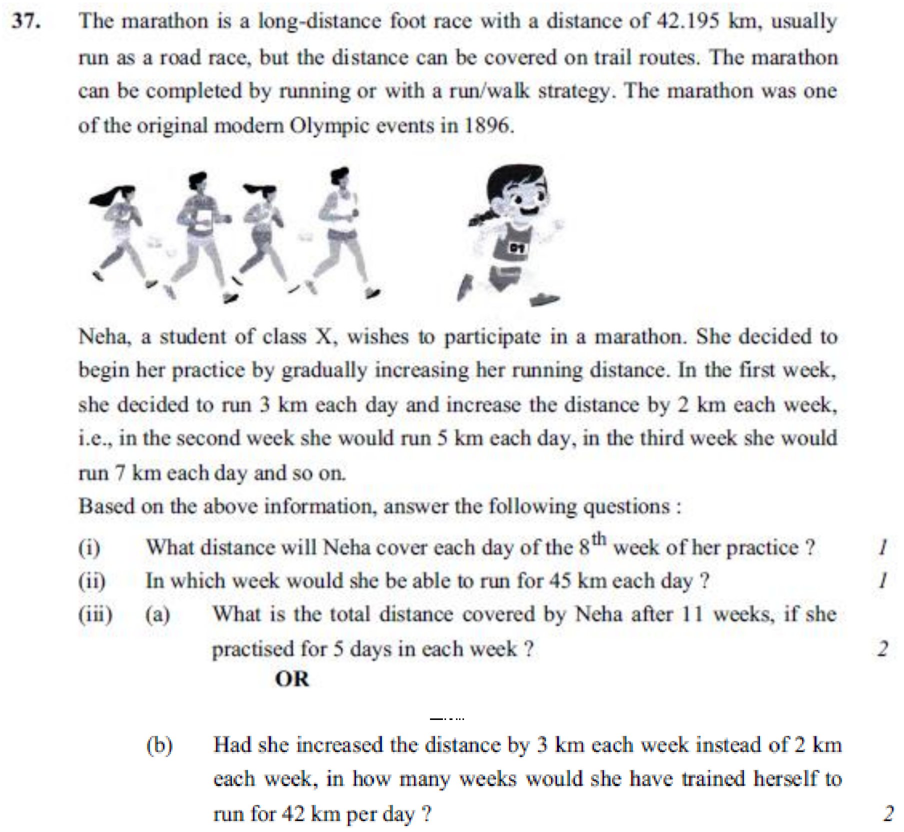
$\therefore$ foot of the ladder should be placed at a distance of $\frac{4\sqrt{3}}{3}\, m$ from the foot of the pole

**OR**

(b)



| | |
|---|---|
| (b) Let angle be $\theta$. | |
| In Δ BDC, | |
| $\tan\theta = \frac{4}{4} = 1 \Rightarrow \theta = 45^0$ | ½ |
| $Now\ \cos 45^0 = \frac{4}{BC} \Rightarrow \frac{1}{\sqrt{2}} = \frac{4}{BC} \Rightarrow BC = 4\sqrt{2}$ | 1½ |
| ∴the length of the ladder if its foot is kept at a distance of 4m from the foot of the pole is $4\sqrt{2}$ m | |



**37.** The marathon is a long-distance foot race with a distance of 42.195 km, usually run as a road race, but the distance can be covered on trail routes. The marathon can be completed by running or with a run/walk strategy. The marathon was one of the original modern Olympic events in 1896.

Neha, a student of class X, wishes to participate in a marathon. She decided to begin her practice by gradually increasing her running distance. In the first week, she decided to run 3 km each day and increase the distance by 2 km each week, i.e., in the second week she would run 5 km each day, in the third week she would run 7 km each day and so on.

Based on the above information, answer the following questions :

(i) What distance will Neha cover each day of the 8th week of her practice ? *1*

(ii) In which week would she be able to run for 45 km each day ? *1*

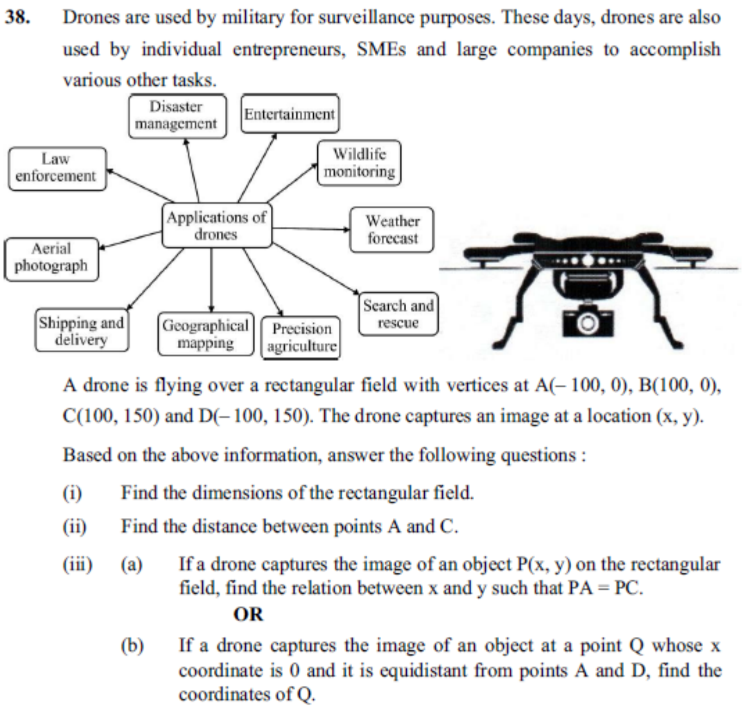
(iii) (a) What is the total distance covered by Neha after 11 weeks, if she practised for 5 days in each week ? *2*

**OR**

(b) Had she increased the distance by 3 km each week instead of 2 km each week, in how many weeks would she have trained herself to run for 42 km per day ? *2*

| | |
|---|---|
| Solution:(i) Distance covered in each day of the 8th week = 3 + 7(2) = 17 km | 1 |
| (ii) 45 = 3 + (n-1)2 ⇒ n = 22 | 1 |
| (iii) $s_{11} = \frac{11}{2}(2\times 3 + 10\times 2)$ | |
| $= 143km$ | 1 |
| Total distance covered by Neha after 11 weeks practicing 5 days in each week | |
| = 143 × 5 = 715 km | 1 |

| | |
|---|---|
| **OR** | |
| 42 = 3 + (n-1)3 | 1 |
| ⇒ n = 14 | 1 |
| Neha would have trained herself to run for 42 km per day in 14 weeks. | |



**38.** Drones are used by military for surveillance purposes. These days, drones are also used by individual entrepreneurs, SMEs and large companies to accomplish various other tasks.

A drone is flying over a rectangular field with vertices at A(– 100, 0), B(100, 0), C(100, 150) and D(– 100, 150). The drone captures an image at a location (x, y).

Based on the above information, answer the following questions :

(i) Find the dimensions of the rectangular field. *1*

(ii) Find the distance between points A and C. *1*

(iii) (a) If a drone captures the image of an object P(x, y) on the rectangular field, find the relation between x and y such that PA = PC. *2*

**OR**

(b) If a drone captures the image of an object at a point Q whose x coordinate is 0 and it is equidistant from points A and D, find the coordinates of Q. *2*

| | |
|---|---|
| Solution(i) Dimensions of the rectangular field are 200 units and 150 units | 1 |
| (ii) $AC = \sqrt{(200)^2 + (150)^2}$<br>$= 250$ | 1 |
| (iii) PA = PC ⇒ $(x+100)^2 + y^2 = (x - 100)^2 + (y - 150)^2$ | 1 |
| ⇒ $4x + 3y = 225$ | 1 |
| **OR** | |
| Let coordinates of Q be (0,y) | |
| QA = QD | |
| ⇒ $(0+100)^2 + y^2 = (0 + 100)^2 + (y - 150)^2$ | 1 |
| $y = 75$ | ½ |
| The coordinates of the point Q are (0,75) | ½ |