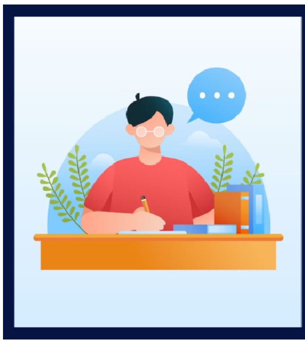


For CBSE 2026 Board Exams - Class 10 (Basic)

# SAMPLE PAPER

issued by CBSE on 30 July, 2025

# MATHEMATICS (041)

**Time Allowed : 180 Minutes** **Max. Marks : 80**

**General Instructions :**

**1.** This Question paper contains **five sections** - A, B, C, D and E.

**2.** Section A has **20 MCQs** of **1 mark** each.
Section B has **05 questions** of **2 marks** each.
Section C has **06 questions** of **3 marks** each.
Section D has **04 questions** of **5 marks** each.
Section E has **03 Case-based integrated units of assessment** with three **sub-parts** of **1, 1 and 2 marks** each.

**3.** Each section is compulsory. However, there are internal choices in some questions.
The **internal choice** has been provided in
- **02 Questions of Section B**
- **02 Questions of Section C**
- **02 Questions of Section D**
- **03 Questions of Section E**

You have to attempt only one of the alternatives in all such questions.

**4.** Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

## SECTION A

*(Question numbers 01 to 20 carry **1 mark** each.)*
*Followings are **multiple choice questions**. Select the correct option in each one of them.*

01. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM $(a, b, c) = 3780$, then x is equal to
(a) 1 (b) 2 (c) 3 (d) 0

02. The shortest distance (in units) of the point $(2, 3)$ from y-axis is
(a) 2 (b) 3 (c) 5 (d) 1

03. If the lines given by $3x + 2ky = 2$ and $2x + 5y + 1 = 0$ are not parallel, then k has to be
(a) $\frac{15}{4}$ (b) $\neq \frac{15}{4}$
(c) any rational number (b) any rational number having 4 as denominator

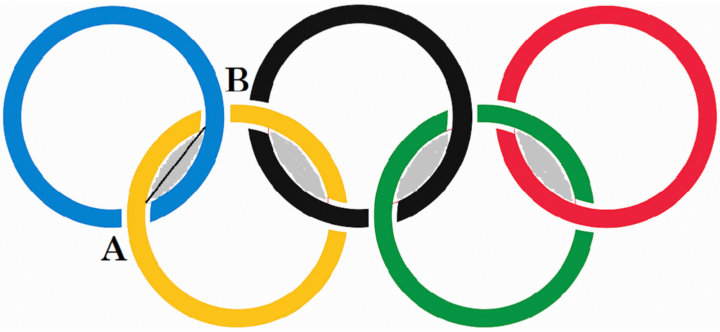
04. A quadrilateral ABCD is drawn to circumscribe a circle.
If $BC = 7$ cm, $CD = 4$ cm and $AD = 3$ cm, then the length of AB is
(a) 3 cm (b) 4 cm (c) 6 cm (d) 7 cm

05. If $\sec\theta + \tan\theta = x$, then $\sec\theta - \tan\theta$ will be
(a) $x$ (b) $x^2$ (c) $\frac{2}{x}$ (d) $\frac{1}{x}$

06. Which one of the following is not a quadratic equation?
(a) $(x+2)^2 = 2(x+3)$ (b) $x^2 + 3x = (-1)(1-3x)^2$
(c) $x^3 - x^2 + 2x + 1 = (x+1)^3$ (d) $(x+2)(x+1) = x^2 + 2x + 3$

07. Given below is the picture of the Olympic rings made by taking five congruent circles of radius 1 cm each, intersecting in such a way that the chord formed by joining the point of intersection

of two circle is also of length 1 cm. Total area of all the dotted regions (assuming the thickness of the rings to be negligible) is




(a) $4\left[\frac{\pi}{12}-\frac{\sqrt{3}}{4}\right]\text{cm}^2$ (b) $\left[\frac{\pi}{6}-\frac{\sqrt{3}}{4}\right]\text{cm}^2$ (c) $4\left[\frac{\pi}{6}-\frac{\sqrt{3}}{4}\right]\text{cm}^2$ (d) $8\left[\frac{\pi}{6}-\frac{\sqrt{3}}{4}\right]\text{cm}^2$

**FOR VISUALLY IMPAIRED STUDENTS**

The area of the circle that can be inscribed in a square of 6 cm is

(a) $36\pi\text{ cm}^2$ (b) $18\pi\text{ cm}^2$ (c) $12\pi\text{ cm}^2$ (d) $9\pi\text{ cm}^2$

08. A pair of dice is tossed. The probability of not getting the sum eight is

(a) $\frac{5}{36}$ (b) $\frac{31}{36}$ (c) $\frac{5}{18}$ (d) $\frac{5}{9}$

09. If $2\sin 5x=\sqrt{3}$, $0°\le x\le 90°$, then x is equal to

(a) 10° (b) 12° (c) 20° (d) 50°

10. The sum of two numbers is 1215 and their HCF is 81, then the possible pairs of such numbers are

(a) 2 (b) 3 (c) 4 (d) 5

11. If the area of the base of a right circular cone is $51\text{ cm}^2$ and its volume is $85\text{ cm}^3$, then the height of the cone is given as

(a) $\frac{5}{6}$ cm (b) $\frac{5}{3}$ cm (c) $\frac{5}{2}$ cm (d) 5 cm

12. If zeroes of the quadratic polynomial $ax^2+bx+c$ $(a, c\ne 0)$ are equal, then

(a) c and b must have opposite signs (b) c and a must have opposite signs
(c) c and b must have same signs (d) c and a must have same signs

13. The area (in $\text{cm}^2$) of a sector of a circle of radius 21 cm cut off by an arc of length 22 cm is

(a) 441 (b) 321 (c) 231 (d) 221

14. If $\Delta ABC\sim\Delta DEF$, $AB=6$ cm, $DE=9$ cm, $EF=6$ cm and $FD=12$ cm, then the perimeter of $\Delta ABC$ is

(a) 28 cm (b) 28.5 cm (c) 18 cm (d) 23 cm

15. If the probability of the letter chosen at random from the letters of the word “Mathematics” to be a vowel is $\frac{2}{2x+1}$, then x is equal to

(a) $\frac{4}{11}$ (b) $\frac{9}{4}$ (c) $\frac{11}{4}$ (d) $\frac{4}{9}$

16. The points $A(9, 0)$, $B(9, -6)$, $C(-9, 0)$ and $D(-9, 6)$ are the vertices of a

(a) Square (b) Rectangle (c) Parallelogram (d) Trapezium

17. The median of a set of 9 distinct observations is 20.5. If each of the observations of a set is increased by 2, then the median of a new set

(a) is increased by 2 (b) is decreased by 2
(c) is two times by original number (d) remains same as that of original observations

18. The length of tangent drawn to a circle of radius 9 cm from a point at a distance of 41 cm from the center of the circle is
(a) 40 cm (b) 9 cm (c) 41 cm (d) 50 cm

*Followings are **Assertion-Reason based questions**.*
In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and 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) :** The number $5^n$ cannot end with the digit 0, where n is a natural number.
**Reason (R) :** A number ends with 0, if its prime factorization contains both 2 and 5.

20. **Assertion (A) :** If $\cos A + \cos^2 A = 1$, then $\sin^2 A + \sin^4 A = 1$.
**Reason (R) :** $\sin^2 A + \cos^2 A = 1$.

## SECTION B

*(Question numbers 21 to 25 carry **2 marks** each.)*

21. (A) The A.P. $8, 10, 12, ...$ has 60 terms. Find the sum of last 10 terms.

**OR**

(B) Find the middle term of A.P. $6, 13, 20, ..., 230$.

22. If $\sin(A+B)=1$ and $\cos(A-B)=\frac{\sqrt{3}}{2}$ ; $0° < A, B < 90°$, find the measure of angles A and B.

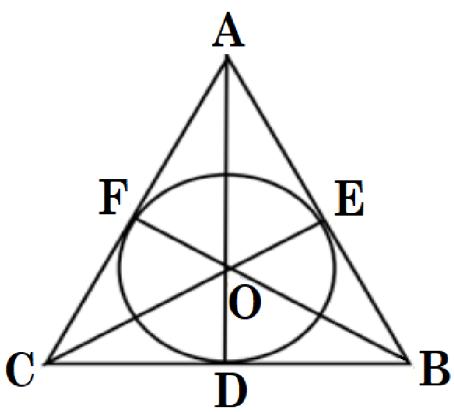
23. If AP and DQ are medians of triangles ABC and DEF respectively, where $\Delta ABC \sim \Delta DEF$, then prove that $\frac{AB}{DE} = \frac{AP}{DQ}$.

24. (A) A horse, a cow and a goat are tied, each by ropes of length 14 m, at the corners A, B and C respectively, of a grassy triangular field ABC with sides of lengths 35 m, 40 m and 50 m. Find the area of grass field that can be grazed by them.

**OR**

(B) Find the area of the major segment (in terms of $\pi$) of a circle of radius 5 cm, formed by a chord subtending an angle of $90°$ at the centre.

25. A $\Delta ABC$ is drawn to circumscribe a circle of radius 4 cm such that the segment BD and DC are of lengths 10 cm and 8 cm respectively. Find the lengths of the sides AB and AC, if it is given that $ar(\Delta ABC) = 90 \text{ cm}^2$.



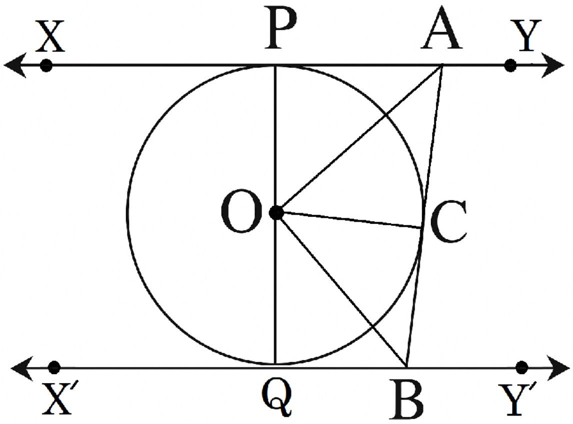
**FOR VISUALLY IMPAIRED STUDENTS**

A circle is inscribed in a right-angled triangle ABC, right angled at B.
If $BC = 7$ cm and $AB = 24$ cm, find the radius of the circle.

**SECTION C**

*(Question numbers 26 to 31 carry **3 marks** each.)*

26. In figure, XY and $X'Y'$ are two parallel tangents to a circle with center O and another tangent AB with point of contact C intersecting XY and $X'Y'$ at A and B respectively. Prove that $\angle AOB = 90°$.




**FOR VISUALLY IMPAIRED STUDENTS**

Two tangents PA and PB are drawn to a circle with center O from an external point P. Prove that $\angle APB = 2(\angle OAB)$.

27. In a workshop, the number of teachers of English, Hindi and Science are 36, 60 and 84 respectively. Find the minimum number of rooms required, if in each room the same numbers of teachers are to be seated and all of them being of the same subject.

28. Find the zeroes of the quadratic polynomial $2x^2 - (1 + 2\sqrt{2})x + \sqrt{2}$ and verify the relationship between the zeroes and coefficients of the polynomial.

29. (A) If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$.

**OR**

(B) Prove that $\dfrac{\cos A - \sin A + 1}{\cos A + \sin A - 1} = \operatorname{cosec} A + \cot A$.

30. On a particular day, Vidhi and Unnati couldn't decide on who would get to drive the car. They had one coin each and flipped their coin exactly three times. The following was agreed upon:
    1. If Vidhi gets two heads in a row, she would drive the car.
    2. If Unnati gets a head immediately followed by a tail, she would drive the car.

    Who has greater probability to drive the car that day? Justify your answer.

31. (A) The monthly income of Aryan and Babban are in the ratio $3:4$ and their monthly expenditures are in ratio $5:7$. If each saves ₹15,000 per month, find their monthly incomes.

**OR**

(B) Solve the system of equations graphically : $2x + y = 6$, $2x - y - 2 = 0$. Also find the area of the triangle so formed by two lines and x-axis.

**FOR VISUALLY IMPAIRED STUDENTS**

Five years hence, father's age will be three times the age of son. Five years ago, father was seven times as old as his son. Find their present ages.

## SECTION D

*(Question numbers 32 to 35 carry **5 marks** each.)*

32. A train travels at a certain average for a distance of $63$ km and then travels at a distance of $72$ km at an average speed of $6$ km/hr more than its original speed. If it takes 3 hours to complete the total journey, what is the original average speed?

33. Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
Hence in $\Delta PQR$, prove that a line $\ell$ intersects the sides PQ and PR of a $\Delta PQR$ at L and M respectively such that $LM \parallel QR$. If $PL = 5.7$ cm, $PQ = 15.2$ cm and $MR = 5.5$ cm, then find the length of PM (in cm).

34. (A) From a solid right circular cone, whose height is 6 cm and radius of base is $12$ cm, a right circular cylindrical cavity of height $3$ cm and radius $4$ cm is hollowed out such that bases of cone and cylinder form concentric circles. Find the surface area of the remaining solid in terms of $\pi$.

**OR**

(B) An empty cone of radius $3$ cm and height $12$ cm is filled with ice-cream such that the lower part of the cone which is $\left(\frac{1}{6}\right)^{th}$ of the volume of the cone is unfilled (empty) but a hemisphere is formed on the top. Find the volume of the ice-cream.

35. (A) If the mode of the following distribution is 55, then find the value of x. Hence, find the mean.

| Class Interval | 0-15 | 15-30 | 30-45 | 45-60 | 60-75 | 75-90 |
|---|---|---|---|---|---|---|
| Frequency | 10 | 7 | x | 15 | 10 | 12 |

**OR**

(B) A survey regarding heights (in cm) of 51 girls of class X of a school was conducted and the following data was obtained.

| Heights (in cm) | Number of girls |
|---|---|
| Less than 140 | 04 |
| Less than 145 | 11 |
| Less than 150 | 29 |
| Less than 155 | 40 |
| Less than 160 | 46 |
| Less than 165 | 51 |

Find the median height of girls. If mode of the above distribution is $148.05$, find the mean using empirical formula.

## SECTION E

*(Question numbers 36 to 38 carry **4 marks** each.)*
*This section contains **three Case-study / Passage based questions**.*
*Each question has **three sub-parts** (i), (ii) and (iii). Two sub-parts are of **1 mark each** while the remaining third sub-part (with internal choice) is of **2 marks**.*

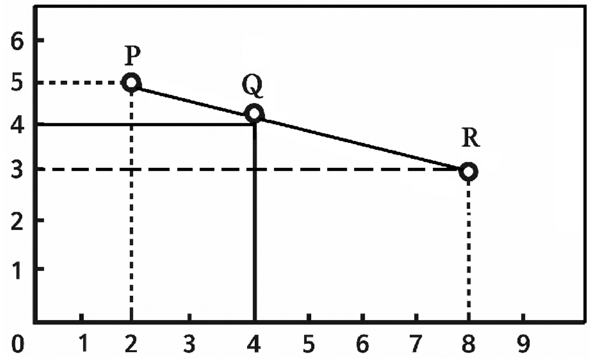
36. In a class, the teacher asks every student to write an example of A.P. Two boys Aryan and Roshan writes the progression as $-5, -2, 1, 4, \ldots$ and $187, 184, 181, \ldots$ respectively. Now the teacher asks his various students the following questions on progression.
Help the students to find answers for the following.
**(i)** Find the sum of the common difference of two progressions.
**(ii)** Find the $34^{th}$ term of progression written by Roshan.

**(iii)** (A) Find the sum of first 10 terms of the progression written by Aryan.

**OR**

**(iii)** (B) Which term of the progression will have the same value?

37. A group of class X students goes to picnic during winter holidays. The position of three friends Aman, Kirti and Chahat are shown by the points P, Q and R.




**(i)** Find the distance between P and R.
**(ii)** Is Q, the midpoint of PR? Justify by finding midpoint of PR.
**(iii)** (A) Find the point on x-axis which is equidistant from P and Q.

**OR**

**(iii)** (B) Let S be a point which divides the line segment joining P and Q (line PQ) in ratio $2:3$. Find the coordinates of S.

**<u>FOR VISUALLY IMPAIRED STUDENTS</u>**

A group of class X students goes to picnic during winter holidays. Aman, Kirti and Chahat are three friends. The position of three friends Aman, Kirti and Chahat are shown by the points P, Q and R.
The co-ordinates of $P(2, 5)$, $Q(4, 4)$ and $R(8, 3)$ are given.

**(i)** Find the distance between P and R.
**(ii)** Is Q the midpoint of PR? Justify by finding midpoint of PR.
**(iii)** (A) Find the point on x-axis which is equidistant from P and Q.

**OR**

**(iii)** (B) Let S be a point which divides the line joining PQ in ratio $2:3$. Find the coordinates of point S.

38. India Gate (formerly known as All India War Memorial) is located near Karthavya path (formerly Rajpath) at New Delhi. It stands as a memorial to $74187$ soldiers of Indian Army, who gave their life in the first world war. This $42$ m tall structure was designed by Sir Edwin Lutyens in the style of Roman triumphal arches. A student Shreya of height $1$ m visited India Gate as a part of her study tour.

**(i)** What is the angle of elevation from Shreya's eye to the top of India Gate, if she is standing at a distance of 41 m away from the India Gate?

**(ii)** If Shreya observes the angle of elevation from her eye to the top of India Gate to be $60°$, then how far is she standing from the base of the India Gate?

**(iii)** (A) If the angle of elevation from Shreya's eye changes from $45°$ to $30°$, when she moves some distance back from the original position. Find the distance she moves back.

**OR**

**(iii)** (B) If Shreya moves to a point which is at a distance of $\frac{41}{\sqrt{3}}$ m from the India Gate, then find the angle of elevation made by her eye to the top of India Gate.

## 🕮 DETAILED SOLUTIONS (Mathematics Standard - 041)

**SECTION A**

01. (c) LCM $(a, b, c) = 2^2 \times 3^x \times 5 \times 7 = 3780$

That is, $140 \times 3^x = 3780$

$\Rightarrow 3^x = 27 = 3^3$

$\therefore x = 3$

02. (a) As shortest distance from $(2, 3)$ to y-axis is the x coordinate, i.e., 2.

03. (b) As lines are parallel, so $\frac{3}{2} \neq \frac{2k}{5}$

Hence, $k \neq \frac{15}{4}$.

04. (c) $AB + CD = AD + BC$

$\Rightarrow AB + 4 = 3 + 7$

$\therefore AB = 6$ cm

05. (d) As $\frac{1}{\sec\theta + \tan\theta} = \frac{(\sec\theta - \tan\theta)}{(\sec\theta + \tan\theta)(\sec\theta - \tan\theta)} = \frac{(\sec\theta - \tan\theta)}{1} = \sec\theta - \tan\theta$

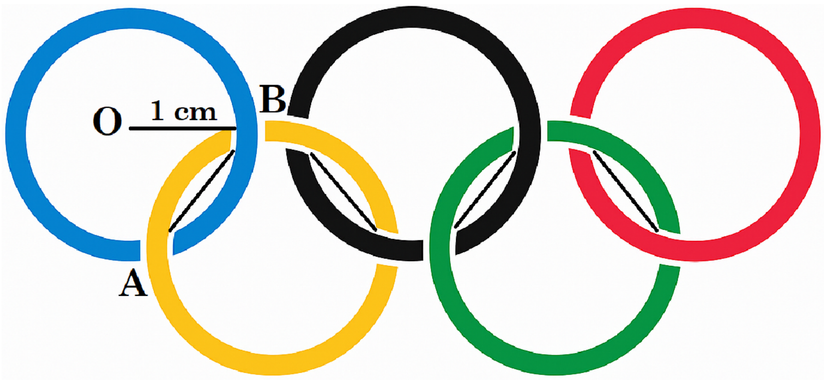
So, $\sec\theta - \tan\theta = \frac{1}{x}$. [$\because \sec^2\theta - \tan^2\theta = 1$

06. (d) $(x+2)(x+1) = x^2 + 2x + 3$,

$\Rightarrow x^2 + 3x + 2 = x^2 + 2x + 3$, which gives $x - 1 = 0$.

It's not a quadratic equation.

07. (d) Refer the diagram shown.




Required Area $= 8 \times$ area of one segment (with $r = 1$ cm and $\theta = 60°$)

$= 8 \times \left( \frac{60°}{360°} \times \pi \times 1^2 - \frac{\sqrt{3}}{4} \times 1^2 \right) = 8\left[\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right] cm^2$

**FOR VISUALLY IMPAIRED STUDENTS**

(d) Area of circle $= \pi(3^2) = 9\pi$ cm$^2$

08. (b) Probability of getting sum 8 is $\frac{5}{36}$

$\therefore$ Probability of not getting sum 8 is $1 - \frac{5}{36} = \frac{31}{36}$.

09. (b) $\because \sin 5x = \frac{\sqrt{3}}{2}$ i.e., $\sin 5x = \sin 60°$

So, $5x = 60°$

$\Rightarrow x = 12°$.

10. (c) Since HCF $= 81$, the numbers can be $81x$ and $81y$.

That is, $81x+81y=1215$

$\Rightarrow x+y=15$, which gives four pairs as $(1, 14)$, $(2, 13)$, $(4, 11)$, $(7, 8)$.

11. (d) $\because \pi r^2 = 51$

Also $V=\frac{1}{3}\times\pi r^2\times h$

$\Rightarrow 85=\frac{1}{3}\times 51\times h$

$\therefore h=\frac{85}{17}=5$ cm

12. (d) As for equal roots to the corresponding equation, $b^2=4ac$

Hence $ac=\frac{b^2}{4}$

That is, $ac>0$

$\therefore$ c and a must have same signs.

13. (c) Area of sector $=\frac{1}{2}\times l\times r=\frac{1}{2}\times 22\times 21=231\text{ cm}^2$

14. (c) As $\Delta ABC \sim \Delta DEF$

So, $\frac{AB}{DE}=\frac{BC}{BF}=\frac{AC}{DF}=\frac{\text{Perimeter of }\Delta ABC}{\text{Perimeter of }\Delta DEF}$

$\Rightarrow \frac{6}{9}=\frac{\text{Perimeter of }\Delta ABC}{27}$

$\therefore$ Perimeter of $\Delta ABC=18$ cm.

15. (b) Probability of getting vowels in the word Mathematics is $\frac{4}{11}$ so, $\frac{2}{2x+1}=\frac{4}{11}$

$\Rightarrow x=\frac{9}{4}$.

16. (c) By visualizing the figure by plotting points in the coordinate plane it can be concluded as a parallelogram.

17. (a) median is increased by 2

18. (a) Refer the diagram shown.

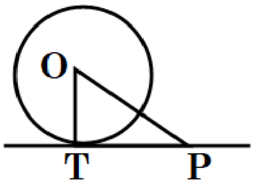
Since, tangent is perpendicular to the radius at the point of contact.

In $\Delta OPT$, right angled at T, we have $OP^2=OT^2+TP^2$

$\Rightarrow 41^2=9^2+TP^2$

$\Rightarrow TP^2=1681-81=1600$

$\therefore TP=40$ cm.




19. (a) Both the statements, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

20. (a) $\cos A+\cos^2 A=1$ ...(i)

Gives $\cos A=\sin^2 A$ ...(ii) (using $\sin^2 A+\cos^2 A=1$

Substituting value of $\cos A$ from (ii) in (i), we get $\sin^2 A+\sin^4 A=1$.

$\therefore$ Both the statements, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

## SECTION B

21. (A) We have $n=60$, $a=8$ and $d=2$.

$\therefore a_{60}=8+(60-1)(2)=8+59\times 2=126$

Also, $a_{51} = 8 + (51-1)(2) = 8 + 50 \times 2 = 108$.

Hence, $a_{51} + a_{52} + ... + a_{60} = \frac{10}{2}(108 + 126) = 1170$.

**OR**

(B) Using $a_n = a + (n-1)d$, we get $230 = 6 + (n-1)7$, which gives $n = 33$.

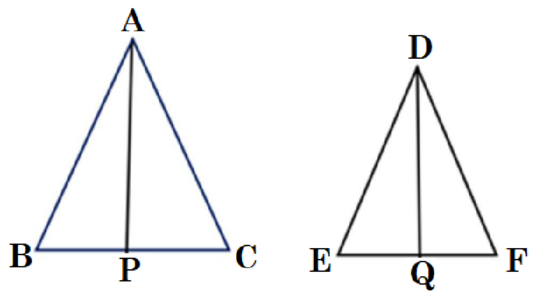
$\therefore$ Middle Term $= a_{17} = 6 + (17-1)(7) = 6 + 16 \times 7 = 118$.

22. We have $\sin(A+B) = 1$ and $\cos(A-B) = \frac{\sqrt{3}}{2}$ ; $0° < A, B < 90°$

$\Rightarrow A + B = 90°$ and $A - B = 30°$

On solving, we get $A = 60°$ and $B = 30°$.

23. Given $\Delta ABC \sim \Delta DEF$




$\Rightarrow \frac{AB}{DE} = \frac{BC}{EF}$

$\Rightarrow \frac{AB}{DE} = \frac{2BP}{2EQ}$ [AP and DQ are the medians

$\Rightarrow \frac{AB}{DE} = \frac{BP}{EQ}$

In $\Delta ABP$ and $\Delta DEQ$,

$\frac{AB}{DE} = \frac{BP}{EQ}$

$\angle B = \angle E$ [$\because \Delta ABC \sim \Delta DEF$

$\Rightarrow \Delta ABP \sim \Delta DEQ$

Hence, $\frac{AB}{DE} = \frac{AP}{DQ}$.

24. (A) Area of grass field that can be grazed by them $= \frac{\theta_1}{360°} \times \pi r^2 + \frac{\theta_2}{360°} \times \pi r^2 + \frac{\theta_3}{360°} \times \pi r^2$

$$= \frac{\pi r^2}{360°}(\theta_1 + \theta_2 + \theta_3) = \frac{\pi r^2}{360°} \times 180°$$

$$= \frac{22}{7} \times \frac{14 \times 14}{2} = 308 \text{ m}^2.$$

**OR**

(B) Area of minor segment = Area of sector − Area of triangle

$$= \frac{90°}{360°}\pi r^2 - \frac{1}{2} \times r^2$$

Area of major segment = Area of circle − Area of minor segment

$$= \pi \times 5^2 - \left(\frac{25}{4}\pi - \frac{25}{2}\right)$$

$$= 25\pi - \frac{25}{4}\pi + \frac{25}{2}$$

$$= \left(\frac{75}{4}\pi + \frac{25}{2}\right) \text{cm}^2.$$

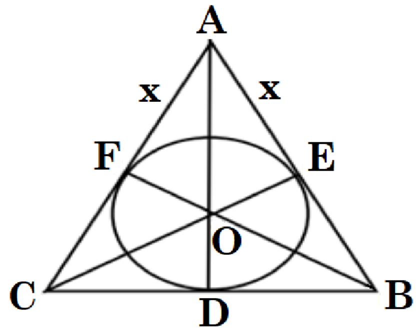
25. Let r be the radius of the inscribed circle.

$BD = BE = 10$ cm, $CD = CF = 8$ cm

Let $AF = AE = x$.

Now $ar(\Delta ABC) = ar(\Delta AOC) + ar(\Delta BOC) + ar(\Delta AOB)$

$$= \frac{1}{2}\times r\times AC + \frac{1}{2}\times r\times BC + \frac{1}{2}\times r\times AB$$




$\Rightarrow 90 = \frac{1}{2}\times 4(x+8+18+x+10)$

$\Rightarrow 45 = 2x + 36$

$\Rightarrow x = \frac{9}{2}$ cm $= 4.5$ cm

$\therefore AB = 4.5 + 10 = 14.5$ cm

and, $AC = 4.5 + 8 = 12.5$ cm.

**FOR VISUALLY IMPAIRED STUDENTS**

$AC^2 = AB^2 + BC^2 = 24^2 + 7^2 = 625$

$\therefore AC = 25$ cm

Area of $\Delta ABC = \frac{1}{2}\times 7\times 24 = 84\ cm^2$ …(i)

Let r be the radius of circle.

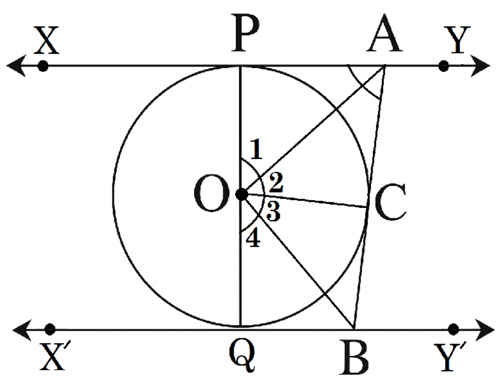
Also, area of $\Delta ABC = \frac{1}{2}(24r + 25r + 7r)$

$\Rightarrow 84 = \frac{1}{2}\times 56r$ …(ii)

From (i) and (ii), we get $r = 3$ cm.

## SECTION C

26. Join OC.




In $\Delta OPA$ and $\Delta OCA$,

$OP = OC$ (Radii of same circle

$PA = CA$ (Tangents from an external point

$AO = AO$ (Common

$\therefore \Delta OPA \cong \Delta OCA$ (By S.S.S. congruency criterion

Hence, $\angle 1 = \angle 2$

(Corresponding parts of congruent $\Delta$s

Similarly $\Delta OQB \cong \Delta OCB$, so $\angle 3 = \angle 4$

Now $\angle POC + \angle QOC = 180°$

(Co-interior angles are supplementary as $XY \parallel X'Y'$

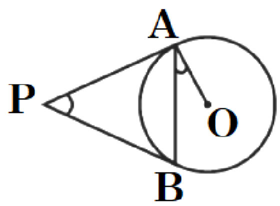
$\Rightarrow 2\angle 2 + 2\angle 3 = 180°$ i.e., $\angle 2 + \angle 3 = 90°$

$\Rightarrow \angle AOB = 90°$.

**FOR VISUALLY IMPAIRED STUDENTS**

$PA = PB$ (Tangents from external point to a circle

$\angle PAB = \angle PBA = x$ (Angles opposite to equal sides




In $\Delta PAB$, $\angle PAB + \angle PBA + \angle APB = 180°$

$\Rightarrow x + x + \angle APB = 180°$

$\Rightarrow 2x + \angle APB = 180°$

$\Rightarrow \angle APB = 180° - 2x$ …(i)

Also $\angle PAB + \angle OAB = 90°$ (Radius is perpendicular to the tangent at the point of contact

$\Rightarrow x + \angle OAB = 90°$

$\Rightarrow x = 90° - \angle OAB$ …(ii)

Substituting (ii) in (i), we get $\angle APB = 180° - 2(90° - \angle OAB)$

$\therefore\ \angle APB = 2\angle OAB$.

27. HCF $(36, 60, 84) = 12$

Required number of rooms $= \frac{36}{12} + \frac{60}{12} + \frac{84}{12} = 3 + 5 + 7 = 15$

28. $2x^2 - (1 + 2\sqrt{2})x + \sqrt{2} = 2x^2 - x - 2\sqrt{2}x + \sqrt{2} = (2x - 1)(x - \sqrt{2})$

Hence, the required zeroes are $\frac{1}{2}$ and $\sqrt{2}$.

Now $\frac{-b}{a} = \frac{2\sqrt{2} + 1}{2} = \sqrt{2} + \frac{1}{2}$ and $\frac{c}{a} = \frac{\sqrt{2}}{2} = \frac{1}{2}\sqrt{2}$.

29. We have $\sin\theta + \cos\theta = \sqrt{3}$, which gives $(\sin\theta + \cos\theta)^2 = 3$.

Hence, $1 + 2\sin\theta\cos\theta = 3$ [$\because \sin^2\theta + \cos^2\theta = 1$

$\Rightarrow 2\sin\theta\cos\theta = 2$

$\Rightarrow \sin\theta\cos\theta = 1$ …(i)

$\therefore \tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$

$= \frac{1}{\sin\theta\cos\theta}$

$\Rightarrow \tan\theta + \cot\theta = \frac{1}{1} = 1$ [By (i), $\sin\theta\cos\theta = 1$

**OR**

LHS : $\frac{\cos A - \sin A + 1}{\cos A + \sin A - 1}$

$= \frac{(\cos A - \sin A + 1)(\cos A + \sin A + 1)}{(\cos A + \sin A - 1)(\cos A + \sin A + 1)}$

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

$= \frac{\cos^2 A + 2\cos A + 1 - \sin^2 A}{\cos^2 A + \sin^2 A + 2\sin A\cos A - 1}$

$= \frac{\cos^2 A + 2\cos A + \cos^2 A}{2\sin A\cos A}$

$= \frac{2\cos A(1 + \cos A)}{2\sin A\cos A} = \frac{1 + \cos A}{\sin A}$

$= \operatorname{cosec} A + \cot A = \text{RHS}$.

30. P(Vidhi drives the car) $= \frac{3}{8}$; as favourable outcomes are HHT, THH, HHH.

P(Unnati drives the car) $= \frac{4}{8}$; as favourable outcomes are THT, THH, HTH, TTH

As $\frac{4}{8} > \frac{3}{8}$ so, Unnati has greater probability to drive the car.

31. Let the income of Aryan and Babban be $3x$ and $4x$ respectively and let their expenditure be $5y$ and $7y$ respectively.

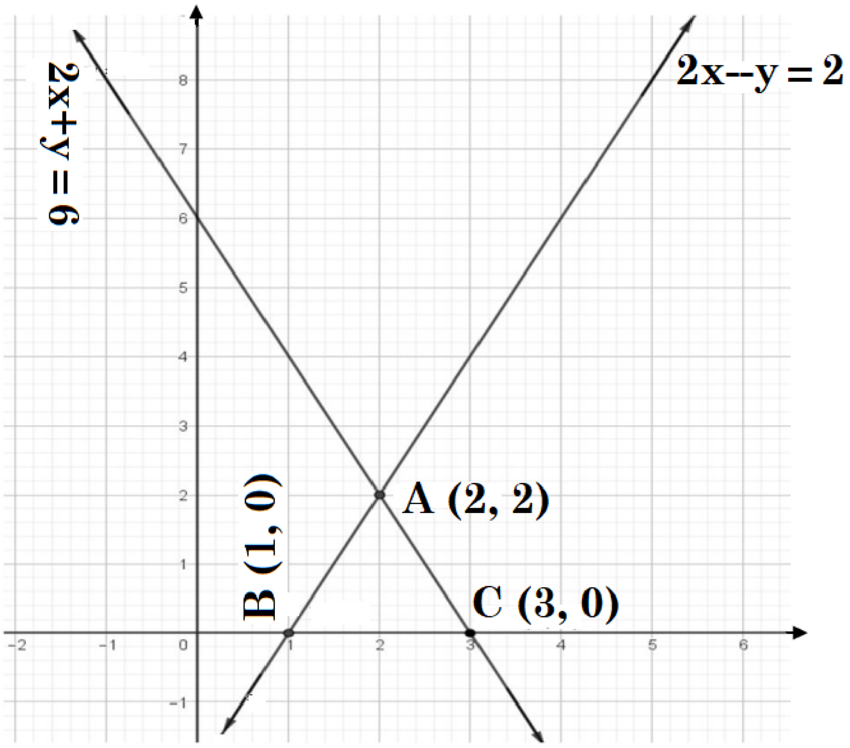
Since each saves ₹15,000, we get : $3x - 5y = 15000$ and $4x - 7y = 15000$.

Hence on solving the above equations, we get $x = 30000$.

Theus, their income will be ₹90,000 and ₹1,20,000 respectively.

**OR**

Refer the graph shown below.




Note that the lines $2x+y=6$, $2x-y-2=0$ cut each other at A (2, 2).
Hence, the required solution is $x=2$, $y=2$.

Also, the area of triangle ABC $=\frac{1}{2}\times 2\times 2=2$ Sq. units.

**FOR VISUALLY IMPAIRED STUDENTS**

Let the present age of father be x and son be y (both in years).
So, $(x+5)=3(y+5) \Rightarrow x-3y=10$ ...(i)
Also $x-5=7(y-5) \Rightarrow x-7y=-30$ ...(ii)
Solving (i) and (ii), we get $x=40$, $y=10$.
Hence, the present ages of father and son are 40 years and 10 years respectively.

**SECTION D**

32. Let the original speed of train be $x$ km/hr.

Distance $=63$ km, time $(t_1)=\frac{63}{x}$ hrs.

Faster speed $=(x+6)$ km/hr

Time $(t_2)=\frac{72}{x+6}$ hrs

Now $t_1+t_2=3$ hrs

So, $\frac{63}{x}+\frac{72}{x+6}=3$

$\Rightarrow 63(x+6)+72x=3(x+6)x$

$\Rightarrow 135x+378=3x^2+18x$

$\Rightarrow 3x^2-117x-378=0$

$\Rightarrow x^2 - 39x - 126 = 0$

$\Rightarrow x^2 - 42x + 3x - 126 = 0$ gives $(x+3)(x-42) = 0$

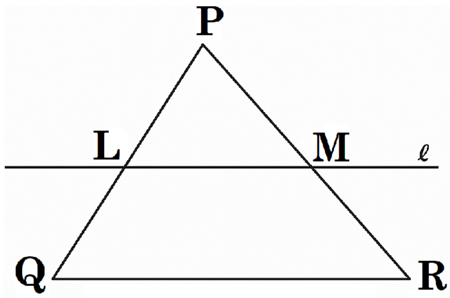
As x can't be negative, so $x = 42$ km/hr .

The original speed of train $= 42$ km/hr .

33. Refer to the proof of **BPT** in **MATHMISSION FOR X** book (Chapter-6).

Since LM is parallel to QR.

Let $PM = x$.




$\therefore \dfrac{PL}{PQ} = \dfrac{PM}{PR}$

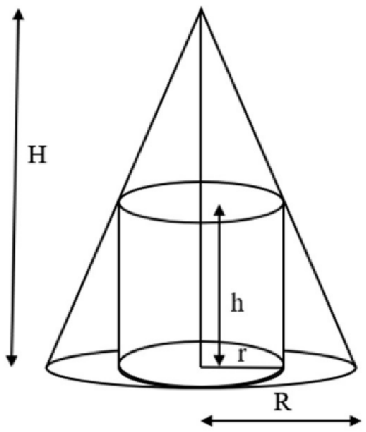
$\Rightarrow \dfrac{5.7}{15.2} = \dfrac{x}{x+5.5}$

$\Rightarrow 5.7x + 31.35 = 15.2x$

$\Rightarrow 31.35 = 9.5x$

$\therefore x = PM = 3.3$ cm .

34. (A) Refer the diagram.




Slant height of the cone $L = \sqrt{R^2 + H^2} = \sqrt{12^2 + 6^2} = 3\sqrt{20}$ cm

Curved surface area of cone $= \pi R L$

$$= \pi \times 12 \times 3\sqrt{20} = (36\sqrt{20})\pi \text{ cm}^2$$

Area of base circle of cone

$$= \begin{pmatrix} \text{area of outer circle} - \text{area of inner circle} \\ + \text{top circular area of cylinder} \end{pmatrix}$$

$$= \pi R^2 = \pi \times (12)^2 = 144\pi \text{ cm}^2$$

Curved surface area of cylinder $= 2\pi r h$

$$= 2\pi \times 4 \times 3 = 24\pi \text{ cm}^2$$

Surface area of the remaining solid $=$ Curved surface of cone $+$ area of base circle of cone $+$ curved surface area of cylinder

$$= (36\sqrt{20})\pi + 144\pi + 24\pi$$

$$= (168 + 36\sqrt{20})\pi \text{ cm}^2.$$

**OR**

(B) Volume of cone $= \dfrac{1}{3}\pi r^2 h = \dfrac{1}{3}\pi \times 3 \times 3 \times 12 = 36\pi$ cm$^3$,

Volume of ice-cream in the cone $= \dfrac{5}{6} \times 36\pi$ cm$^3$ $= 30\pi$ cm$^3$,

Volume of ice-cream in the hemispherical part $= \dfrac{2}{3}\pi r^3 = \dfrac{2}{3}\pi \times 3 \times 3 \times 3 = 18\pi$ cm$^3$

Total volume of the ice cream $= (30\pi + 18\pi) = 48\pi = 150.86$ cm$^3$ .

35. (A) Mode of the frequency distribution $= 55$

Modal class is 45-60, lower limit is 45 and Class interval $(h) = 15$ .

Now, the Mode $= l + \left(\dfrac{(f_1 - f_0)}{2f_1 - f_0 - f_2}\right) \times h$

$\Rightarrow 55 = 45 + \dfrac{15 - x}{30 - x - 10} \times 15$

$\Rightarrow 10=\dfrac{15-x}{20-x}\times 15$

$\Rightarrow \dfrac{2}{3}=\dfrac{15-x}{20-x}$

So, $x=5$.

| C.I. | $f_i$ | $x_i$ | $f_i x_i$ |
|---|---|---|---|
| 0-15 | 10 | 7.5 | 75 |
| 15-30 | 7 | 22.5 | 157.5 |
| 30-45 | 5 | 37.5 | 187.5 |
| 45-60 | 15 | 52.5 | 787.5 |
| 60-75 | 10 | 67.5 | 675 |
| 75-90 | 12 | 82.5 | 990 |
| Total | 59 | | 2872.5 |

$\text{Mean}=\overline{x}=\dfrac{2872.5}{59}=48.686$ (approx.) .

**OR**

(B) Refer the table given below.

| Height (in cm) | Number of girls | Class Interval | Frequency | Cumulative Frequency |
|---|---|---|---|---|
| Less than 140 | 04 | 135-140 | 4 | 4 |
| Less than 145 | 11 | 140-145 | 7 | 11 |
| Less than 150 | 29 | 145-150 | 18 | 29 |
| Less than 155 | 40 | 150-155 | 11 | 40 |
| Less than 160 | 46 | 155-160 | 6 | 46 |
| Less than 165 | 51 | 160-165 | 5 | 51 |

Since $N=51$ gives $\dfrac{N}{2}=\dfrac{51}{2}=25.5$. Therefore, the median class is 145-50.

Now, the Median $=l+\left(\dfrac{\frac{N}{2}-cf}{f}\right)\times h$

$=145+\left(\dfrac{\frac{51}{2}-11}{18}\right)\times 5$

$=149.03$

$\therefore$ Median height $=149.03$ cm

As $3\times\text{Median}=\text{Mode}+2\times\text{Mean}$

$\Rightarrow 3\times 149.03=148.05+2\times\text{Mean}$

$\therefore \text{Mean}=149.52$.

## SECTION E

36. **(i)** Common difference of first progression $=3$

Common difference of first progression $=-3$

$\therefore$ Sum of common difference $=0$.

**(ii)** $a_{34}=187+(34-1)(-3)$

$\Rightarrow a_{34}=187-99$

So, $a_{34} = 88$.

**(iii)** (A) Sum $= \frac{10}{2}[2(-5)+(10-1)(3)]$

$= \frac{10}{2}[-10+27] = 85$.

**OR**

**(iii)** (B) $-5+(n-1)3 = 187+(n-1)(-3)$

$\Rightarrow -8+3n = 190-3n$

$\Rightarrow 6n = 198$

$\therefore n = 33$.

37. **(i)** $PR = \sqrt{(8-2)^2+(3-5)^2} = 2\sqrt{10}$.

**(ii)** Coordinates of $Q(4, 4)$.

The mid-point of PR is $(5, 4)$.

$\therefore Q$ is not the mid-point of PR.

**(iii)** (A) Let the point be $(x, 0)$.

So, $\sqrt{(2-x)^2+25} = \sqrt{(4-x)^2+16}$

$\Rightarrow 4-4x+x^2+25 = 16-8x+x^2+16$

$\Rightarrow 4x = 3$

Hence, $x = \frac{3}{4}$.

Therefore the point is $\left(\frac{3}{4}, 0\right)$.

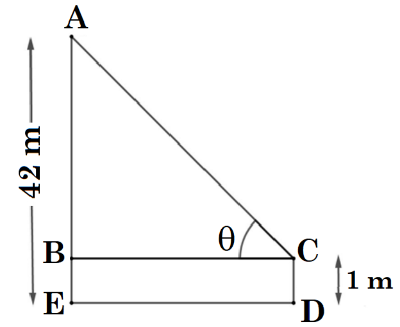
**OR**

**(iii)** (B) The coordinates of S will be $\left(\frac{2\times4+3\times2}{2+3}, \frac{2\times4+3\times5}{2+3}\right) = \left(\frac{14}{5}, \frac{23}{5}\right)$.

38. **(i)** Distance from India Gate $= 41$ m.

Height of monument $= 42$ m.

Shreya's height $= 1$ m.




So, $\tan\theta = \frac{41}{41}$

$\Rightarrow \tan\theta = 1$

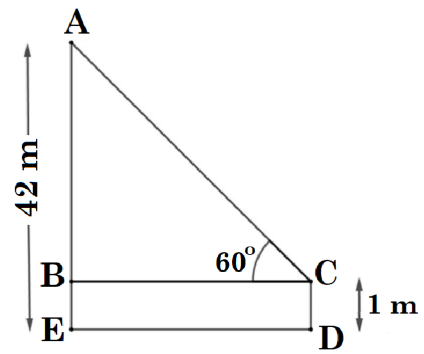
$\Rightarrow \tan\theta = \tan 45^\circ$

$\therefore$ Angle of elevation $= \theta = 45^\circ$.

**(ii)** Angle of elevation $= 60^\circ$.

Perpendicular $= 41$ m.

Let the distance from the India Gate be $x$ m.




Hence, $\tan 60^\circ = \frac{41}{x}$

$\Rightarrow \sqrt{3} = \frac{41}{x}$

$\Rightarrow x = \frac{41}{\sqrt{3}}$

$\therefore$ Shreya is standing at a distance of $\left(\frac{41\sqrt{3}}{3}\right)$ m.

**(iii)** (A) Distance from the India Gate $= 41$ m

Let the distance moved back be $x$ m.

Then, $\tan 30° = \frac{41}{41+x}$

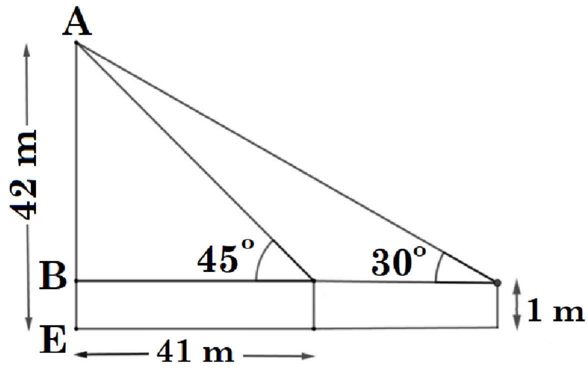
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{41}{41+x}$

$\Rightarrow 41 + x = 41\sqrt{3}$

$\Rightarrow x = (41\sqrt{3} - 41)$ m

$\therefore x = 41(\sqrt{3} - 1)$ m

$\therefore$ The distance moved back $= 41(\sqrt{3} - 1)$ m.




**OR**

**(iii)** (B) Let the angle of elevation of be $\theta$.

Now, $\tan\theta = \frac{41}{\frac{41}{\sqrt{3}}}$

$\Rightarrow \tan\theta = \sqrt{3}$

$\Rightarrow \tan\theta = \tan 60°$

$\therefore \theta = 60°$.