# MATHEMATICS STANDARD (2025) - SET-1

## AJMER REGION

**SUJITHKUMAR KP 16/3/2025**

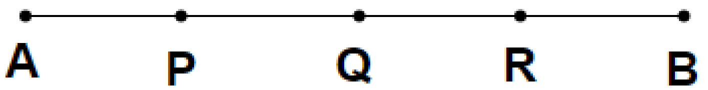
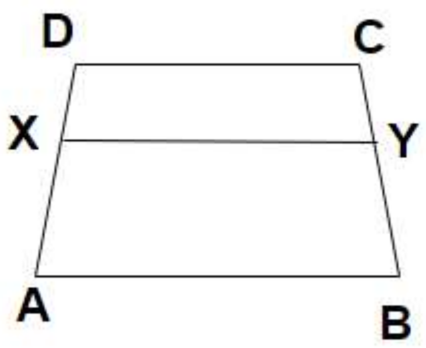
**General Instructions:**

Read the following instructions carefully and follow them:
1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion- Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study based questions carrying 4 marks each with sub parts of the values of 1, 1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take π =22/7 wherever required if not stated.
11. Use of calculators is not allowed



**SECTION- A**

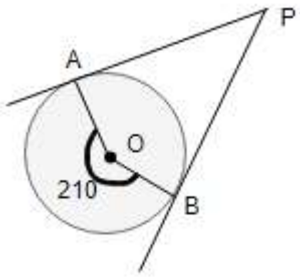
| | | | |
|---|---|---|---|
| 1. | $(\sqrt{3}+2)^2 + (\sqrt{3}-2)^2$ is a/ an<br>(A) positive rational number<br>(C) positive irrational number | (B) negative rational number<br>(D) negative irrational number | |
| | ANS: (A) positive rational number | $(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$<br>$(\sqrt{3}+2)^2 + (\sqrt{3}-2)^2 = 2\left((\sqrt{3})^2 + 2^2\right) =$<br>$2 \times 7 = 14$ (positive rational number) | |
| 2. | Let $x = a^2b^3c^n$ and $y = a^3b^mc^2$ , where $a, b, c$ are prime numbers. If LCM of $x$ $and$ $y$ is $a^3b^4c^3$ , then the value of $m + n$ $is$<br>(A) 10 (B) 7 | (C) 6 (D) 5 | |
| | ANS: (B) 7 | $x = a^2b^3c^n$ , $= a^3b^mc^2$<br>LCM = $a^3b^4c^3$<br>$\Rightarrow m = 4, n = 3$<br>$m + n = 7$ | |
| 3. | For any number p, if p divides $a^2$ where $a$ is any real number then p also divides<br>(A) $a$ (B) $a^{\frac{1}{2}}$ | (C) $a^{\frac{3}{2}}$ (D) $a^{\frac{1}{8}}$ | |
| | ANS: (A) $a$ | | |
| 4. | Which of the following equations is a quadratic equation?<br>(A) $x^2 + 1 = (x-1)^2$<br>(C) $x^3 + 3x^2 = (x+1)^3$ | (B) $(x+\sqrt{x})^2 = 2x\sqrt{x}$<br>(D) $(x+1)(x-1) = (x+1)^2$ | |
| | ANS: (B) $(x+\sqrt{x})^2 = 2x\sqrt{x}$ | $(x+\sqrt{x})^2 = 2x\sqrt{x}$<br>$\Rightarrow x^2 + x + 2x\sqrt{x} = 2x\sqrt{x}$ | |

| | | | |
|---|---|---|---|
| | | $\Rightarrow x^2 + x = 0$ (quadratic equation) | |
| 5. | If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of $b$ can be<br>(A) 0 (B) 4 (C) 3 (D) $-3$ | | |
| | ANS: (D) $-3$ | $x^2 + bx + b = 0$<br>$D = b^2 - 4ac > 0$<br>$D = b^2 - 4b > 0 \Rightarrow b^2 > 4b$<br>Put $b = -3$<br>$D = (-3)^2 - 4 \times 1 \times (-3) = 9 + 12 = 21$<br>Note:<br>When $b = 0 \Rightarrow x^2 = 0$ (repeated roots)<br>When $b = 4 \Rightarrow x^2 + 4x + 4 = 0$<br>$\Rightarrow (x + 2)^2$(repeated roots)<br>When $b = 3$<br>$\Rightarrow x^2 + 3x + 3 = 0$<br>$D = 3^2 - 4 \times 3 < 0$ (No real roots) | |
| 6. | In the given figure below, points $P, Q, R$ divides the line segment AB in four equal parts.<br><br><br>The point Q divides PB in the ratio<br>(A) 1: 3 (B) 2: 3 (C) 1: 2 (D) 1: 1 | | |
| | ANS: (C) 1: 2 | | |
| 7 | A bag contains red balls and black balls in the ratio 3 : 7. A ball is drawn at random. The probability that ball drawn is black in colour, is<br>(A) $\frac{3}{7}$ (B) 0.3 (C) 0.7 (D) $\frac{1}{7}$ | | |
| | ANS: (C) 0.7 | | |
| 8. | Which of the following statements is false?<br>(A) Two right triangles are always similar.<br>(B) Two squares are always similar.<br>(C) Two equilateral triangles are always similar.<br>(D) Two circles are always similar. | | |
| | ANS: (A) Two right triangles are always similar. | | |
| 9. | In the adjoining figure, ABCD is a trapezium in which $XY \parallel AB \parallel CD$. If $AX = \frac{2}{3}AD$, then $CY : YB =$<br>(A) 2: 3 (B) 3: 2<br>(C) 1: 3 (D) 1: 2 | <br> | |
| | ANS: (D) 1: 2 | | |
| 10. | Which of the following statements is false?<br>(A) Infinite number of tangents can be drawn to a circle.<br>(B) Infinite number of tangents can be drawn to a circle from a point outside the circle<br>(C) Infinite number of secants can be drawn to a circle from a point outside the circle.<br>(D) Angle between tangent and diameter at point of contact is 90° | | |

ANS: (B) Infinite number of tangents can be drawn to a circle from a point outside the circle

11. In the adjoining figure, PA and PB are tangents to a circle with centre O. The measure of angle APB is

(A) 210° (B) 150°
(C) 105° (D) 30°




ANS: (D) 30°

12. $\frac{1-\tan^2 30°}{1+\tan^2 30°}$ is equal to

(A) $\sin 60°$ (B) $\cos 60°$ (C) $\tan 60°$ (D) $\sec 60°$

ANS: (B) $\cos 60°$

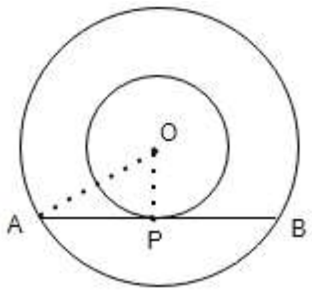
13. An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is 45° . The height of the chimney above the ground is

(A) $38.2\,m$ (B) $36.4\,m$ (C) $40\,m$ (D) $38.2\sqrt{2}m$

ANS: (C) $40\,m$

14. In the adjoining figure , the sum of radii of two concentric circle is 16 cm. The length of chord AB which touches the inner circle at P is 16 cm. The difference of the radii of the given circles is

(A) $8\,cm$ (B) $4\,cm$
(C) $2\,cm$ (D) $3\,cm$




ANS: (B) $4\,cm$

15. A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

(A) $17\,cm$ (B) $18\,cm$ (C) $22\,cm$ (D) $23\,cm$

ANS: (A) $17\,cm$

16. If $x\ median + y\ mean = z\ mode$; is the empirical relationship between mean , median and mode, then the value of $x + y + z$ is

(A) 6 (B) 3 (C) 2 (D) 1

ANS: (C) 2

17. Following data shows the marks obtained by 100 students in a class test:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Marks obtained | 20 | 29 | 28 | 33 | 42 | 38 | 43 | 25 |
| Number of students | 6 | 28 | 24 | 15 | 2 | 4 | 1 | 20 |

The median will be the average of which two observations?

(A) 28 and 33 (B) 25 and 28 (C) 28 and 29 (D) 33 and 38

ANS: (C) 28 and 29

18. The probability of getting a composite number greater than 3 on throwing a die is

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

ANS: (B) $\frac{1}{3}$

In the question numbers 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** Choose the correct option from the following :

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

19. **Assertion (A)** : For acute angle $\theta$ , $sin\theta = \frac{3}{5} \Rightarrow cos\theta = -\frac{4}{5}$.

**Reason (R) :** For any value of $\theta$ , $(0° \leq \theta \leq 90°)$ $sin^2\theta + cos^2\theta = 1$.

ANS: (D) A is false but R is true.

20. **Assertion (A)** : For an AP, 3, 6, 9, ………., 198, $10^{th}$ term from the end is 168.

**Reason (R) :** If $a$ $and$ $l$ are the first term and last term of an AP with common difference $d$, then nth term from the end of the given AP is $l - (n-1)d$.

ANS: (D) A is false but R is true.

**SECTION - B**

21. The cost of 2 kg apples and 1 kg of grapes on a day was found to be Rs. 320. The cost of 4 kg apples and 2 kg of grapes was found to be Rs. 600. If cost of 1 kg of apples and 1 kg of grapes is Rs$x$ and Rs.y respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not.

**OR**

Solve for $x$ $and$ $y$:

$\sqrt{2}x + \sqrt{3}y = 5$ , $\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$

ANS: $2x + y = 320$

$4x + 2y = 600$

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$ , $\frac{b_1}{b_2} = \frac{1}{2}$ , $\frac{c_1}{c_2} = \frac{320}{600}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ in-consistent

**OR**

$\sqrt{2}x + \sqrt{3}y = 5 \Rightarrow \sqrt{2}.\sqrt{3}x + \sqrt{3}.\sqrt{3}\,y = 5.\sqrt{3}$

$\sqrt{6}\,x + 3y = 5\sqrt{3} - - - - - - (i)$

$\sqrt{3}x - \sqrt{8}y = -\sqrt{6} \Rightarrow \sqrt{3}.\sqrt{2}\,x - \sqrt{8}.\sqrt{2}\,y = -\sqrt{6}.\sqrt{2}$

$\sqrt{6}\,x - 4y = -\sqrt{12} - - - - - - - - (ii)$

(i) – (ii) $\Rightarrow 7y = 5\sqrt{3} - (-\sqrt{12})$

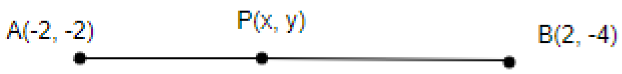
$\Rightarrow 7y = 5\sqrt{3} + 2\sqrt{3} = 7\sqrt{3}$

$\Rightarrow y = \sqrt{3}$ substitute and we get $x = \sqrt{2}$

Solution $x = \sqrt{2}$ , $y = \sqrt{3}$

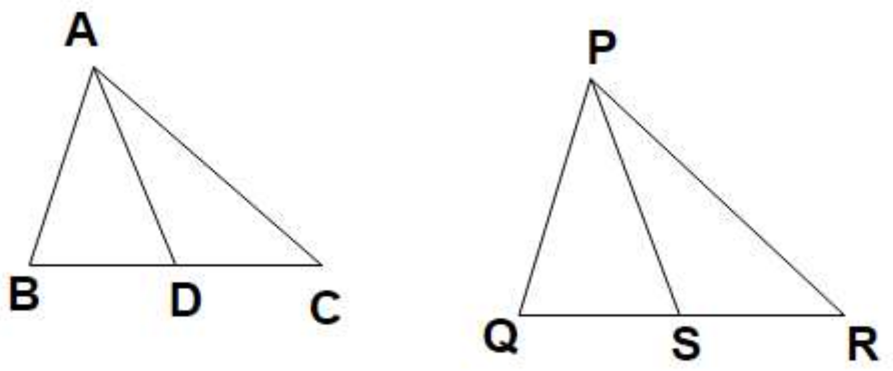
22. The coordinates of the end points of the line segment AB are $A(-2,-2)$ and $B(2,-4)$ is the point on AB such that $BP = \frac{4}{7}AB$. Find the coordinates of point P.

ANS:




$BP = \frac{4}{7}AB \Rightarrow \frac{BP}{AB} = \frac{4}{7}$

$\Rightarrow \frac{AP}{PB} = \frac{3}{4}$

| | | |
|---|---|---|
| | $x = \frac{mx_2 + nx_1}{m+n}, y = \frac{my_2 + ny_1}{m+n}$<br>$x = \frac{3\times 2 + 4\times(-2)}{3+4} = -\frac{2}{7}$<br>$y = \frac{3\times -4 + 4\times(-2)}{3+4} = -\frac{20}{7}$<br>coordinates of point P $\left(-\frac{2}{7}, -\frac{20}{7}\right)$ | |
| 23. | (a) It is given that $\sin(A-B) = sinA\ cosB - cosA\ sinB$ . use it to find the value of sin 15°.<br>**OR**<br>(b) If $sinA = y$, then express $cosA\ and\ tanA$ in terms of $y$. | |
| | ANS: (a) $\sin(A-B) = sinA\ cosB - cosA\ sinB$<br>Let $A = 45°$, $B = 30°$<br>$\sin(45° - 30°) = sin45\ cos30 - cos45\ sin30$<br>$sin15° = \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2} = \frac{\sqrt{3}-1}{2\sqrt{2}}$<br>**OR**<br>(b) $sinA = y$<br>$cosA = \sqrt{1 - sin^2A} = \sqrt{1-y^2}$<br>$tanA = \frac{sinA}{cosA} = \frac{y}{\sqrt{1-y^2}}$ | |
| 24. | AD and PS are medians of triangles ABC and PQR respectively such that $\Delta ABD \sim \Delta PQS$ . Prove that $\Delta ABC \sim \Delta PQR$. | |
| | ANS:<br><br><br>Given<br>$\Delta ABD \sim \Delta PQS$ , $AD\ and\ PS\ are\ medians$ ⇒ D and S are midpoints<br>$\Rightarrow \frac{AB}{PQ} = \frac{BD}{QS}\ and\ \angle B = \angle Q$<br>$\frac{AB}{PQ} = \frac{2BD}{2QS} = \frac{BC}{QR}$<br>In $\Delta ABC, \Delta PQR\ \frac{AB}{PQ} = \frac{BC}{QR}\ and \angle B = \angle Q \Rightarrow \Delta ABC \sim \Delta PQR$ by SAS similarity | |
| 25. | While shuffling a pack of 52 cards, one card was accidently dropped. Find the probability that the dropped card (i) is not a face card. (ii) is a black king. | |
| | (i) Total outcomes = 52 and favourable outcomes = 52-12 = 40<br>P( Not getting a face card) $= \frac{40}{52} = \frac{10}{13}$<br>OR<br>P( getting a face card) = $\frac{12}{52} = \frac{3}{13}$<br>P( Not getting a face card) $=1 - \frac{3}{13} = \frac{10}{13}$<br><br>(ii) Total outcomes = 52 and favourable outcomes 2<br>P(a black king) $= \frac{2}{52} = \frac{1}{26}$ | |

## SECTION -C

**26.** (a) Prove that $\sqrt{3}$ is irrational.

**OR**

State true or false for each of the following statements and justify in each case:

(i) $2 \times 3 \times 5 \times 7 + 7$ is a composite number

(ii) $2 \times 3 \times 5 \times 7 + 1$ is a composite number.

ANS: Let $\sqrt{3} = \frac{p}{q}$ , $p$ $and$ $q$ $are$ $co-prime$ , $q \neq 0$

Squaring $3 = \frac{p^2}{q^2}$

$p^2 = 3q^2$ ________(i)

$p^2$ is divisible by 3⇒ $p$ is divisible by 3

Let $p = 3k$

Sub: in(i) $(3k)^2 = 3q^2 \Rightarrow 3k^2 = q^2$

$q^2$ is divisible by 3 ⇒ $q$ is divisible by 3

⇒ $p$ $and$ $q$ have a common factor 3

This is contradiction to the fact that $p$ $and$ $q$ are co-primes.

⇒ $\sqrt{3}$ is irrational.

OR

(i) A composite number is a positive integer that has at least one positive divisor other than one or itself.

$2 \times 3 \times 5 \times 7 + 7 = 7(30) = 210$ which is a composite number

(ii) $2 \times 3 \times 5 \times 7 + 1 = 211$ which is a prime

**Prime numbers** are the numbers that have only two factors, that are, 1 and the number itself.

**27.** Obtain the zeros of the polynomial $7x^2 + 18x - 9$. Hence , write a polynomial each of whose zeros is twice the zeros of given polynomial.

ANS: $7x^2 + 18x - 9 = 7x^2 + 21x - 3x - 9$

$= 7x(x+3) - 3(x+3) = (7x-3)(x+3)$

zeros of the polynomial $7x^2 + 18x - 9$ are $\frac{3}{7}, -3$

Twice the zeros of given polynomial are $x = \frac{6}{7}$ $and$ $x = -6$

Required polynomial $(7x-6)(x+6) = 7x^2 + 36x - 36$

**28.** Solve the following system of linear equations graphically.

$2x - y - 2 = 0,\ -4x + y + 4 = 0$ . Also find the absolute difference between the ordinates of the points where given lines cut $y - axis$.

ANS:

$2x - y - 2 = 0$

| **x** | **0** | **1** |
|---|---|---|
| **y** | -2 | 0 |

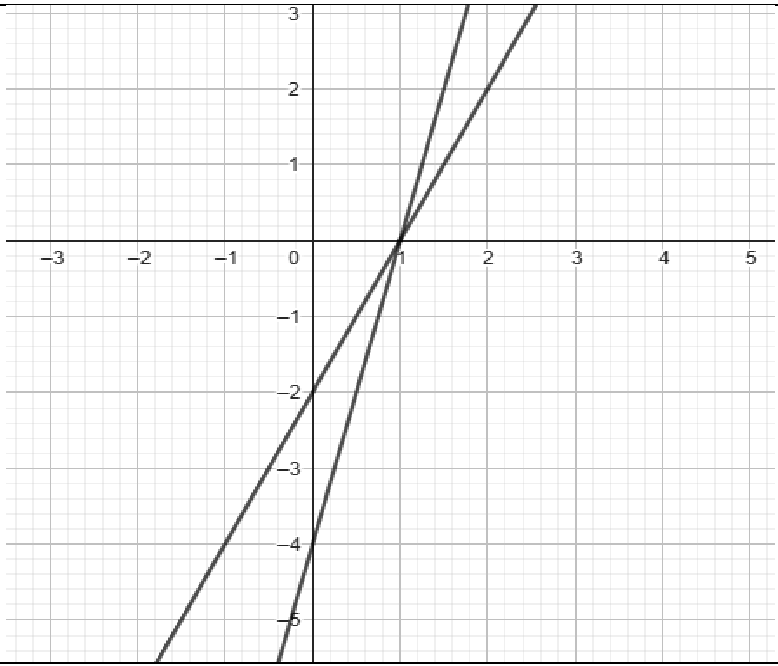
$-4x + y + 4 = 0$

| x | 0 | 1 |
|---|---|---|
| y | -4 | 0 |

Point of intersection (1,0)

Solution is (1,0)

absolute difference between the ordinates of the points where given lines cut $y - axis$ is $|-4 - (-2)| = 2$



**29.** Find a relation between $x$ and $y$ such that $P(x, y)$ is equidistant from the points $A\ (3, 5)$ and $B\ (7, 1)$. Hence, write the coordinates of the points on $x-axis$ and $y-axis$ which are equidistant from points A and B.

ANS: $P(x, y)$, $A\ (3, 5)$, $B\ (7, 1$

Given $PA = PB$

$$\sqrt{(x-3)^2 + (y-5)^2} = \sqrt{(x-7)^2 + (y-1)^2}$$

$$x^2 + 9 - 6x + y^2 + 25 - 10y = x^2 + 49 - 14x + y^2 + 1 - 2y$$

$$-6x + 14x - 10y + 2y = 49 + 1 - 9 - 25$$

$$8x - 8y = 16 \Rightarrow x - y = 2$$

Required relation is $x - y = 2$

$x - y = 2$ cut $x-$ $axis$ at (2, 0)

$x - y = 2$ cut $y-$ $axis$ at $(0, -2)$

OR

It can be solved in the following way also

Let the coordinates on $x - axis$ be $Q(x, 0)$

$QA = QB \Rightarrow \sqrt{(x-3)^2 + (0-5)^2} = \sqrt{(x-7)^2 + (0-1)^2}$

$x^2 + 9 - 6x + 25 = x^2 + 49 - 14x + 1$

$8x - 16 = 0 \Rightarrow x - 2 = 0 \Rightarrow x = 2$, $\Rightarrow$ (2, 0) is the required point on $x-$ $axis$

Let the coordinates on $y - axis$ be $R(0, y)$

$RA = RB \Rightarrow \sqrt{(0-3)^2 + (y-5)^2} = \sqrt{(0-7)^2 + (y-1)^2}$

$\Rightarrow 9 + y^2 + 25 - 1y = 49 + y^2 + 1 - 2y$

$-8y - 16 = 0 \Rightarrow y = -2$ , $\Rightarrow$ $(0, -2)$ is the required point on $y-$ $axis$

**30.** (a) Prove the following trigonometric identity : $\frac{1+cosecA}{cosecA} = \frac{cos^2A}{1-sinA}$

**OR**

(b) Let 2A + B and A+2B be acute angles such that $\sin(2A + B) = \frac{\sqrt{3}}{2}$ and $\tan(A + 2B) = 1$ . Find the value of $\cot(4A - 7B)$.

ANS: $LHS = \frac{1+cosecA}{cosecA} = \frac{1}{cosecA} + 1 = 1 + sinA$

$RHS = \frac{cos^2A}{1-sinA} = \frac{1-sin^2A}{1-sinA} = \frac{(1-sinA)(1+sinA)}{1-sinA} = 1 + sinA$

$LHS = RHS$

**OR**

$\sin(2A + B) = \frac{\sqrt{3}}{2} \Rightarrow 2A + B = 60°$

$\tan(A + 2B) = 1 \Rightarrow A + 2B = 45°$

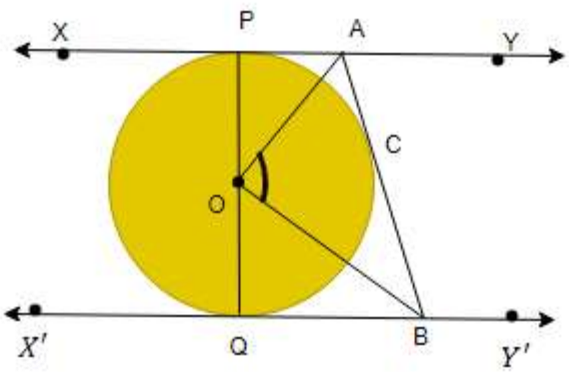
$$2A + B = 60 - - - -(i)$$

$$2A + 4B = 90 - - - (ii)$$

$3B = 30 \Rightarrow B = 10$

$A = 25$

**31.** In the adjoining figure, $XY$ and $X'Y'$ are parallel tangents to a circle with centre O. Another tangent AB touches the circle at C intersecting $XY$ at A and $X'Y'$ at B. Prove that AB subtends right angle at the centre of the circle.




Given. $XY and\ X'Y'$ are parallel tangents to a circle with centre O.

.

Tangent AB intercepts an angle AOB at the centre.

To Prove. ∠ AOB = 90°.

Construction. Join OC

Proof. OC ⊥ AB.

[A tangent at any point of a circle is perpendicular to the radius through the point of contact.]

In right angled Δs OPA and OCA

OP = OC (radii),

OA = OA (common)

AP = AC (tangents from external points)

$\Delta OPA \sim OCA$ by (SSS)

∠ 1 = ∠ 2,

Similarly in right angled Δs OCB and OQB

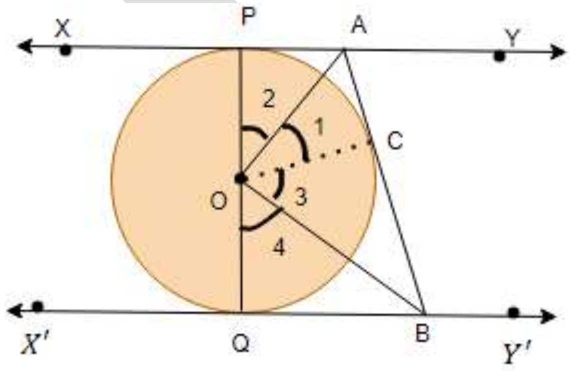
∠ 3 = ∠ 4

$\angle AOB = \angle 1 + \angle 3 = \frac{1}{2}\ [2\angle 1 + 2\angle 3)]$

$= \frac{1}{2}\ (\angle 1 + \angle 1 + \angle 3 + \angle 3)$

$= \frac{1}{2}\ (\angle 1 + \angle 2 + \angle 3 + \angle 4) = \frac{1}{2}\ (180°) = 90°.$

AB subtends right angle at the centre of the circle.




**SECTION - D**

32. (a) A 2 – digit number is seven times the sum of its digits and two more than 5 times the product of its digits. Find the number.

**OR**

(b) Find the value (s) of p for which the quadratic equation given as $(p+4)x^2 - (p+1)x + 1 = 0$ has real and equal roots. Also , find the roots of the equation(s) so obtained.

ANS:

(a) Let the Required number be $10x + y$

Given $10x + y = 7(x + y)$

$\Rightarrow\ 10x + y = 7x + 7y$

$\Rightarrow x = 2y$ -------(i)

$5xy + 2 = 10x + y$ ------(ii)

Substitute $x = 2y\ in\ (ii)$

$5 \times 2y \times y + 2 = 10 \times (2y) + y$

$10y^2 - 21y + 2 = 0$

$10y^2 - 20y - y + 2 = 0$

$10y(y-2)-(y-2)=0 \Rightarrow y=2, y=\frac{1}{10}$ $(discarded)$

When $y=2, x=4$

Required number be $10x+y=42$

**OR**

$(p+4)x^2-(p+1)x+1=0$ -------(i)

For equal roots, D = 0 $\Rightarrow$ $b^2-4ac=0$

$(-(p+1))^2-4\times(p+4)=0$

$p^2+1+2p-4p-16=0$

$p^2-2p-15=0 \Rightarrow (p-5)(p+3)=0$

$p=-3, 5$

Substitute in (i) $p=-3$ then $x^2+2x+1=0 \Rightarrow (x+1)^2=0 \Rightarrow x=-1,-1$

Substitute in (i) $p=5$ then $9x^2-6x+1=0 \Rightarrow (3x-1)^2=0 \Rightarrow x=\frac{1}{3},\frac{1}{3}$

roots of the equations are $-1, \frac{1}{3}$.

33. If a line is drawn parallel to one side of a triangle, intersecting the other two sides distinct points then it divides the two sides in the same ratio, prove it.
Also state the converse of the above statement.

ANS: Statement:

Given : A triangle ABC, DE || BC, meeting AB at D and AC at E.

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

Construction : Join BE, CD and draw EL ⊥ AD.

Proof : ΔBDE and ΔCDE are on the same base and between the same parallel BC and DE, hence equal in area, i.e.,

ar(ΔBDE) = ar(ΔCDE) ...(i)

$\frac{area\ (\Delta\ ADE)}{area\ (\Delta BDE)}=\frac{\frac{1}{2}AD\ .EL}{\frac{1}{2}BD\ .EL}=\frac{AD}{BD}$

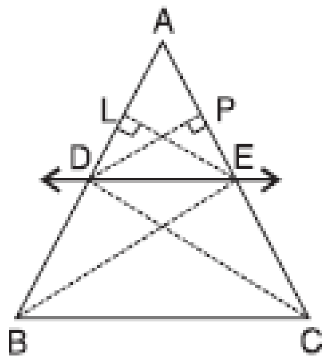
$\frac{area\ (\Delta\ ADE)}{area\ (\Delta CDE)}=\frac{\frac{1}{2}AE\ .DL}{\frac{1}{2}EC\ .DP}=\frac{AE}{EC}$

$\frac{area\ (\Delta\ ADE)}{area\ (\Delta BDE)}=\frac{area\ (\Delta\ ADE)}{area\ (\Delta CDE)}$

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

Converse of BPT

If a line divides any two side of a triangle in the same ratio , then the line is parallel to third side.




34. (a) From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also find the total surface area of remaining solid.
(b) From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid

ANS: (a) Total number of hemispheres that can be scooped out from one face = 100

total surface area of cube = $6a^2$

$6\times14\times14=1176\ cm^2$

100 hemispheres are scooped from one face

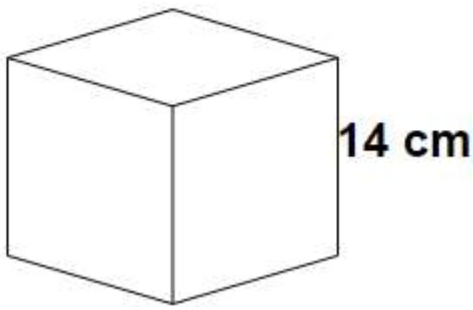
Area of 100 circles $=100\times\frac{22}{7}\times\frac{7}{10}\times\frac{7}{10}=154$

Area of 100 hemispheres $=100\times2\times\frac{22}{7}\times\frac{7}{10}\times\frac{7}{10}$

= 308

total surface area of remaining solid =

$1176-154+308=1330\ cm^2$



**OR**

(b) volume of the remaining solid

= Volume of Cylinder – 2( volume of cone)

$$= \pi r^2 H - 2 \times \frac{1}{3}\pi r^2\, h$$

$$= \pi r^2 \left(H - \frac{2}{3}h\right)$$

$$= \frac{22}{7} \times 25 \left(24 - \frac{2}{3} \times 12\right)$$

$$= \frac{22}{7} \times 25\,(24 - 8) = \frac{22}{7} \times 25 \times\ 16$$

$$= 1257.14\ cm^3$$

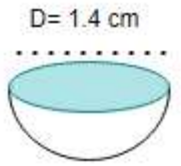
volume of the remaining solid = $1257.14\ cm^3$

surface area of the remaining solid= CSA of cylinder + 2(CSA of cone )

Required SA of Solid = $2\pi r H + 2(\pi r l)$

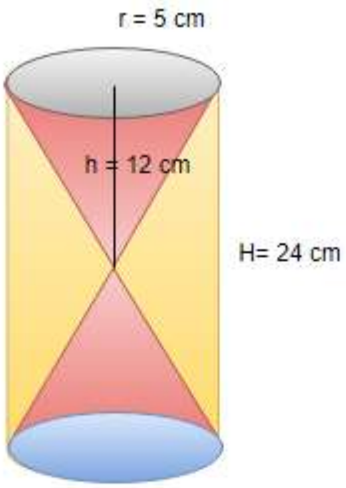
$= 2 \times \frac{22}{7} \times 5(24 + 13)$

$$= \frac{44}{7} \times 5 \times 37 = \frac{8140}{7} = 1162.85\ cm^2$$




r = 0.7 cm

**OR**




35 Medical check- up was carried out for 35 students of a class and their weights were recorded as follows.

| Weight(in kg) | 38- 40 | 40- 42 | 42- 44 | 44- 46 | 46- 48 | 48-50 | 50- 52 |
|---|---|---|---|---|---|---|---|
| Number of students | 3 | 2 | 4 | 5 | 14 | 4 | 3 |

Find the difference between the mean weight and median weight.

| class | $f_i$ | $x_i$ | $u_i = \frac{x_i - 45}{2}$ | $f_i\, u_i$ | CF |
|---|---|---|---|---|---|
| 38- 40 | 3 | 39 | $-3$ | $-9$ | 3 |
| 40- 42 | 2 | 41 | $-2$ | $-4$ | 5 |
| 42- 44 | 4 | 43 | $-1$ | $-4$ | 9 |
| 44- 46 | 5 | 45 | 0 | 0 | 14 |
| 46- 48 | 14 | 47 | 1 | 14 | 28 |
| 48-50 | 4 | 49 | 2 | 8 | 32 |
| 50- 52 | 3 | 51 | 3 | 9 | 35 |
| Total | **35** | | | **14** | |

$$Mean = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$Mean = 45 + \frac{14}{35} \times 2 = 45 + \frac{28}{35} = 45.8$$

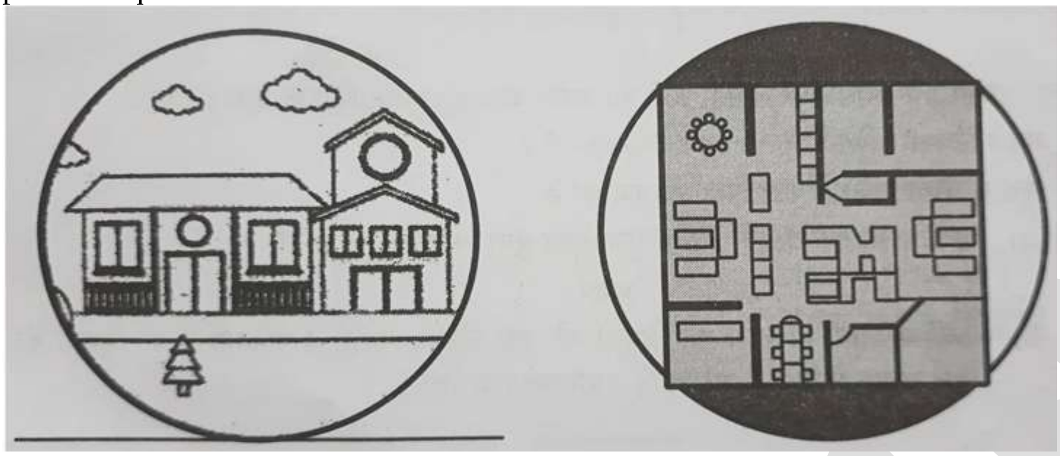
$$Median\ =\ l + \frac{\frac{N}{2} - cf}{f} \times h$$

$$Median\ = 46 + \frac{17.5 - 14}{14} \times 2 =\ \ 46 + \frac{7}{14} = 46.5$$

The difference between the mean weight and median weight = $45.8 - 46.5 =\ -0.7$

## SECTION – E

**36.** A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown.



The radius of the circular piece of land is 35 cm

Based on the given information, answer the following questions.

(i) Find the length of the wire needed to fence the entire land.

(ii) Find the length of each side of the square land on which house will be constructed.

(iii) (a) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of Rs.50 per square metre.

**OR**

(b) Find the ratio of the area of land on which house is built to remaining area of circular piece of land.

(i) length of the wire needed to fence the entire land = $2\pi r$

$$= 2 \times \frac{22}{7} \times 35 = 220\ m$$

(ii) length of each side of the square = $a = \frac{70}{\sqrt{2}} = 35\sqrt{2}\ m$

(iii) (a) Area of remaining part = $\pi r^2 - a^2 = \frac{22}{7} \times\ 35 \times 35 - \left(35\sqrt{2}\right)^2$

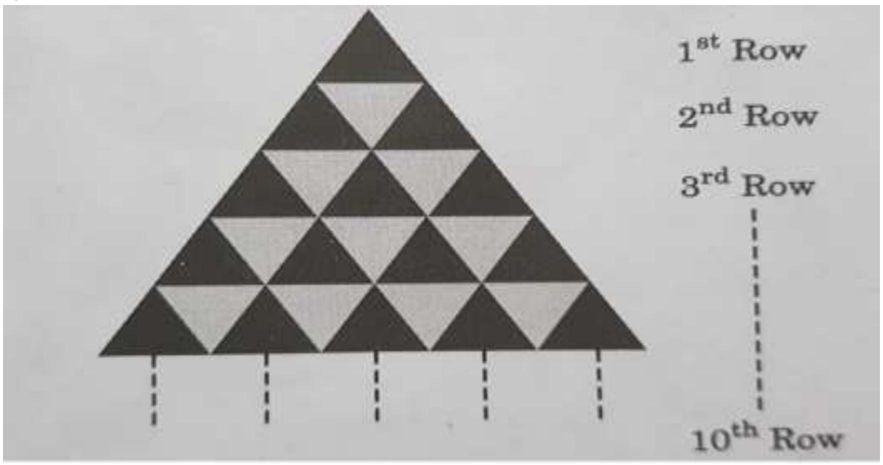
$$= 3850 - 2450 = 1400$$

Area of shaded region = $\frac{1}{2} \times 1400 = 700\ m^2$

Cost = $700 \times 50 = Rs. 35000$

(iii) (b) Ratio of the area of land on which house is built to remaining area of circular piece of land. $= \frac{\left(35\sqrt{2}\right)^2}{1400} = \frac{2450}{1400} = \frac{7}{4}$

**37.** In an equilateral triangle of side 10 cm, equilateral triangles of 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.



Based on the given information, answer the following questions using AP.

(i) How many triangles will be there in the bottom most row?

(ii) How many triangles will be there in the fourth row from the bottom?

(iii) (a) Find the total number of triangles of side 1 cm each till $8^{th}$ row?

**OR**

(b) How many more number of triangles are there from $5^{th}$ row to $10^{th}$ row than in first 4 rows? Show working.

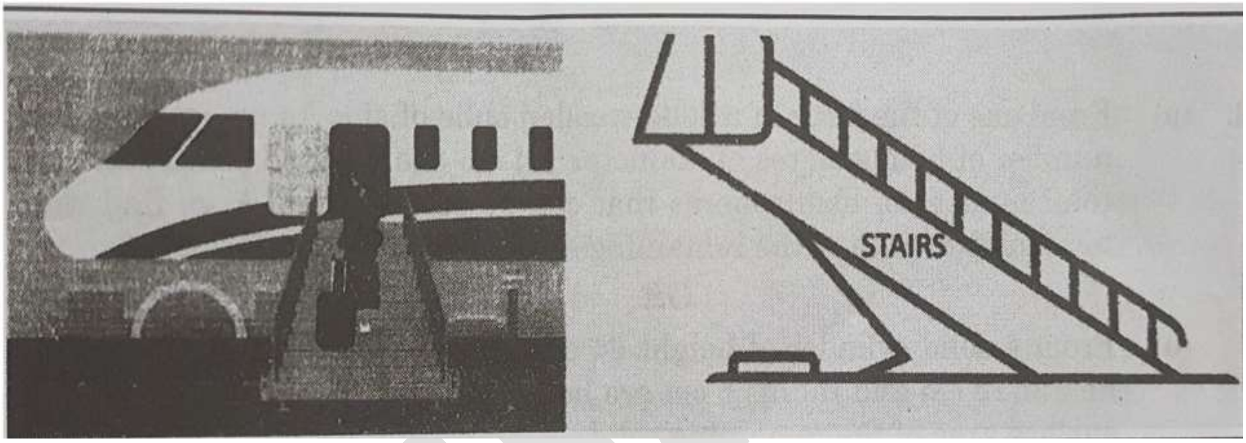
ANS: (i) 19

(ii) 13

(iii) (a) 64

(iii) (b) 68

38. Passengers boarding stairs, sometimes referred to as boarding ramps, stair cars or air craft steps, provide a mobile means to travel between the air craft doors and the ground. Larger air craft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de- boarding.




An air craft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on the given information, answer the following questions given in part (i) and (ii).

(i) Find the angle at which the stairs are inclined to reach the door sill 15 feet high above the ground.

(ii) Find the length of the stairs used to reach the door sill.

Further, answer any **one** of the following questions

(iii) (a) If the 20 feet long stairs is inclined at an angle of 60° to reach the door sill, then find the height of the door sill above the ground ($\sqrt{3} = 1.732$)

**OR**

(b) What should be the shortest possible length of the stairs to reach the door sill of the plane 20 feet above the ground , if the angle of elevation cannot exceed 30° ? Also find the horizontal distance of base of the stair car from the plane.

ANS: (i) 45°

(ii) $15\sqrt{2}\, m$

(iii) (a) $10\sqrt{3}\, m = 10 \times 1.732 = 17.32m$

(iii) (b) 40 ft , 34.64 ft.