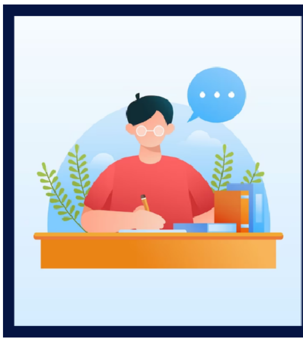
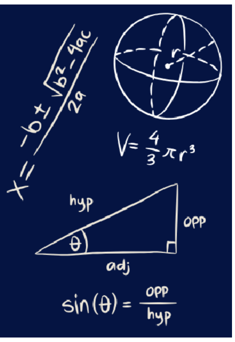


For CBSE 2026 Board Exams - Class 10 (Basic)

# SAMPLE PAPER

issued by CBSE on 30 July, 2025

# MATHEMATICS (241)




**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. The exponent of 3 in the prime factorization of 2025 is
(a) 1 (b) 2 (c) 3 (d) 4

02. If $2024x + 2025y = 1;\ 2025x + 2024y = -1$, then $x - y =$
(a) 0 (b) $-2$ (c) 2 (d) $-1$

03. The number of polynomials having $-2$ and $5$ as its zeroes is
(a) one (b) two (c) three (d) Infinitely many

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

05. The value of x for which $2x$, $(x+10)$ and $(3x+2)$ are the three consecutive terms of an A.P. is
(a) 6 (b) $-6$ (c) $-2$ (d) 2

06. If $1+2+3+4+...+50 = 25k$, then $k =$
(a) 50 (b) 51 (c) 49 (d) 26

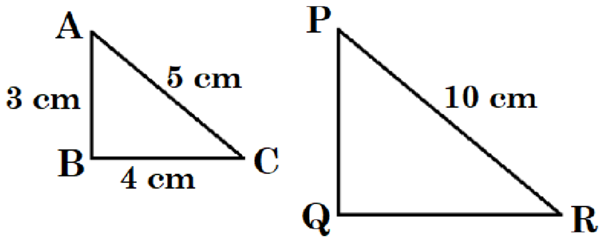
07. The distance between the points $(\cos 30°, \sin 30°)$ and $(\cos 60°, -\sin 60°)$ is
(a) 0 unit (b) $\sqrt{3}$ units (c) 1 unit (d) $\sqrt{2}$ units

08. The coordinates of the point which is mirror image of the point $(-3, 5)$ about x-axis are
(a) $(3, 5)$ (b) $(3, -5)$ (c) $(-3, -5)$ (d) $(-3, 5)$

09. If in $\Delta ABC$ and $\Delta DEF$, $\frac{AB}{EF} = \frac{AC}{DE}$, then they will be similar when

(a) $\angle A = \angle D$ (b) $\angle A = \angle E$ (c) $\angle C = \angle F$ (d) $\angle B = \angle E$

10. If $\Delta ABC \sim \Delta PQR$, then perimeter of the triangle PQR (in cm) is



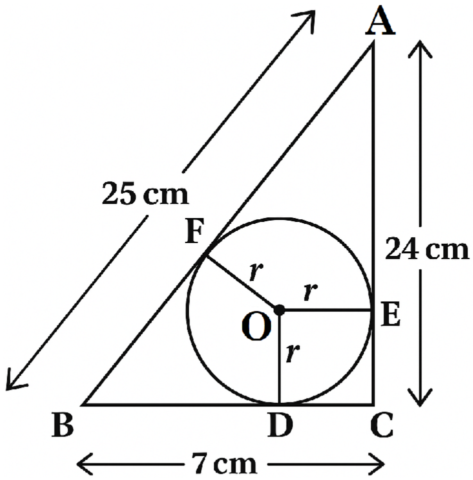

(a) 12 (b) 24 (c) 18 (d) 20

**FOR VISUALLY IMPAIRED STUDENTS**

If $\Delta ABC \sim \Delta PQR$, where $AB = 3$ cm, $BC = 4$ cm, $AC = 5$ cm and $PR = 10$ cm, then perimeter of the triangle PQR (in cm) is

(a) 12 (b) 24 (c) 18 (d) 20

11. In the figure given below, radius r of the circle which touches the sides of the triangle is




(a) 3 cm (b) 6 cm (c) 7 cm (d) 4 cm

**FOR VISUALLY IMPAIRED STUDENTS**

From a point P, which is at a distance of 26 cm from the centre O of a circle with radius 10 cm, the pair of tangents PQ and PR to the circle are drawn. Then the area of the quadrilateral PQOR (in $cm^2$) is

(a) 220 (b) 240 (c) 260 (d) 280

12. Which one of the following is **not** equal to unity?

(a) $\sin^2 x + \cos^2 x$ (b) $\cot^2 x - \text{cosec}^2 x$

(c) $\sec^2 x - \tan^2 x$ (d) $\tan x . \cot x$

13. Consider the following frequency distribution.

| Class | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 |
|---|---|---|---|---|---|
| Frequency | 11 | 12 | 13 | 9 | 11 |

The upper limit of median class is

(a) 10 (b) 13 (c) 15 (d) 20

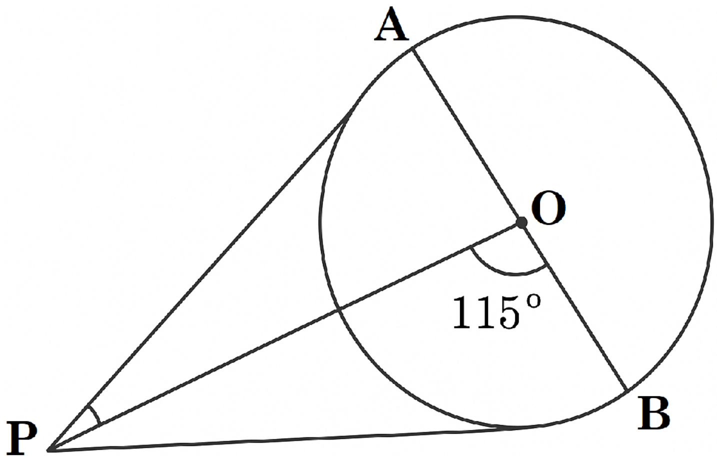
14. Let empirical relationship between the three measures of central tendency be given by the expression $a(\text{Median}) = \text{Mode} + b(\text{Mean})$, then $(2b + 3a) =$

(a) 11 (b) 12 (c) 13 (d) 14

15. From an external point Q, the length of tangent to a circle is 12 cm and the distance of Q from the centre of circle is 13 cm. The radius of circle (in cm) is

(a) 10 (b) 5 (c) 12 (d) 7

16. In the given figure, PA is a tangent from an external point P to a circle with centre O and the diameter AB. If $\angle POB = 115°$, then measure of $\angle APO$ is




(a) 25° (b) 30° (c) 20° (d) 65°

**FOR VISUALLY IMPAIRED STUDENTS**

At one end A of a diameter AB of a circle with radius 13 cm, tangent XAY is drawn to the circle. The length of the chord CD parallel to XY and at a distance 18 cm from A is

(a) 24 cm (b) 25 cm (c) 26 cm (d) 18 cm

17. The circumference of two circles are in the ratio $3:4$. The ratio of their areas is

(a) $3:4$ (b) $4:3$ (c) $9:16$ (d) $16:9$

18. An event is most unlikely to happen. Its probability is

(a) 0.0001 (b) 0.001 (c) 0.01 (d) 0.1

*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) :** Line joining the midpoints of two sides of triangle is parallel to the third side.
**Reason (R) :** If a line divides two sides of a triangle in the same ratio, then it is parallel to the third side.

20. **Assertion (A) :** Two coins are tossed simultaneously. Possible outcomes are two heads, one head and one tail, two tails. Hence, the probability of getting two heads is $\frac{1}{3}$.
**Reason (R) :** Probabilities of 'equally likely' outcomes of an experiment are always equal.

## SECTION B

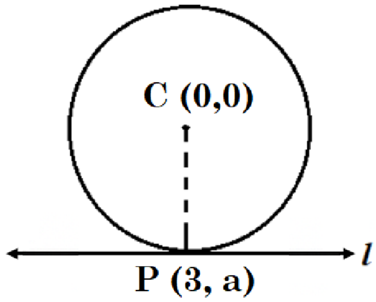
*(Question numbers 21 to 25 carry **2 marks** each.)*

21. (A) Show that the number $2\times5\times7\times11+11\times13$ is a composite number.

**OR**

(B) Find the smallest number which is divisible by both 306 and 657.

22. Find the radius of the circle with centre at origin, if line $l$ given by $x+y=5$ is tangent to the circle at point P. Refer the figure shown below.




**FOR VISUALLY IMPAIRED STUDENTS**

Find the radius of the circle whose end points of a diameter are $(0, 0)$ and $(6, 8)$.

23. If the zeroes of the quadratic polynomial $x^2+(a+1)x+b$ are 2 and $-3$, then find the values of $a$ and $b$.

24. Find the nature of roots of the quadratic equation $x^2+4x-3\sqrt{2}=0$.

25. (A) Evaluate : $2\sin 30^\circ \tan 60^\circ - 3\cos^2 60^\circ \sin^2 30^\circ$.

**OR**

(B) If $\sin x = \frac{7}{25}$, where x is an acute angle, then find the value of $\sin x.\cos x(\tan x+\cot x)$.

## SECTION C

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

26. Show that $\sqrt{2}-\sqrt{5}$ is an irrational number.

27. (A) The frequency distribution table of agriculture holdings in a village is given below.

| Area of Land (in hectares) | 1-3 | 3-5 | 5-7 | 7-9 | 9-11 | 11-13 |
|---|---|---|---|---|---|---|
| No. of families | 20 | 45 | 80 | 55 | 40 | 12 |

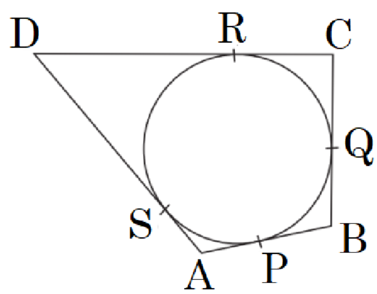
Find the modal agriculture holdings of the village.

**OR**

(B) If the mean of the following distribution is 54, find the value of p.

| Class Interval | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
|---|---|---|---|---|---|
| Frequency | 7 | p | 10 | 9 | 13 |

28. A quadrilateral ABCD is drawn to circumscribe a circle, as shown in the given figure. Show that $\frac{AB+CD}{AD+BC}=1$.




**FOR VISUALLY IMPAIRED STUDENTS**

Show that parallelogram circumscribing a circle is a rhombus.

29. (A) On a particular day, 50000 people attended a Cricket Test Match between India and Australia in Sydney Cricket Ground. Let x be the number of adults attended the cricket match and y be the number of children attended the cricket match. Cost of an adult ticket was ₹1000 while cost of a child ticket was ₹200. On that day Revenue earned by selling all 50000 tickets, was ₹42000000. Find how many adults and how many children attended the cricket match?

**OR**

(B) Solve for x and y, graphically : $2x + y = 6;\ x + y = 5$.

**FOR VISUALLY IMPAIRED STUDENTS**

(B) A 2-digit number is 6 times the sum of its digits. The number formed by reversing the digits is 9 less than the given number. Find the number.

30. Prove that : $(\sin x - \cos x + 1).(\sec x - \tan x) = (\sin x + \cos x - 1)$.

31. The sum of first n terms of an A.P. is $5n^2 - n$. Find the $n^{th}$ term of the A.P.

## SECTION D

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

32. Prove that a line drawn parallel to one side of a triangle intersecting other two sides in distinct points, divides the other two sides in the same ratio.

33. (A) The numerator of a fraction is 3 less than its denominator. If 2 is added to both of its numerator and denominator, then the sum of the new fraction and original fraction is $\frac{29}{20}$. Find the original fraction.

**OR**

(B) A train covers a distance of $300$ km at a uniform speed. If the speed of the train is increased by $5$ km/hr, it takes 2 hours less in the journey. Find the original speed of the train.

34. (A) The angle of elevation of the top of a chimney from the foot of a tower is $60°$ and the angle of depression of the foot of the chimney from the top of the tower is $30°$. If the height of the tower is 40 meters, find the height of the chimney. Also, find the length of the wire tied from the top of the chimney to the top of tower.

**OR**

(B) The angle of depression of the top and bottom of a $50$ m high building from the top of a tower are $45°$ and $60°$ respectively. Find the height of the tower and the horizontal distance between the tower and the building. (Use $\sqrt{3} = 1.73$).

35. A solid toy is in the form of a hemisphere surmounted by a right circular cone of height $2$ cm and diameter of base $4$ cm. If a right circular cylinder circumscribes the toy, find the difference of the volumes of the cylinder and the toy. [Use $\pi = 3.14$].

## SECTION E

*(Question numbers 36 to 38 carry **4 marks** each.)*

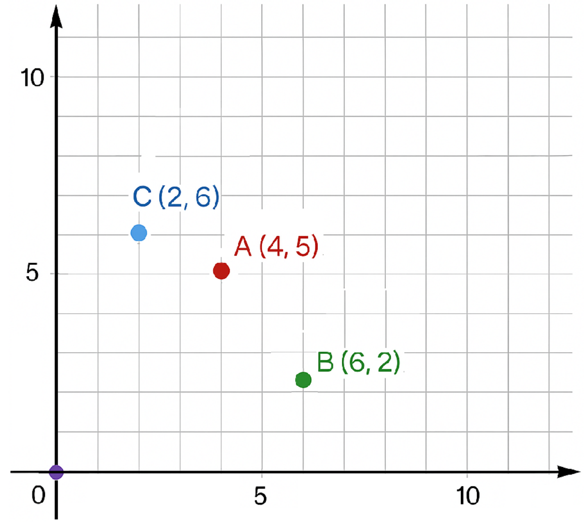
*This section contains **three Case-study / Passage based questions**.*

*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. Carpooling is the sharing of car journeys so that more than one person travels in a car, and prevents the need for others to have to drive to a location themselves. By having more people using one vehicle, carpooling reduces each person's travel costs such as: fuel costs, tolls and the stress of driving. Carpooling is also a more environmentally friendly and sustainable way to travel as sharing journeys reduces air pollution, carbon emissions, traffic congestion on the roads, and the need for parking spaces.

Three friends Amar, Bhavin and Chetanya live in the societies represented by the points $A(4, 5)$, $B(6, 2)$ and $C(2, 6)$ respectively.

They all work in offices located in a same building represented by the point $O(0, 0)$. Since they all go to same building every day, they decided to do carpooling to save money on petrol.




Based on the above information, answer the following questions.

**(i)** What is the distance between B and C?

**(ii)** If Bhavin and Chetanya planned to meet at a club situated at the mid-point of the line joining the points B and C, find the coordinates of this point.

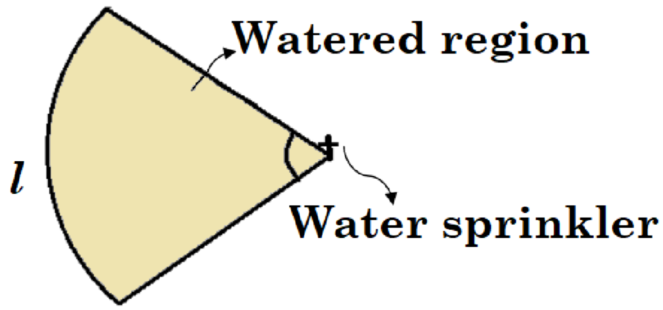
**(iii)** (A) Which society is farthest from the office? Also find its distance from the office.

**OR**

**(iii)** (B) Out of B and C, which society is nearer to A? Also find their distances.

37. A water sprinkler is a device used to irrigate agricultural crops, landscapes, golf courses and other areas. Water sprinklers can be used for residential, industrial and agricultural usage.

A water sprinkler is set to shoot of water a distance of $21$ m and rotate through an angle which is equal to complementary angle of $10°$.




Based on the above information, answer the questions given below.

**(i)** What is the area of sector in terms of arc length?

**(ii)** What is the area of the watered region (in terms of $\pi$)?
**(iii)** (A) If the radius (r) changes to $28\text{ m}$, then find the angle $\theta$ so that the area of the watered region remains the same.

**OR**

**(iii)** (B) If the radius (r) is increased from $21\text{ m}$ to $28\text{ m}$ and the angle remains the same, what is the increase in the area of the watered region?

38. One of four main blood types can be found in a human body. They are known as A, B, AB and O. Each blood type can be further classified as either a Rhesus positive $(+)$ or Rhesus negative $(-)$. For example a possible combination is blood type O and Rhesus negative which is written as $O^-$.
The data below shows the distribution of the blood types and Rhesus types of given blood type for a **Blood Donation Centre** recorded (in percentages) for the year 2023.

| BLOOD GROUP | RHESUS FACTOR | NUMBER OF PERSONS (in %) |
|---|---|---|
| O | $O^-$ | x |
| | $O^+$ | 30 |
| A | $A^-$ | 8 |
| | $A^+$ | 24 |
| B | $B^-$ | 6 |
| | $B^+$ | 18 |
| AB | $AB^-$ | 1 |
| | $AB^+$ | 3 |

Based on the above information, answer the questions given below.
**(i)** Find the value of x.
**(ii)** Find the probability that a randomly selected person has a Rhesus negative blood type.
**(iii)** (A) What is the probability that the person selected from the record is Rhesus positive but neither blood type A nor B?

**OR**

**(iii)** (B) People with blood type AB positive $(AB^+)$ are known as the universal recipient and with blood type O negative $(O^-)$ are known as universal donor. Find the probability of a selected person to be neither universal recipient nor universal donor.

## 📖 DETAILED SOLUTIONS (Mathematics Basic - 241)

**SECTION A**

01. (d) As $2025 = 3^4 \times 5^4$.
So, the exponent of 3 in the prime factorization of 2025 is 4.

02. (b) On subtracting first equation from second equation, we get
$2025x + 2024y - 2024x - 2025y = -1 - 1$
$\Rightarrow (x - y) = -2$.

03. (d) As $f(x) = k(x+2)(x-5)$
$\Rightarrow f(x) = k(x^2 - 3x - 10)$, $k \neq 0$
Since k can be any non-zero real number.
So, there are Infinitely many such polynomials.

04. (c) On simplification, given equations reduce to
(a) $x^2 + 2x - 2 = 0$ (Quadratic Equation)
(b) $2x^2 - 3x - 1 = 0$ (Quadratic Equation)
(c) $3x + 1 = 0$ (**Not** a Quadratic Equation)
(d) $4x^2 + x = 0$ (Quadratic Equation)

05. (a) As $2(x+10) = (3x+2) + 2x$
$\Rightarrow 2x + 20 = 5x + 2$
$\Rightarrow 3x = 18$
$\Rightarrow x = 6$.

06. (b) As $\frac{50(51)}{2} = 25k$
$\Rightarrow 25 \times 51 = 25k$
$\Rightarrow k = 51$.

07. (d) Distance between the given points $= \sqrt{\left(\frac{1}{2} - \frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2} + \frac{\sqrt{3}}{2}\right)^2} = \sqrt{2}$.

08. (c) We know that, for the coordinates of a mirror image of a point in x-axis, abscissa remains the same and ordinate will be of opposite sign of the ordinate of given point. So, the mirror image of the point $(-3, 5)$ about x-axis is $(-3, -5)$.

09. (b) As $\Delta ABC \sim \Delta EFD \Rightarrow \angle A = \angle E$.

10. (b) As $\Delta ABC \sim \Delta PQR$
$\Rightarrow \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{1}{2}$
Consider $\frac{AB}{PQ} = \frac{1}{2}$, $\frac{BC}{QR} = \frac{1}{2}$
$\Rightarrow PQ = 6$ cm, $QR = 8$ cm
$\therefore$ Perimeter of the triangle PQR (in cm) $= 6 + 8 + 10 + 24$.

**FOR VISUALLY IMPAIRED STUDENTS**

(b) The solution is same as above.

11. (a) From the figure, $AE = 24 - r = AF$.
So, $BF = 1 + r = 7 - r$
$\Rightarrow r = 3$ cm.

**FOR VISUALLY IMPAIRED STUDENTS**

(b) As $PQ = PR = 24$ cm.

So, Area of Quadrilateral PQOR (in $cm^2$) $= 2\times\frac{1}{2}\times 24\times 10 = 240$.

12. (b) As $\cot^2 x - \operatorname{cosec}^2 x = -1$, so it is **not** equal to unity.
13. (c) As the Median class is 10-15. So, its upper limit is 15.
14. (c) Since 3 Median $=$ Mode $+2$ Mean. So, $a = 3$ and $b = 2$.
15. (b) Radius (in cm) $= \sqrt{13^2 - 12^2} = 5$.
16. (a) As $\angle PAO = 90°$. So, $\angle APO = 115° - 90° = 25°$.

**FOR VISUALLY IMPAIRED STUDENTS**

(a) As the chord is at a distance of 18 cm (more than the radius). So, the chord will be at a distance of 5 cm on the opposite side of the centre.

Thus, length of the chord CD will be $2\sqrt{13^2 - 5^2} = 2\sqrt{144} = 2\times 12 = 24$ cm.

17. (c) As $r_1 : r_2 = 3:4$. So, the ratio of their areas $= r_1^2 : r_2^2 = 9:16$.
18. (a) Since the event is most unlikely to happen.
Therefore, its probability is $0.0001$.
19. (a) Both the statements, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
20. (d) Since events given in Assertion (A) are not equally likely, so probability of getting two heads is not $\frac{1}{3}$. Thus, Assertion (A) is false but Reason (R) is true.

**SECTION B**

21. (A) It can be observed that, $2\times5\times7\times11+11\times13 = 11\times(70+13) = 11\times83$.
Since $2\times5\times7\times11+11\times13$ is the product of two factors other than 1.
Therefore, it is a composite number.

**OR**

(B) The smallest number which is divisible by any two numbers is their LCM.
So, the number which is divisible by both 306 and 657 $=$ LCM (306, 657).
Since, $306 = 2^1\times3^2\times17^1$ and $657 = 3^2\times73$.
$\therefore$ LCM $(306, 657) = 2^1\times3^2\times17^1\times73 = 22338$.

22. As $P(3, a)$ lies on the line L, so $3 + a = 5 \Rightarrow a = 2$.
Now, the radius of the circle $=$ CP $= \sqrt{3^2 + 2^2} = \sqrt{13}$ units.

**FOR VISUALLY IMPAIRED STUDENTS**

Diameter of the circle $=$ Distance between $(0, 0)$ and $(6, 8) = \sqrt{6^2 + 8^2} = 10$

Radius of the circle $= \frac{1}{2}\times$(Diameter of the circle) $= 5$ units.

23. Sum of the zeroes $= 2 + (-3) = -\frac{(a+1)}{1}$
$\Rightarrow -1 = -a - 1$
$\Rightarrow a = 0$
Product of the zeroes $= 2(-3) = \frac{b}{1}$
$\Rightarrow b = -6$
Hence, $a = 0$, $b = -6$.

24. Discriminant, $D = 4^2 - 4\times1\times(-3\sqrt{2}) = 16 + 12\sqrt{2} > 0$
As the Discriminant (D) is positive.
So, the Roots are real and distinct.

25. (A) $2\sin 30°\tan 60° - 3\cos^2 60°\sec^2 30° = 2\left(\frac{1}{2}\right)(\sqrt{3}) - 3\left(\frac{1}{2}\right)^2\left(\frac{2}{\sqrt{3}}\right)^2$

$$= \sqrt{3} - 3\times\frac{1}{4}\times\frac{4}{3}$$

$$= \sqrt{3} - 1.$$

**OR**

(B) As $\sin x.\cos x(\tan x + \cot x) = \sin x.\cos x\left(\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}\right)$

$$= \sin x.\cos x\left(\frac{\sin^2 x + \cos^2 x}{\cos x \,.\, \sin x}\right)$$

$$= \sin x.\cos x\left(\frac{1}{\cos x.\sin x}\right)$$

$$= 1 \text{ (Constant)}$$

Since, the value of $\sin x.\cos x(\tan x + \cot x)$ is constant, so it equals 1 for all the angles $x$.

## SECTION C

26. To prove that $(\sqrt{2} - \sqrt{5})$ is an irrational number, we will use the contradiction method.
Let, if possible, $\sqrt{2} - \sqrt{5} = x$, where x is any rational number (clearly $x \neq 0$).
So, $\sqrt{2} = x + \sqrt{5}$
$\Rightarrow 2 = (x + \sqrt{5})^2$ (On squaring both the sides
$\Rightarrow 2 = x^2 + 5 + 2\sqrt{5}x$
$\Rightarrow -x^2 - 3 = 2\sqrt{5}x$
$\Rightarrow \frac{-x^2 - 3}{2x} = \sqrt{5}$ ...(i)
Note $\sqrt{5}$ is an irrational number, as the square root of any prime number is always an irrational number.
In equation (i), LHS is a rational number while RHS is an irrational number.
But an irrational number cannot be equated to a rational number.
So, our assumption is wrong.
Thus, $(\sqrt{2} - \sqrt{5})$ is an irrational number.

27. (A) Refer the table shown.

| Area of land (in hectares) | 1-3 | 3-5 | 5-7 | 7-9 | 9-11 | 11-13 |
|---|---|---|---|---|---|---|
| No. of families | 20 | 45 | 80 | 55 | 40 | 12 |

$\therefore$ Modal class = 5-7, $l = 5$, $h = 2$, $f_0 = 45$, $f_1 = 80$, $f_2 = 55$.

So, mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)\times h$

$$= 5 + \left( \frac{80 - 45}{2 \times 80 - 45 - 55} \right) \times 2 = 6.1666...$$

Hence, modal agriculture holdings of the village is 6.17 hectare (approx.)

**OR**

(B) Refer the table given below.

| Class Interval | $f_i$ | $x_i$ | $d_i = \frac{x_i - 30}{h}$ | $f_i d_i$ |
|---|---|---|---|---|
| 0-20 | 7 | 10 | $-1$ | $-7$ |
| 20-40 | p | 30 | 0 | 0 |
| 40-60 | 10 | 50 | 1 | 10 |
| 60-80 | 9 | 70 | 2 | 18 |
| 80-100 | 13 | 90 | 3 | 39 |
| Total | $39 + p$ | | | 60 |

Let the assumed mean (A) be 30, $h = 20$.

Now, the $\text{Mean} = 54 = 30 + \frac{60}{39 + p} \times 20$

$\Rightarrow 24 = \frac{1200}{39 + p}$

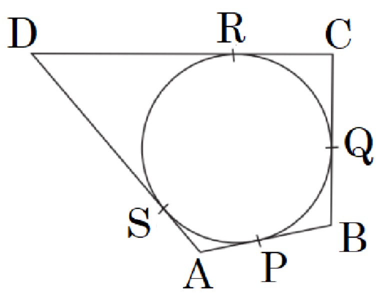
$\Rightarrow 50 = 39 + p$

$\therefore p = 11$.

28. Tangents drawn to a circle from an external point are equal in length.

So, $AP = AS$, $BP = BQ$,

$CR = CQ$, $DR = DS$




On adding the above equations, we get

$(AP + PB) + (CR + RD) = (AS + BQ) + (CQ + DS)$

$\Rightarrow AB + CD = (AS + SD) + (BQ + QC)$

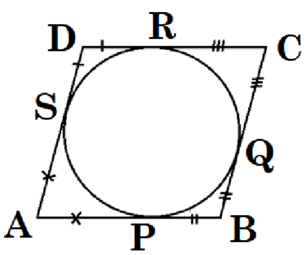
$\Rightarrow AB + CD = AD + BC$

$\Rightarrow \frac{AB + CD}{AD + BC} = 1$.

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

Parallelogram ABCD circumscribes a circle as shown in figure.

Tangents drawn to a circle from an external point are equal.




On adding the above equations, we get

$(AP + PB) + (CR + RD) = (AS + BQ) + (CQ + DS)$

$\Rightarrow AB + CD = (AS + SD) + (BQ + QC)$

$\Rightarrow AB + CD = AD + BC$

$\Rightarrow 2 \times AB = 2 \times BC$ (Opposite sides of parallelogram are equal)

Thus, $AB = BC$

Since, in the parallelogram ABCD - a pair of adjacent sides are equal.

Hence, ABCD is a rhombus.

29. (A) According to the question, $1000x + 200y = 42000000$

$\Rightarrow 5x + y = 21000$ …(i)

and $x + y = 50000$ …(ii)

By (i) – (ii), we get $4x = 160000$

$\Rightarrow x = 40000$

Substituting value of x in (ii), we get $y = 10000$

$\therefore$ Number of adults attended the match is $40000$ and number of children attended is $10000$.

**OR**

29. (B) $2x + y = 6$

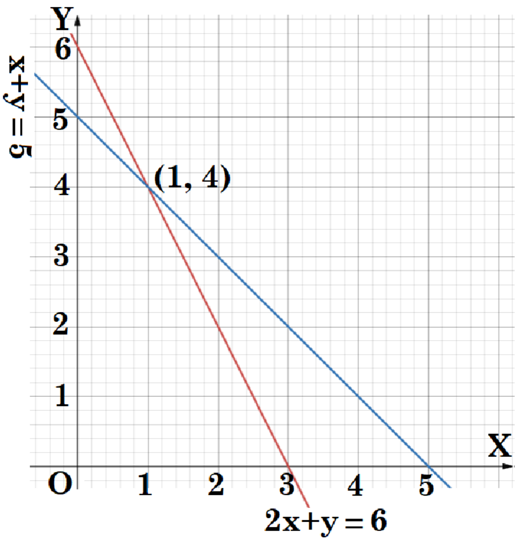
$\Rightarrow x = \dfrac{6-y}{2}$

| | | | |
|---|---|---|---|
| x | 2 | 3 | 0 |
| y | 2 | 0 | 6 |

and $x + y = 5$

$\Rightarrow x = 5 - y$

| | | | |
|---|---|---|---|
| x | 2 | 5 | 0 |
| y | 3 | 0 | 5 |




Note that, the lines intersect at (1, 4).
Hence, solution is $x = 1,\ y = 4$.

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

(B) Let unit's place digit be x and ten's place digit be y.

$\therefore$ Original number $= 10y + x$

And, the reversed number $= 10x + y$

Given $10y + x = 6(x + y)$

$\Rightarrow 5x - 4y = 0$ ...(i)

and $(10y + x) - (10x + y) = 9$

$\Rightarrow -9x + 9y = 9$

$\Rightarrow x - y = -1$ ...(ii)

On solving (i) and (ii), we get $x = 4,\ y = 5$

Therefore, the number is 54.

30. LHS : $(\sin x - \cos x + 1).(\sec x - \tan x)$

$= (\sin x - \cos x + 1).\left(\dfrac{1-\sin x}{\cos x}\right)$

$= (1+\sin x)\left(\dfrac{1-\sin x}{\cos x}\right) - \cos x\left(\dfrac{1-\sin x}{\cos x}\right)$

$= \left(\dfrac{1-\sin^2 x}{\cos x}\right) - (1-\sin x)$

$= \dfrac{\cos^2 x}{\cos x} - 1 + \sin x$

$= \sin x + \cos x - 1 = \text{RHS}$.

31. As $S_n = 5n^2 - n$

Now, $n^{th}$ term is given by $a_n = S_n - S_{n-1}$

$\Rightarrow a_n = [5n^2 - n] - [5(n-1)^2 - (n-1)]$

$\Rightarrow a_n = 5[n^2 - (n-1)^2] - [n - (n-1)]$

$\Rightarrow a_n = 5\,[2n - 1] - [1]$

$\Rightarrow a_n = 10n - 6$.

**Alternatively,** $S_n = 5n^2 - n$

So, $S_1 = a_1 = 5\times1^2 - 1 = 4$; $S_2 = a_1 + a_2 = 5\times2^2 - 2 = 18$.

Now $d = a_2 - a_1 = (a_1 + a_2) - 2(a_1) = 18 - 2\times4 = 10$

Hence, $a_n = a + (n-1)d = 4 + (n-1)\times10$

$\therefore a_n = 10n - 6$.

## SECTION D

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

33. (A) Let the denominator of the required fraction be x.
Then its numerator will be $(x-3)$.

So, the original fraction is $\frac{x-3}{x}$.

Given $\frac{(x-3)+2}{x+2} + \frac{(x-3)}{x} = \frac{29}{20}$

$\Rightarrow \frac{(x-1)}{x+2} + \frac{(x-3)}{x} = \frac{29}{20}$

$\Rightarrow \frac{(x-1)x + (x-3)(x+2)}{(x+2)x} = \frac{29}{20}$

$\Rightarrow \frac{x^2 - x + x^2 - x - 6}{x^2 + 2x} = \frac{29}{20}$

$\Rightarrow 20(2x^2 - 2x - 6) = 29(x^2 + 2x)$

$\Rightarrow 11x^2 - 98x - 120 = 0$

$\Rightarrow 11x^2 - 110x + 12x - 120 = 0$

$\Rightarrow (11x+12)(x-10) = 0$

$\Rightarrow x = 10$ or $x = -\frac{12}{11}$ (not possible as it is not an integer)

$\therefore x = 10$

Hence, the required fraction is $\frac{7}{10}$.

**OR**

(B) Let the original speed of the train be x km/hr.
Distance travelled is 300 km.

$\therefore$ Original time $(t_0) = \frac{300}{x}$ hr

New speed of the train $= (x+5)$ km/hr

$\therefore$ New time $(t_n) = \frac{300}{x+5}$ hr

Given $t_o - t_n = 2$ $\Rightarrow \frac{300}{x} - \frac{300}{x+5} = 2$ $\Rightarrow \frac{300(x+5) - 300(x)}{x(x+5)} = 2$

$\Rightarrow \frac{1500}{x^2 + 5x} = 2$

$\Rightarrow x^2 + 5x - 750 = 0$

$\Rightarrow x^2 + 30x - 25x - 750 = 0$

$\Rightarrow x(x+30) - 25(x+30) = 0$

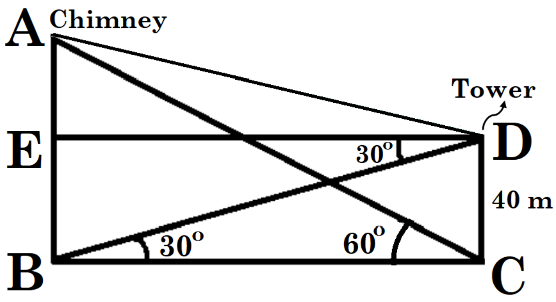
$\Rightarrow (x-25)(x+30) = 0$

$\Rightarrow x = 25$ or $x = -30$ (not possible as speed cannot be negative)

$\therefore x = 25$

Hence, the original speed of the train is 25 km/hr.

34. (A) Let BA be the chimney and CD be the tower.




In $\Delta CBD$, $\tan 30° = \frac{40}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{BC}$

$\Rightarrow BC = 40\sqrt{3}$ m

In $\Delta ABC$, $\tan 60° = \frac{AB}{40\sqrt{3}}$

$\Rightarrow \sqrt{3} = \frac{AB}{40\sqrt{3}}$

$\Rightarrow AB = 120$ m

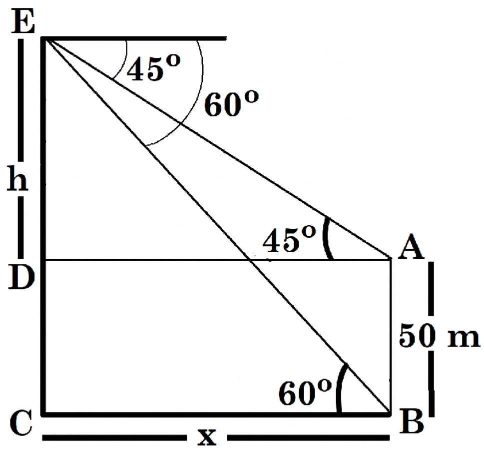
$\therefore AE = (120-40)$ m $= 80$ m, $ED = BC = 40\sqrt{3}$ m

Now, $AD = \sqrt{AE^2 + ED^2} = \sqrt{6400+4800} = 40\sqrt{7}$ m.

Thus, length of wire tied from the top of the chimney to the top of tower is $40\sqrt{7}$ m.

**OR**

(B) Let EC be the tower and AB be the building.




In $\Delta EDA$, $\tan 45° = \frac{h}{x}$

$\Rightarrow 1 = \frac{h}{x}$

$\Rightarrow h = x$ ...(i)

In $\Delta EBC$, $\tan 60° = \frac{EC}{BC}$

$\Rightarrow \sqrt{3} = \frac{h+50}{h}$ [$\because BC = x = h$, by (i)]

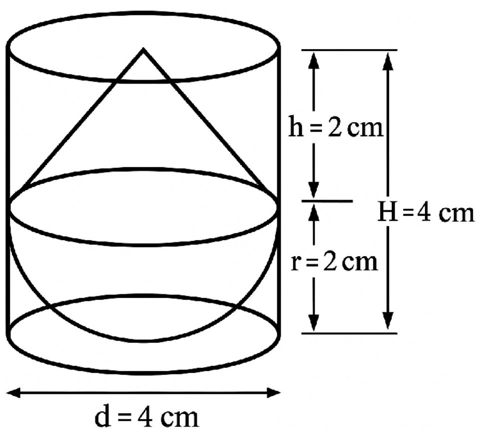
$\Rightarrow h + 50 = \sqrt{3}h$

$\Rightarrow h = \frac{50}{\sqrt{3}-1} = 25(\sqrt{3}+1)$ m $= 25(1.73+1)$ m $= 68.25$ m.

Thus, $h = 68.25$ m $= x$ (Horizontal distance between the tower and building)

Now, height of the tower $= 68.25 + 50 = 118.25$ m.

35. Volume of toy $=$ Volume$_{\text{Hemi-sphere}}$ + Volume$_{\text{Cone}}$




$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi r^2(2r+h)$

$= \frac{1}{3}\times 3.14\times 2^2(2\times 2+2)$

$= 25.12$ cm$^3$

Volume of circumscribing cylinder $= \pi r^2 H$

$= 3.14\times 2^2\times 4$

$= 50.24\ cm^3$

Now, difference in the volumes of circumscribing cylinder and the toy

$= $ Vol. of cylinder $-$ Vol. of toy

$= (50.24 - 25.12)\ cm^3$

$= 25.12\ cm^3$

Hence, difference in the volumes of circumscribing cylinder and the toy is $25.12\ cm^3$.

**SECTION E**

36. Given $A(4, 5)$, $B(6, 2)$ and $C(2, 6)$.

**(i)** Distance between B and C $= \sqrt{(2-6)^2 + (6-2)^2} = \sqrt{16+16} = 4\sqrt{2}$ units.

**(ii)** Mid-point of the line joining the points B and C $= \left(\frac{6+2}{2}, \frac{2+6}{2}\right) = (4, 4)$.

**(iii)** (A) As $OA = \sqrt{41}$ units, $OB = \sqrt{40}$ units, $OC = \sqrt{40}$ units.

So, Society A is the farthest from the office.

**Note**, that distance of (x, y) from (0, 0) is given as $\sqrt{x^2 + y^2}$ units.

**OR**

**(iii)** (B) As $AB = \sqrt{(6-4)^2 + (2-5)^2} = \sqrt{13}$ units, $AC = \sqrt{(2-4)^2 + (6-5)^2} = \sqrt{5}$ units.

So, Society C is nearer to Society A.

37. **(i)** Area of sector $= \frac{(\text{Arc length} \times \text{radius})}{2}$

**(ii)** Area of sector $= \frac{80}{360}\pi \times 441 = 98\pi\ m^2$.

**(iii)** (A) $\frac{80}{360}\pi \times 441 = \frac{\theta}{360}\pi \times 28^2$

$\Rightarrow 80 \times 441 = \theta \times 28^2$

$\Rightarrow 80 \times 63 = \theta \times 28 \times 4$

$\Rightarrow 80 \times 9 = \theta \times 4 \times 4$

$\Rightarrow 5 \times 9 = \theta$

$\therefore \theta = 45^\circ$.

**OR**

**(iii)** (B) Increase in the area of the lawn watered $= \frac{80}{360}\pi \times (784 - 441) = 239.56\ m^2$.

38. **(i)** $x = 100 - (30 - 32 - 24 - 4) = 10$.

**(ii)** P(selected person to have Rhesus negative blood type) $= \frac{10+8+6+1}{100} = \frac{25}{100} = \frac{1}{4}$.

**(iii)** (A) P(person is Rhesus positive but neither A nor B type blood) $= \frac{30+3}{100} = \frac{33}{100}$.

**OR**

**(iii)** (B) P(person is neither universal recipient nor universal donor) $= 1 - \frac{(3+10)}{100}$

$= 1 - \frac{13}{100} = \frac{87}{100}$.