SAMPLE PAPER TEST 2 FOR BOARD EXAM 2025

SUBJECT: MATHEMATICS | **MAX. MARKS : 80**
CLASS : X | **DURATION : 3 HRS**

General Instruction:

1. This Question Paper has 5 Sections A-E.
2. **Section A** has 20 MCQs carrying 1 mark each.
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A

Questions 1 to 20 carry 1 mark each.

1. Given HCF(2520, 6600) = 40, LCM(2520, 6600) = 252 × k, then the value of k is:
(a) 1650 (b) 1600 (c) 165 (d) 1625

2. Three cubes each of side 15 cm are joined end to end. The total surface area of the cuboid is:
(a) 3150 cm^2 (b) 1575 cm^2 (c) 1012.5 cm^2 (d) 576.4 cm^2

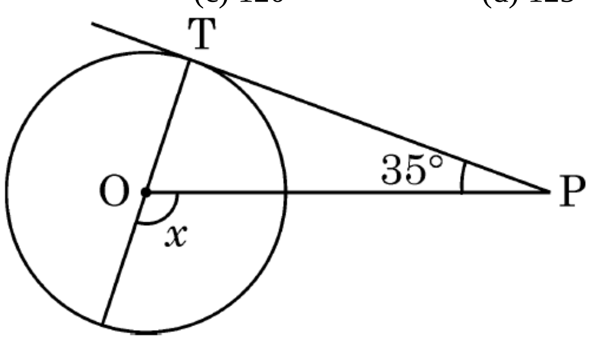
3. From a point on the ground, which is 30m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is:
(a) $10\sqrt{3}$ (b) $30\sqrt{3}$ (c) 60 (d) 30

4. If $\cos\theta = \sqrt{3}/2$ and $\sin\phi = 1/2$, then $\tan(\theta + \phi)$ is:
(a) $\sqrt{3}$ (b) $1/\sqrt{3}$ (c) 1 (d) not defined

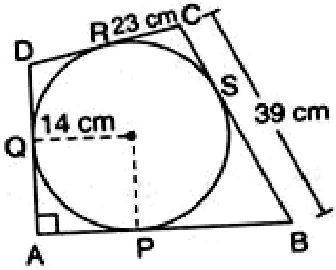
5. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to
(a) 1 (b) 2 (c) 3 (d) 0

6. The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are:
(a) 3, –3/2 (b) –3,–3/2 (c) –3,3/2 (d) 3,3/2

7. In the given figure, if PT is a tangent to a circle with centre O and ∠TPO = 35°, then the measure of ∠x is:
(a) 110° (b) 115° (c) 120° (d) 125°



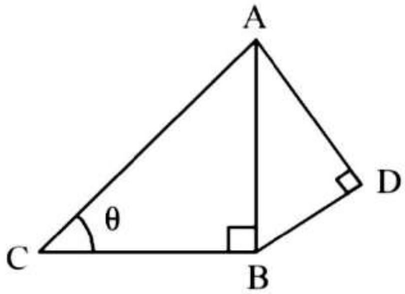
8. In the given figure, quadrilateral ABCD is circumscribed, touching the circle at P, Q, R and S such that ∠DAB = 90°, If CR = 23 cm and CB = 39 cm and the radius of the circle is 14 cm, then the measure of AB is



(a) 37 cm (b) 16cm (c) 30 cm (d) 39 cm

9. If the circumference of a circle increases from 2π to 4π then its area ......the original area :
(a) Half (b) Double (c) Three times (d) Four times

10. In the figure given below, AD = 4 cm, BD = 3 cm and CB = 12 cm, then cot θ equals :



(a) 3/4 (b) 5/12 (c) 4/3 (d) 12/5

11. The perimeters of two similar triangles are 25 cm and 15 cm respectively. If one side of first triangle is 9 cm., what is the corresponding side of the other triangle?
(a) 5.4 (b) 3.5 (c) 5.5 (d) 4.5

12. If ΔABC ~ ΔEDF and ΔABC is not similar to ΔDEF, then which of the following is not true?
(a) BC.EF = AC.FD (b) AB.EF = AC.DE (c) BC.DE = AB.EF (d) BC.DE = AB.FD

13. The radii of 2 cylinders are in the ratio 2 : 3 and their heights are in the ratio 5 : 3. Then, the ratio of their volumes is:
(a) 19 : 20 (b) 20 : 27 (c) 18:25 (d) 17:23

14. The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is
(a) 20 (b) 19 (c) 18 (d) 17

15. Consider the following distribution:

Marks obtained	Number of students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

the frequency of the class 30-40 is
(a) 4 (b) 48 (c) 51 (d) 3

16. Two dice are thrown together. The probability that they show different numbers is :
(a) 1/6 (b) 5/6 (c) 1/3 (d) 2/3

17. The midpoint of a line segment joining two points A(2, 4) and B(-2, -4) is
(a) (-2, 4) (b) (2, -4) (c) (0, 0) (d) (-2, -4)

18. If the distance between the points A(2, -2) and B(-1, x) is equal to 5, then the value of x is:
(a) 2 (b) -2 (c) 1 (d) -1

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

(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 and 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 point which divides the line segment joining the points A(1, 2) and B(–1, 1) internally in the ratio 1 : 2 is (–1/3, 5/3).
Reason(R): The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$

20. Assertion (A): For any two positive integers a and b, HCF(a, b) x LCM(a, b) = a x b
Reason (R): The HCF of two numbers is 5 and their product is 150. Then their LCM is 40.

SECTION-B

Questions 21 to 25 carry 2M each

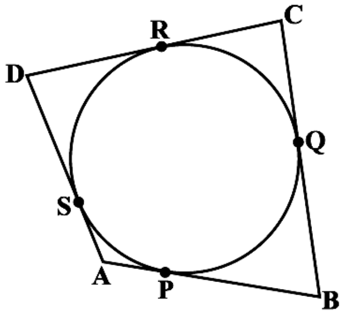
21. Evaluate: $\frac{\cos 45^0 + \sin 60^0}{\sec 30^0 + \cos ec 30^0}$

22. The short and long hands of a clock are 4 cm and 6 cm long respectively. Find the sum of distances travelled by their tips in 2 days

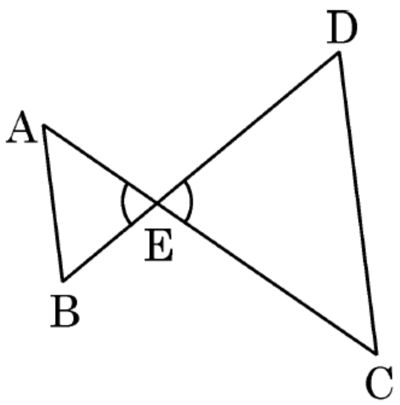
OR

A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the total area cleaned at each sweep of the blades

23. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC.



24. In the given figure, EA/EC = EB/ED, prove that ΔEAB ~ ΔECD



OR

ABCD is a trapezium in which AB || CD and its diagonals intersect each other at the point O. Using a similarity criterion of two triangles, show that $\frac{OA}{OC} = \frac{OB}{OD}$

25. Find the value of p if the pair of equations 2x + 3y – 5 = 0 and px – 6y – 8 = 0 has a unique solution.

SECTION-C

Questions 26 to 31 carry 3 marks each

26. (a) Find the ratio in which the line segment joining the points (5, 3) and (–1,6) is divided by Y-axis.

OR

(b) P(–2, 5) and Q(3, 2) are two points. Find the coordinates of the point R on line segment PQ such that PR = 2QR.

27. Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord.

28. From a pack of 52 playing cards, jacks, queens, kings and aces of red colour are removed. From the remaining a card is drawn at random. Find the probability that the card drawn is (i) a black queen (ii) a red card (iii) a face card.

29. Find the zeroes of the quadratic polynomial x^2 – 15 and verify the relationship between the zeroes and the coefficients of the polynomial.

30. Prove that: $\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$

31. 4 Bells toll together at 9.00 am. They toll after 7, 8, 11 and 12 seconds respectively. How many times will they toll together again in the next 3 hours?

OR

Given that √3 is irrational, prove that (2 + 5√3) is an irrational number.

SECTION-D

Questions 32 to 35 carry 5M each

32. (a) In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the light.

OR

(b) The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.

33. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on (see below figure). In how may rows are the 200 logs placed and how many logs are in the top row?

OR

The sum of the third and the seventh terms of an AP is 6 and their product is 8. Find the sum of first sixteen terms of the AP.

34. State and prove Basic Proportionality theorem.

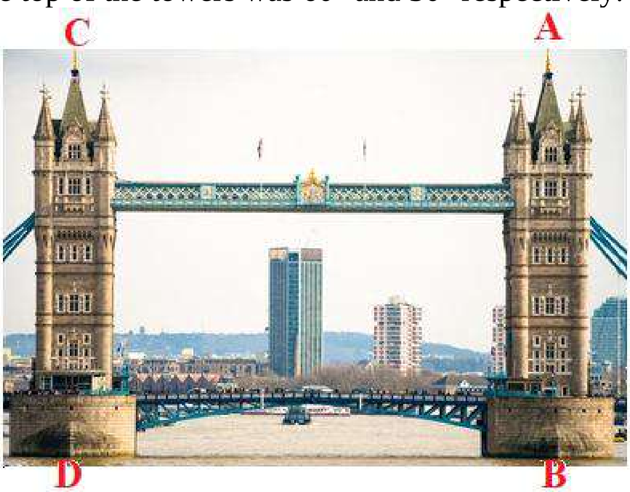
35. The mean of the following frequency distribution is 62.8 and the sum of all the frequencies is 50. Compute the missing frequencies f_1 and f_2.

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

SECTION-E (Case Study Based Questions)

Questions 36 to 38 carry 4M each

36. Tower Bridge is a Grade I listed combined bascule and suspension bridge in London, built between 1886 and 1894, designed by Horace Jones and engineered by John Wolfe Barry. The bridge is 800 feet (240 m) in length and consists of two bridge towers connected at the upper level by two horizontal walkways, and a central pair of bascules that can open to allow shipping.
In this bridge, two towers of equal heights are standing opposite each other on either side of the road, which is 80 m wide. During summer holidays, Neeta visited the tower bridge. She stood at some point on the road between these towers. From that point between the towers on the road, the angles of elevation of the top of the towers was 60° and 30° respectively.

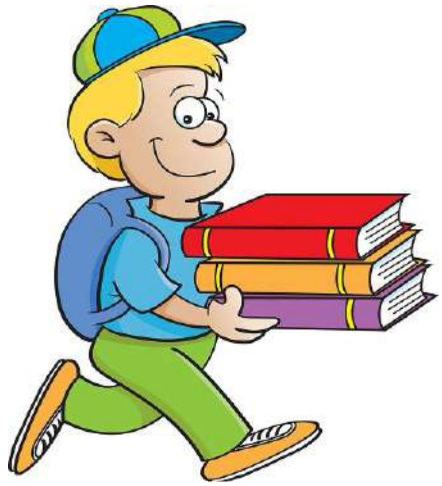


(i) Find the distances of the point from the base of the towers where Neeta was standing while measuring the height. [2]
(ii) Neeta used some applications of trigonometry she learned in her class to find the height of the towers without actually measuring them. What would be the height of the towers she would have calculated? [2]

OR

(ii) Find the distance between Neeta and top of tower AB? Also, Find the distance between Neeta and top tower CD? [2]

37. Deepankar bought 3 notebooks and 2 pens for Rs. 80 and his friend Suryansh bought 4 notebooks and 3 pens for Rs. 110 from the school bookshop.



Based on the above information, answer the following questions.

(i) If the price of one notebook be Rs. x and the price of one pen be Rs. y, write the given situation algebraically. (1)

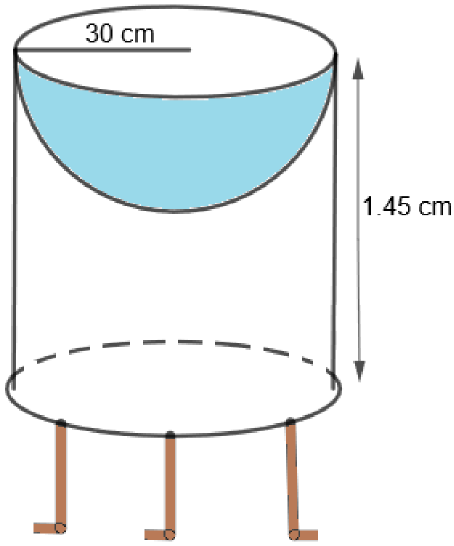
(ii) (a) What is the price of one notebook ? (2)

OR

(b) What is the price of one pen ? (2)

(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens ? (1)

38. Mayank a student of class 7th loves watching and playing with birds of different kinds. One day he had an idea in his mind to make a bird-bath on his garden. His brother who is studying in class 10th helped him to choose the material and shape of the birdbath. They made it in the shape of a cylinder with a hemispherical depression at one end as shown in the Figure below. They opted for the height of the hollow cylinder as 1.45 m and its radius is 30 cm. The cost of material used for making bird bath is Rs. 40 per square meter.



(i) Find the curved surface area of the hemisphere. (Take $\pi = 3.14$)

(ii) Find the total surface area of the bird-bath. (Take $\pi = 22/7$)

(iii) What is total cost for making the bird bath?

OR

(iii) Mayank and his brother thought of increasing the radius of hemisphere to 35 cm with same material so that birds get more space, then what is the new height of cylinder?

SAMPLE PAPER TEST 2 FOR BOARD EXAM 2025
(ANSWERS)

SUBJECT: MATHEMATICS | **MAX. MARKS : 80**
CLASS : X | **DURATION : 3 HRS**

General Instruction:

1. This Question Paper has 5 Sections A-E.
2. **Section A** has 20 MCQs carrying 1 mark each.
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A

Questions 1 to 20 carry 1 mark each.

1. Given HCF(2520, 6600) = 40, LCM(2520, 6600) = 252 × k, then the value of k is:
(a) 1650 (b) 1600 (c) 165 (d) 1625
Ans. (a) 1650

2. Three cubes each of side 15 cm are joined end to end. The total surface area of the cuboid is:
(a) 3150 cm^2 (b) 1575 cm^2 (c) 1012.5 cm^2 (d) 576.4 cm^2
Ans. (a) 3150 cm^2

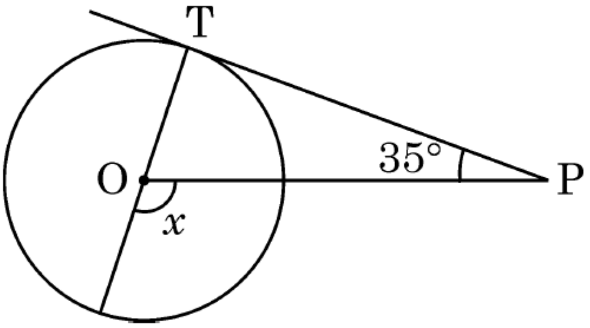
3. From a point on the ground, which is 30m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is:
(a) $10\sqrt{3}$ (b) $30\sqrt{3}$ (c) 60 (d) 30
Ans. (b) $30\sqrt{3}$

4. If $\cos\theta = \sqrt{3}/2$ and $\sin\phi = 1/2$, then $\tan(\theta + \phi)$ is:
(a) $\sqrt{3}$ (b) $1/\sqrt{3}$ (c) 1 (d) not defined
Ans. (a) $\sqrt{3}$

5. 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
Ans. (c) 3

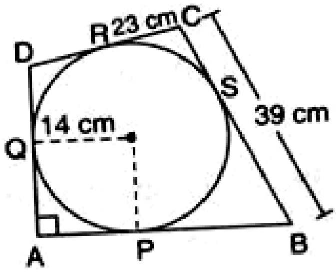
6. The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are:
(a) 3, –3/2 (b) –3,–3/2 (c) –3,3/2 (d) 3,3/2
Ans. (a) 3, –3/2

7. In the given figure, if PT is a tangent to a circle with centre O and ∠TPO = 35°, then the measure of ∠x is:
(a) 110° (b) 115° (c) 120° (d) 125°



Ans. (d) 125°

8. In the given figure, quadrilateral ABCD is circumscribed, touching the circle at P, Q, R and S such that ∠DAB = 90°, If CR = 23 cm and CB = 39 cm and the radius of the circle is 14 cm, then the measure of AB is



(a) 37 cm (b) 16cm (c) 30 cm (d) 39 cm

Ans: (c) 30 cm

∵ Tangent is perpendicular to the radius through the point of contact.

∠OQA = ∠OPA = 90° and OQ = OP [Radii]

∴ OQAP is a square.

⇒ AP = 14cm

Now, CR = CS = 23 cm [Tangents from an external point to a circle are equal]

∴ BS = 39 - 23 = 16cm

And BS = BP = 16 cm [Tangents from an external point to a circle are equal]

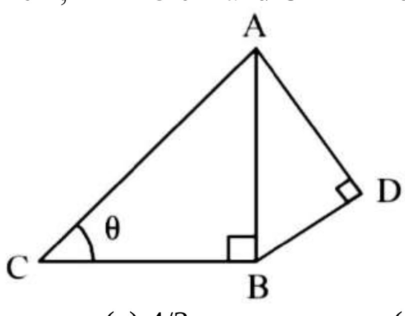
Now, AB = AP + BP = 14 + 16 = 30cm

9. If the circumference of a circle increases from 2π to 4π then its area ......the original area :

(a) Half (b) Double (c) Three times (d) Four times

Ans: (d) Four times

10. In the figure given below, AD = 4 cm, BD = 3 cm and CB = 12 cm, then cot θ equals :



(a) 3/4 (b) 5/12 (c) 4/3 (d) 12/5

Ans: (d) 12/5

11. The perimeters of two similar triangles are 25 cm and 15 cm respectively. If one side of first triangle is 9 cm., what is the corresponding side of the other triangle?

(a) 5.4 (b) 3.5 (c) 5.5 (d) 4.5

Ans: (a) 5.4

Let corresponding sides of two similar Δ's are *a, b, c* and *d, e, f* respectively, let a = 9 cm.

∴ Δ's are similar

$$\frac{a}{d}=\frac{b}{e}=\frac{c}{f}\Rightarrow\frac{a+b+c}{d+e+f}=\frac{a}{d}$$ (Using property of proportion)

$$\Rightarrow\frac{25}{15}=\frac{9}{d}\Rightarrow d=\frac{9\times15}{25}=5.4cm$$

12. If ΔABC ~ ΔEDF and ΔABC is not similar to ΔDEF, then which of the following is not true?
(a) BC.EF = AC.FD (b) AB.EF = AC.DE (c) BC.DE = AB.EF (d) BC.DE = AB.FD
Ans. (c) BC.DE = AB.EF

13. The radii of 2 cylinders are in the ratio 2 : 3 and their heights are in the ratio 5 : 3. Then, the ratio of their volumes is:
(a) 19 : 20 (b) 20 : 27 (c) 18:25 (d) 17:23
Ans: (b) 20 : 27

14. The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is
(a) 20 (b) 19 (c) 18 (d) 17
Ans. (c) 18

15. Consider the following distribution:

Marks obtained	**Number of students**
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

the frequency of the class 30-40 is
(a) 4 (b) 48 (c) 51 (d) 3
Ans: (d) 3

16. Two dice are thrown together. The probability that they show different numbers is :
(a) 1/6 (b) 5/6 (c) 1/3 (d) 2/3
Ans. (b) 5/6

17. The midpoint of a line segment joining two points A(2, 4) and B(-2, -4) is
(a) (-2, 4) (b) (2, -4) (c) (0, 0) (d) (-2, -4)
Ans: (c) (0, 0)
As per midpoint formula, we know;
x-coordinate of the midpoint = [2 + (-2)]/2 = 0/2 = 0
y-coordinate of the midpoint = [4 + (-4)]/2=0/2=0
Hence, (0, 0) is the midpoint of AB.

18. If the distance between the points A(2, -2) and B(-1, x) is equal to 5, then the value of x is:
(a) 2 (b) -2 (c) 1 (d) -1
Ans: (a) 2

$$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}=5\Rightarrow\sqrt{(-1-2)^2+(x+2)^2}=5\Rightarrow\sqrt{9+(x+2)^2}=5$$

$\Rightarrow 9 + (x + 2)^2 = 25$

$\Rightarrow (2 + x)^2 = 16 \Rightarrow 2 + x = 4 \Rightarrow x = 2$

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

19. Assertion (a) : The point which divides the line segment joining the points A(1, 2) and B(–1, 1) internally in the ratio 1 : 2 is (–1/3, 5/3).

Reason(R): The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$

Ans. (d) A is false and R is true

20. **Assertion (A):** For any two positive integers a and b, HCF(a, b) x LCM(a, b) = a x b

Reason (R): The HCF of two numbers is 5 and their product is 150. Then their LCM is 40.

(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 and 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.

Ans: (c) Assertion (A) is true but reason(R) is false.

LCM(a, b) x HCF(a, b) =a x b

⇒ LCM x 5 = 150

⇒ LCM = 150/5 = 30 ⇒ LCM = 30

SECTION-B

Questions 21 to 25 carry 2M each

21. Evaluate: $\frac{\cos 45^0 + \sin 60^0}{\sec 30^0 + \cos ec 30^0}$

Ans. $\frac{\cos 45^0 + \sin 60^0}{\sec 30^0 + \cos ec 30^0}$

$$= \frac{\frac{1}{\sqrt{2}}+\frac{\sqrt{3}}{2}}{\frac{2}{\sqrt{3}}+2} = \frac{2\sqrt{3}+3\sqrt{2}}{4\sqrt{2}(1+\sqrt{3})}$$

22. The short and long hands of a clock are 4 cm and 6 cm long respectively. Find the sum of distances travelled by their tips in 2 days

Ans: In 2 days, the short hand will complete 4 rounds.

∴ Distance moved by its tip = 4(circumference of a circle of radius 4 cm)

$$= 4\times\left(2\times\frac{22}{7}\times 4\right)cm = \frac{704}{7}cm$$

In 2 days, the long hand will complete 48 rounds.

∴ Distance moved by its tip = 48(circumference of a circle of radius 6 cm)

$$= 48\times\left(2\times\frac{22}{7}\times 6\right)cm = \frac{12.672}{7}cm$$

Hence, sum of distances moved by the tips of two hands of the clock $=\left(\frac{704}{7}+\frac{12672}{7}\right)cm$

= 1910.85 cm

OR

A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the total area cleaned at each sweep of the blades

Ans: Here, r = 21 cm, θ = 120°

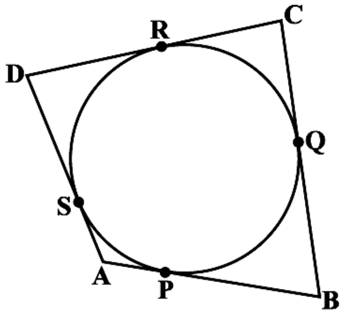
Area of a sector = $\frac{\theta}{360^0} \times \pi r^2 = \frac{120^0}{360^0} \times \frac{22}{7} \times 21 \times 21$

= 462 cm^2

∴ Total area cleaned by two wipers

= 2 × 462 = 924 cm^2

23. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC.



Ans: We know that the lengths of the tangents drawn from an external point to the circle are equal.

DR = DS ...... (i)

BP = BQ ...... (ii)

AP = AS ...... (iii)

CR = CQ ...... (iv)

Adding (i), (ii), (iii), (iv), we get DR + BP + AP + CR = DS + BQ + AS + CQ

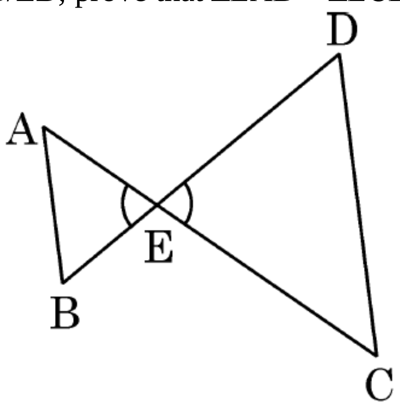
By rearranging the terms we get,

(DR + CR) + (BP + AP) = (CQ + BQ) + (DS + AS)

⇒ CD + AB = BC + AD

Hence it is proved AB + CD = AD + BC.

24. In the given figure, EA/EC = EB/ED, prove that ΔEAB ~ ΔECD



Ans. In ΔEAB and ΔECD

EA/EC = EB/ED

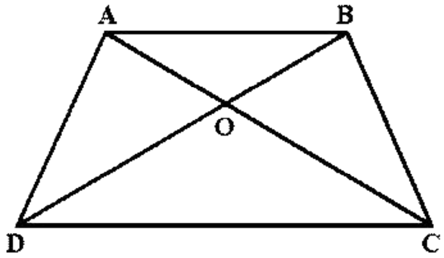
∠AEB = ∠CED

ΔEAB ~ ΔECD (by SAS Similarity)

OR

ABCD is a trapezium in which AB || CD and its diagonals intersect each other at the point O. Using a similarity criterion of two triangles, show that $\frac{OA}{OC} = \frac{OB}{OD}$

Ans: ABCD is a trapezium with AB||CD and diagonals AB and CD intersecting at O.



In △OAB and △OCD

∠AOB =∠DOC [Vertically opposite angles]

∠ABO = ∠CDO [Alternate angles]

∠BAO = ∠OCD [Alternate angles]

∴ △OAB ~ △OCD [AAA similarity]

We know that if triangles are similar, their corresponding sides are in proportional

$\therefore \frac{OA}{OC} = \frac{OB}{OD}$

25. Find the value of p if the pair of equations 2x + 3y – 5 = 0 and px – 6y – 8 = 0 has a unique solution.

Ans: Given, pair of linear equations is 2x + 3y – 5 = 0 and px – 6y – 8 = 0

On comparing with ax + by + c = 0 we get

Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -5$;

And $a_2 = p$, $b_2 = -6$, $c_2 = -8$;

$a_1/a_2 = 2/p$, $b_1/b_2 = -3/6 = -½$, $c_1/c_2 = 5/8$

Since, the pair of linear equations has a unique solution,

$\therefore a_1/a_2 \neq b_1/b_2$

$\Rightarrow 2/p \neq -½$

$\Rightarrow p \neq -4$

Hence, the pair of linear equations has a unique solution for all values of p except – 4.

SECTION-C

Questions 26 to 31 carry 3 marks each

26. (a) Find the ratio in which the line segment joining the points (5, 3) and (–1,6) is divided by Y-axis.

Ans. Let the line segment divides y-axis at (0, y).

Let the required ratio be k : 1

$\therefore \quad 0 = \frac{(-1)k+5(1)}{k+1}$

$\Rightarrow k = 5$

Hence ratio is 5 : 1

OR

(b) P(–2, 5) and Q(3, 2) are two points. Find the coordinates of the point R on line segment PQ such that PR = 2QR.

Ans. Let coordinates of R be (x, y) .

PR : RQ = 2 : 1

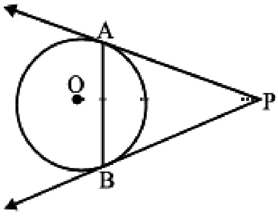
$x = \frac{2(3)+1(-2)}{2+1} = \frac{4}{3}$

$y = \frac{2(2)+1(5)}{2+1} = 3$

$\therefore$ Cordinates of the point R $(\frac{4}{3}, 3)$

27. Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord.

Ans. Let AB be the chord of circle.



In ΔPAB

PA = PB

∠PAB = ∠PBA

28. From a pack of 52 playing cards, jacks, queens, kings and aces of red colour are removed. From the remaining a card is drawn at random. Find the probability that the card drawn is (i) a black queen (ii) a red card (iii) a face card.

Ans: From the total playing 52 cards, red coloured jacks, queen, kings and aces are removed(i.e., 2 jacks, 2 queens, 2 kings, 2 aces) ∴ Remaining cards = 52 – 8 = 44

(i) Favourable cases for a black queen are 2 (i.e., queen of club or spade)

∴ Probability of drawing a black queen = 2/44 = 1/22

(ii) Favourable cases for red cards are 26 – 8 = 18 (as 8 cards have been removed) (i.e.9 diamonds + 9 hearts)

∴ Probability of drawing a red card = 18/44 = 9/22

(iii) Favourable cases for a face card are 6 (i.e. 2 black jacks, queens and kings each)

∴ Probability of drawing a face card = 6/44 = 3/22

29. Find the zeroes of the quadratic polynomial $x^2 – 15$ and verify the relationship between the zeroes and the coefficients of the polynomial.

Ans.

Let $P(x) = x^2 - 15$

$$= (x - \sqrt{15})(x + \sqrt{15})$$

∴ Zeroes of P(x) are $-\sqrt{15}$ and $\sqrt{15}$

Verification-

$$\text{Sum of zeroes} = -\sqrt{15} + \sqrt{15} = \frac{0}{1} = \frac{-\text{ coefficient of x}}{\text{coefficient of } x^2}$$

$$\text{Product of zeroes} = -\sqrt{15} \times \sqrt{15} = -15 = \frac{-15}{1} = \frac{\text{costant term}}{\text{coefficient of } x^2}$$

30. Prove that: $\dfrac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$

Ans.

$$\text{L.H.S} = \frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \frac{\sin\theta(1-2\sin^2\theta)}{\cos\theta(2\cos^2\theta - 1)}$$

$$= \frac{\tan\theta(1-2\sin^2\theta)}{[2(1-\sin^2\theta)-1]} = \frac{\tan\theta(1-2\sin^2\theta)}{(1-2\sin^2\theta)}$$

$$= \tan\theta = \text{R.H.S.}$$

31. 4 Bells toll together at 9.00 am. They toll after 7, 8, 11 and 12 seconds respectively. How many times will they toll together again in the next 3 hours?

Ans: 7 = 7 × 1, 8 = 2 × 2 × 2, 11 = 11 × 1, 12 = 2 × 2 × 3

∴ LCM of 7, 8, 11, 12 = 2 × 2 × 2 × 3 × 7 × 11 = 1848

∴ Bells will toll together after every 1848 sec.

∴ In next 3 hrs, number of times the bells will toll together = $\frac{3\times3600}{1848}$ = 5.84 = 5 times.

OR

Given that √3 is irrational, prove that (2 + 5√3) is an irrational number.

Ans: Let 2 + 5√3 be a rational number such that

2 + 5√3 = *a*, where *a* is a non-zero rational number.

$\Rightarrow 5\sqrt{3} = a - 2 \Rightarrow \sqrt{3} = \frac{a-2}{5}$

Since 5 and 2 are integers and a is a rational number, therefore $\frac{a-2}{5}$ is a rational number

⇒ √3 is a rational number which contradicts the fact that √3 is an irrational number.

Therefore, our assumption is wrong.

Hence 2 + 5√3 is an irrational number

SECTION-D

Questions 32 to 35 carry 5M each

32. (a) In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the light.

Ans. Let original speed of aircraft be x km/hr.

According to the Question,

$\frac{2800}{x-100} - \frac{2800}{x} = \frac{1}{2}$

$\Longrightarrow x^2 - 100x - 560000 = 0$

$\Longrightarrow (x - 800)(x + 700) = 0$

$x \neq -700$ So, $x = 800$

Original Duration $= \frac{2800}{800} = \frac{7}{2}$ hrs or 3 hrs 30 min.

OR

(b) The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.

Ans. Let numerator be x, then denominator be (2x + 1)

Fraction = $\frac{x}{2x+1}$

According to the Question, $\frac{x}{2x+1} + \frac{2x+1}{x} = \frac{58}{21}$

$\Rightarrow 11x^2 - 26x - 21 = 0 \Rightarrow (x-3)(11x+7) = 0$

$\Rightarrow x \neq -\frac{7}{11}.\ So, x = 3.$

∴ Fraction = $\frac{3}{7}$

33. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on (see below figure). In how may rows are the 200 logs placed and how many logs are in the top row?

Ans: Here, a is the first term, d is a common difference and n is the number of terms.
It can be observed that the number of logs in rows are forming an A.P. 20, 19, 18, ...

We know that sum of n terms of AP is given by the formula $S_n = \frac{n}{2}[2a + (n - 1) d]$

$\Rightarrow 200 = \frac{n}{2}[2 \times 20 + (n - 1)(- 1)] \Rightarrow 400 = n [40 - n + 1] \Rightarrow 400 = n [41 - n]$

$\Rightarrow 400 = 41n - n^2 \Rightarrow n^2 - 41n + 400 = 0 \Rightarrow n^2 - 16n - 25n + 400 = 0$

$\Rightarrow n(n - 16) - 25(n - 16) = 0 \Rightarrow (n - 16)(n - 25) = 0 \Rightarrow$ Either $(n -16) = 0$ or $(n - 25) = 0$

$\therefore n = 16$ or $n = 25$

The number of logs in nth row will be $a_n = a + (n - 1) d$

$\Rightarrow a_{16} = a + 15d \Rightarrow a_{16} = 20 + 15 \times (- 1) \Rightarrow a_{16} = 20 – 15 \Rightarrow a_{16} = 5$

Similarly, $a_{25} = 20 + 24 \times (- 1)$

$\Rightarrow a_{25} = 20 – 24 \Rightarrow a_{25} = - 4$

Clearly, the number of logs in the 16th row is 5. However, the number of logs in the 25th row is negative 4, which is not possible.

Therefore, 200 logs can be placed in 16 rows. The number of logs in the top (16th) row is 5.

OR

The sum of the third and the seventh terms of an AP is 6 and their product is 8. Find the sum of first sixteen terms of the AP.

Ans: Here, a is the first term, d is the common difference and n is the number of terms.

Given: $a_3 + a_7 = 6$ ----- (1)

$a_3 \times a_7 = 8$ ----- (2)

We know that nth term of AP is $a_n = a + (n - 1)d$

Third term, $a_3 = a + 2d$ ----- (3)

Seventh term, $a_7 = a + 6d$ ----- (4)

Using equation (3) and equation (4) in equation (1) to find the sum of the terms,

$(a + 2d) + (a + 6d) = 6$

$\Rightarrow 2a + 8d = 6 \Rightarrow a + 4d = 3 \Rightarrow a = 3 - 4d$ ----- (5)

Using equation (3) and equation (4) in equation (2) to find the product of the terms,

$(a + 2d) \times (a + 6d) = 8$

Substituting the value of a from equation (5) above,

$(3 - 4d + 2d) \times (3 - 4d + 6d) = 8$

$\Rightarrow (3 - 2d) \times (3 + 2d) = 8$

$\Rightarrow (3)^2 - (2d)^2 = 8$ [Since $(a + b)(a - b) = a^2 - b^2$]

$\Rightarrow 9 - 4d^2 = 8 \Rightarrow 4d^2 = 1 \Rightarrow d^2 = ¼ \Rightarrow d = ½, -½$

Case 1: When d = ½

$a = 3 - 4d = 3 - 4 \times ½ = 3 - 2 = 1$

$S_n = \frac{n}{2}[2a + (n - 1) d] \Rightarrow S_{16} = \frac{16}{2}[2 \times 1 + (16 - 1) \times ½] = 8 \times 19/2 = 76$

Case 2: When d = - ½

$a = 3 - 4d = 3 - 4 \times (- ½) = 3 + 2 = 5$

$S_n = \frac{n}{2}[2a + (n – 1) d] \Rightarrow S_{16} = \frac{16}{2}[2 \times 5 + (16 - 1) \times (- ½)] = 8 [10 - 15/2] = 8 \times 5/2 = 20$

34. State and prove Basic Proportionality theorem.
Ans: Statement – 1 mark
Given, To Prove, Construction and Figure – 2 marks
Correct Proof – 2 marks

35. The mean of the following frequency distribution is 62.8 and the sum of all the frequencies is 50. Compute the missing frequencies f_1 and f_2.

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

Ans:

Class	Frequency	Class mark (x)	u	fu
0-20	5	10	-1	-5
20-40	f_1	30	0	0
40-60	10	50	1	10
60-80	f_2	70	2	$2f_2$
80-100	7	90	3	21
100-120	8	110	4	32
Total	$f_1 + f_2 + 30$			$2f_2 + 58$

$f_1 + f_2 + 30 = 50 \Rightarrow f_1 + f_2 = 20$

$\Sigma fu = 2f_2 + 58$, $h = 20$, A = 30

$$Mean = A + \left(\frac{\sum fu}{\sum f} \times h\right) \Rightarrow 62.8 = 30 + \left(\frac{2f_2 + 58}{50} \times 20\right)$$

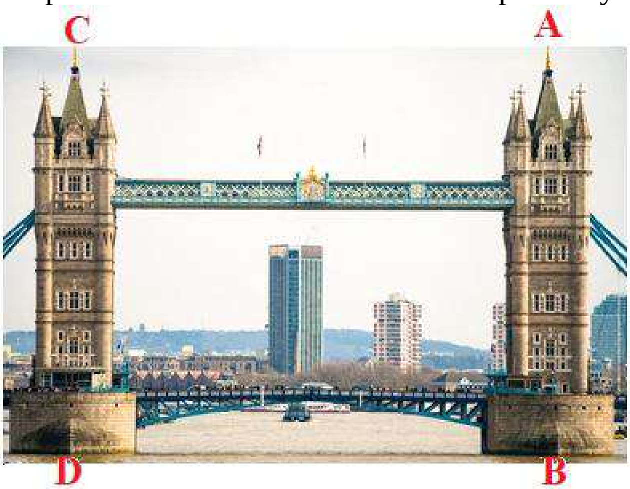
$$\Rightarrow 62.8 - 30 = \frac{2f_2 + 58}{5} \times 2 \Rightarrow 32.8 \times 5 = 2(2f_2 + 58)$$

$$\Rightarrow 4f_2 + 116 = 164 \Rightarrow 4f_2 = 164 - 116 = 48 \Rightarrow f_2 = 12 \Rightarrow f_1 = 20 - 12 = 8$$

SECTION-E (Case Study Based Questions)

Questions 36 to 38 carry 4M each

36. Tower Bridge is a Grade I listed combined bascule and suspension bridge in London, built between 1886 and 1894, designed by Horace Jones and engineered by John Wolfe Barry. The bridge is 800 feet (240 m) in length and consists of two bridge towers connected at the upper level by two horizontal walkways, and a central pair of bascules that can open to allow shipping.
In this bridge, two towers of equal heights are standing opposite each other on either side of the road, which is 80 m wide. During summer holidays, Neeta visited the tower bridge. She stood at some point on the road between these towers. From that point between the towers on the road, the angles of elevation of the top of the towers was 60° and 30° respectively.



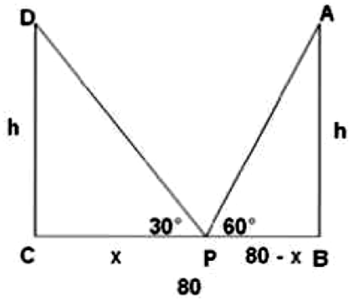
(i) Find the distances of the point from the base of the towers where Neeta was standing while measuring the height. [2]
(ii) Neeta used some applications of trigonometry she learned in her class to find the height of the towers without actually measuring them. What would be the height of the towers she would have calculated? [2]

OR

(ii) Find the distance between Neeta and top of tower AB? Also, Find the distance between Neeta and top tower CD? [2]
Ans: (i) Suppose AB and CD are the two towers of equal height h m. BC be the 80 m wide road. P is any point on the road. Let CP be x m, therefore BP = (80 - x).

Also, ∠APB = 60° and ∠DPC = 30°

In right angled triangle DCP, $\tan 30^0 = \frac{CD}{CP} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x} \Rightarrow h = \frac{x}{\sqrt{3}}$ …… (1)



In right angled triangle ABP, $\tan 60^0 = \frac{AB}{BP} \Rightarrow \frac{h}{80-x} = \sqrt{3} \Rightarrow h = \sqrt{3}(80-x)$

$\Rightarrow \frac{x}{\sqrt{3}} = \sqrt{3}(80-x)$ ⇒ x = 3(80 – x) ⇒ x = 240 -3x

⇒ x + 3x = 240 ⇒ 4x = 240 ⇒ x=60

Thus, the position of the point P is 60 m from C.

(ii) Height of the tower, h = $\frac{x}{\sqrt{3}} = \frac{60}{\sqrt{3}} = 20\sqrt{3}$

The height of each tower is $20\sqrt{3}$ m.

OR

(ii) The distance between Neeta and top of tower AB.

In ΔABP, $\sin 60^0 = \frac{AB}{AP} \Rightarrow \frac{\sqrt{3}}{2} = \frac{20\sqrt{3}}{AP} \Rightarrow AP = 40m$

Similarly, the distance between Neeta and top of tower CD.

In ΔCDP, $\sin 30^0 = \frac{CD}{PD} \Rightarrow \frac{1}{2} = \frac{20\sqrt{3}}{PD} \Rightarrow PD = 40\sqrt{3}m$

37. Deepankar bought 3 notebooks and 2 pens for Rs. 80 and his friend Suryansh bought 4 notebooks and 3 pens for Rs. 110 from the school bookshop.

Based on the above information, answer the following questions.

(i) If the price of one notebook be Rs. x and the price of one pen be Rs. y, write the given situation algebraically. (1)

(ii) (a) What is the price of one notebook ? (2)

OR

(b) What is the price of one pen ? (2)

(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens ? (1)

Ans. (i) 3x + 2y = 80 -----------------(1)

4x + 3y = 110 -----------------(2)

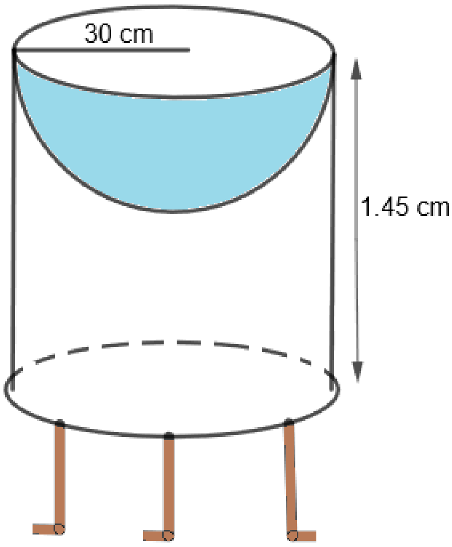
(ii) (a) Solving (1) and (2) to get x=20

OR

(b) Solving (1) and (2) to get y=10

(iii) Total amount paid = 6 x 20 + 3 x 10 = ₹ 150

38. Mayank a student of class 7th loves watching and playing with birds of different kinds. One day he had an idea in his mind to make a bird-bath on his garden. His brother who is studying in class 10th helped him to choose the material and shape of the birdbath. They made it in the shape of a cylinder with a hemispherical depression at one end as shown in the Figure below. They opted for the height of the hollow cylinder as 1.45 m and its radius is 30 cm. The cost of material used for making bird bath is Rs. 40 per square meter.



(i) Find the curved surface area of the hemisphere. (Take π = 3.14)

(ii) Find the total surface area of the bird-bath. (Take π = 22/7)

(iii) What is total cost for making the bird bath?

OR

(iii) Mayank and his brother thought of increasing the radius of hemisphere to 35 cm with same material so that birds get more space, then what is the new height of cylinder?

Ans: (i) Let r be the common radius of the cylinder and hemisphere and h be the height of the hollow cylinder. Then, r = 30 cm and h = 1.45 m = 145 cm.

Curved surface area of the hemisphere = $2\pi r^2$

$=2 \times 3.14 \times 30^2 = 0.56\ m^2$

(ii) Let S be the total surface area of the birdbath.

S = Curved surface area of the cylinder + Curved surface area of the hemisphere

$\Rightarrow S = 2\pi rh + 2\pi r^2 = 2\pi r(h + r) \Rightarrow S = 2 \times \frac{22}{7} \times 30(145 + 30) = 33000\ cm^2 = 3.3\ m^2$

(iii) Total Cost of material = Total surface area x cost per sq m^2 = 3.3 x 40 = Rs. 132

OR

We know that S = 3.3 m^2

$$S = 2\pi r(r+h) \quad \Rightarrow 3.3 = 2\times\frac{22}{7}\times\frac{35}{100}\left(\frac{35}{100}+h\right) \quad \Rightarrow 3.3 = \frac{22}{10}\left(\frac{35}{100}+h\right) \Rightarrow \frac{33}{22} = \frac{35}{100}+h$$

$$\Rightarrow h = \frac{3}{2} - \frac{7}{20} = \frac{23}{20} = 1.15m$$