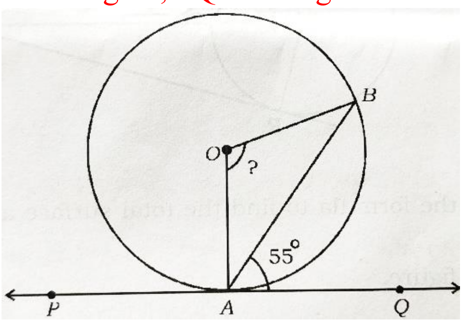
STATE LEVEL SSLC PREPARATORY EXAM – 2025
MATHEMATICS 81 E
QUESTION PAPER & KEY ANSWERS
BY SHIVA.T, MMDRS HARAPANAHALLI TOWN VIJAYANAGARA DIST

MARKS:80	DATE: 27-02-2025	DURATION: 3 Hours 15min

I. *Four* alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. 1x8=8

1. The degree of the polynomial $p(x)=x^2-x^3+2x+1$ is
   A) 2 B) 3 C) -3 D) 1
   Solution: B) 3
2. If 2, x, 12 are in arithmetic progression, then the value of x is …..
   A) 7 B)6 C)8 D)*10*
   Solution: A)7
3. In the pair of linear equations in two variables $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$, if $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c}$ then their graphical representation is
   A)Intersecting lines B)Coincident lines C)Parallel lines D) Perpendicular lines
   Solution: C) Parallel lines
   Explanation: We know that $\frac{a_1}{a_2}\neq\frac{a_1}{a_2}$, there is intersecting lines (Only one solution) – consistent lines
   $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ Coincident lines (infinitely many solutions) - consistent lines
   $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c}$ Parallel lines (No solutions) – Inconsistent lines
4. The formula to find the volume of (V) of a sphere of radius r units is
   A) $V=2\pi r^3$ cubic units B) $V=\frac{4}{3}\pi r^3$ cubic units C) $V=3\pi r^3$ cubic units D) $V=\frac{2}{3}\pi r^3$ cubic units
   Solution: **B)** $V=\frac{4}{3}\pi r^3$ cubic units
5. The sum of the probabilities of all the elementary events of an experiment is
   A) 0 B)$\frac{1}{2}$ C)2 D)1
   Solution: **D)1**
6. The value of the discriminant of the quadratic equation $x^2+4x+4=0$ is
   A) 0 B) 12 C) 16 D) 48
   Solution: A) 0
7. In the figure, PQ is a tangent to the circle with centre O. If $\angle BAQ=55$, then measure of $\angle BOA$ is



   A)90^0 B) 120^0 C) 110^0 D) 100^0
   Solution: **C)** 110^0
8. The distance of the point P(a, b) from the origin (0, 0) is _____ .
   A) a^2+b^2 B) $\sqrt{a^2-b^2}$ C) $\sqrt{a+b}$ D) $\sqrt{a^2+b^2}$
   Solution: **D)** $\sqrt{a^2+b^2}$

II. Answer the following questions **1x8=8**

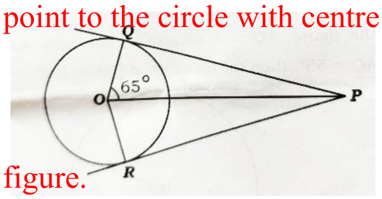
9. What is secant of the circle?.

Solution: A straight line which passes through a circle at two points is called secant of the circle.

10. State basic proportionality theorem.

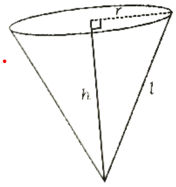
Solution: if a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio.

11. In the given figure, PQ and PR are the tangents drawn from an external point to the circle with centre O. If $\lfloor QOP = 65$, Find the measure of $\lfloor RPQ$.



Solution: $\lfloor RPQ = 70^0$

12. Write the formula to find the total surface area of the solid figure in the figure.



Solution: Total surface area of the solid figure = $\pi r(r+l)$

13. Write the median class for the following cumulative frequency distribution table.

Marks	Number of students	Cumulative frequency (c.f.)
0 – 10	3	3
10 – 20	4	7
20 – 30	7	14
30 – 40	6	20
	n = 20	

Solution: 20-30

14. If nth term of an arithmetic progression is $a_n=5n-2$, then find the value of a_2.

Solution: 8

15. The area of the sector of a circle with radius 7cm is 22 sq cm. find the area of the remaining part of the circle.

Solution: Remaining part of the circle is 132 sq cm.

16. If a fair coin is tossed once, then write the number of possible outcomes.

Solution: when fair coin is tossed the number of possible outcomes are 2.

III. Answer the following questions **2x8=16**

17. Prove that $5+\sqrt{3}$ is an irrational number.

Solution: Let us assume on the contrary that $5-\sqrt{3}$ is rational. Then, there exist prime positive integers a and b such that

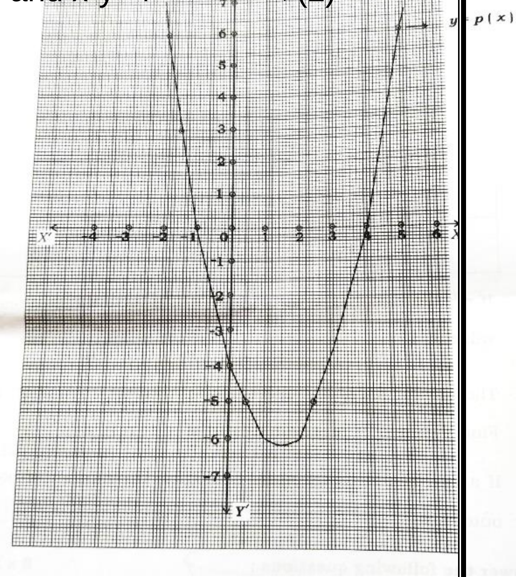
: we have 2x+y=14-------→(1) and x-y=4-----------→(2)

$5+\sqrt{3}=a/b$

$\Rightarrow 5-a/b=\sqrt{3}$

$\Rightarrow \sqrt{3}$ is rational [∵a,b are integers∴5b−a/bis a rational num

This contradicts the fact that $\sqrt{3}$ is irrational.
So, our assumption is incorrect. Hence, $5+\sqrt{3}$ is an irrational number. Hence, proved.



18. Solve 2x+y=14 and x-y=4.

Solu

By elimination method 2x+y=14

x-y=4

by subtracting above two we get **x=6**

Put this x value in any one of the above equation we get **y=2**

19. Find the polynomial p(x) represented in the given graph.

Solution: The zeroes of the polynomial are -1 and 4.

$\alpha=-1$ and $\beta=4$

then quadratic polynomial is x^2-3x-4

20. Find the roots of the quadratic equation $2x^2+x-6=0$

Solution: the given equation is $2x^2+x-6=0$

By factorization method. $2x^2+x-6=0$

$$2x^2+4x-3x-6=0$$

$$2x(x+2) \ -3\ (x+2) = 0$$

$$x=-2 \text{ and } x=\frac{3}{2}$$

21. Find the sum of first 20 terms of the A.P 3, 7, 11…………..

Solution: a=3, d=7-3 = 4 and n=20

We have to find S_{20}, $S_{20}=\frac{20}{2}\{2x3+(19)x4\}$

$$= 10(6+76)$$

$$= 10x82$$

$$= 820$$

So sum of first 20 terms of this A.P is 820

OR

How many three-digit numbers are divisible by 7?

Solution: Three digit numbers which are divisible by 7 are 105, 112, 119, ……….. 994

a=105, d=7 and an=994

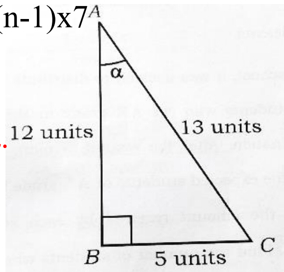
an=a+(n-1)d

994=105+(n-1)x7

n=128

So the three-digit numbers which are divisible by 7 are 128.

22. In the given figure, if ⌊ABC=900, then find the value of cosα and cotα.



Solution: from the figure, $\cos\alpha=\frac{AB}{AC}=\frac{12}{13}$

$$\cot\alpha=\frac{AB}{BC}=\frac{12}{5}$$

23. Find the distance between two points (3, 1) and B(6, 4) using distance formula.

Solution: we have distance formula $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$$=\sqrt{(6-3)^2+(4-1)^2}$$

$$=\sqrt{(3)^2+(3)^2} = \sqrt{9+9} = 3\sqrt{2} \text{ units}$$

24. A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. Find the probability of that ball is drawn is not a red.

Solution:

We have 3 red balls + 5 black balls= 8 balls = n(S)

Not red balls, means = 5 black balls = 5 = n(E)

Probability is P(E) = $\frac{n(E)}{n(S)} = \frac{5}{8}$

OR

12 defective pens are accidentally mixed with 132 good pens. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is good one.

Solution: Number of good pens =132

Number of defective pens =12

∴ Total pens =132+12=144

Probability of an event is $=\frac{n(E)}{n(S)}=\frac{132}{144}=\frac{11}{12}$

IV. Answer the following questions 3x9=27

25. Find the LCM and HCF of the integers 510 and 92 by prime factorization method and verify that LCMxHCF=product of two integers.

Solution: we have the integers, a=510 and b=92

HCF= 2 and LCM = 23460

Verification:

HCFxLCM=Product of two integers

2x23460 = 510x92

46920 = 46920

26. Find the zeroes of the polynomial p(x)=$6x^2$-7x-3 is and verify the relationship between the zeroes and coefficients.

Solution: we have p(x)= $6x^2-7x-3$

$6x^2-9x+2x-3$

$3x(2x-3)+1(2x-3)$

$(2x-3)(3x+1)$

Two zeroes are $x=\frac{3}{2}$ and $x=\frac{-1}{3}$

$\alpha=\frac{3}{2}$ and $\beta=\frac{-1}{3}$

verification:

And we know $\alpha+\beta=\frac{-b}{a}$ and $\alpha\beta=\frac{c}{a}$

$\alpha+\beta=\frac{-(-7)}{6}$ and $\alpha\beta=\frac{k}{1}$

$\frac{7}{6}=\frac{7}{6}$ and $\frac{-1}{2}=\frac{-1}{2}$ hence verified

27. In a school, it was decided to distribute Rs.1500 equally among the students who get A+ grade in the 10^{th} standard annual examination. After the results, 5 more students got A+ grade than the expected students of A+ grade before the examination. As a result the amount received by each student was reduced by Rs.25. Find the number of students who got A+grade after the result.

Solution: Let the expected students = x and each one get amount = Rs.y

Total amount to be distributed = 1500

According to question, $\frac{1500}{x}$ = y ----------→(1)

After results, number of students were 5 more = x+5 and amount was reduced 25 = y-25

Again $\frac{1500}{x+5}$ = y-25

$\frac{1500}{x+5}$ +25= y ----------→(2)

From (1) and (2)

$25x^2+125x-7500=0$ divided by 25 we get reduced quadratic equation

$x^2+5x-300=0$ by solving this we get x= 15

so number of students are 15 and each got Rs.100

OR

Verify whether the following situation is possible or not by finding the discriminant of the quadratic equation for this situation.

Situation: the sum of ages of two friends is 20 years. Four years ago, age product of their ages in years was 48. If so, determine their present age.

Solution: let first one age is x years and the second one is (20-x) years.

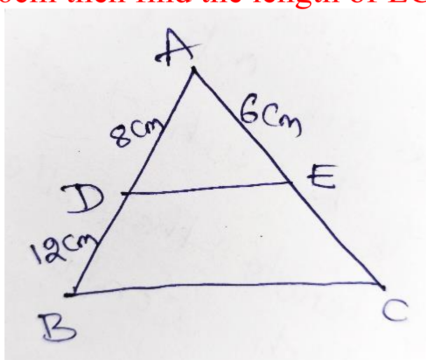
According to question (**x**-4)(20-x-4)= 48

(**x**-4) (16-x) = 48

$x^2-20x+112=0$

it is not possible to solve, so that situation is not possible for the given data.

28. In triangle ABC, DE||BC. If AD=8cm, DB=12cm and AE=6cm then find the length of EC and also find DE:BC.



Solution: we have AD=8cm, DB=12cm and AE=6cm

By Thales theorem, $\frac{AD}{DB}=\frac{AE}{EC}$

$\frac{8}{12}=\frac{6}{EC}$

EC=9cm and

$\Delta ABC \sim \Delta ADE$

DE:BC= 2:5

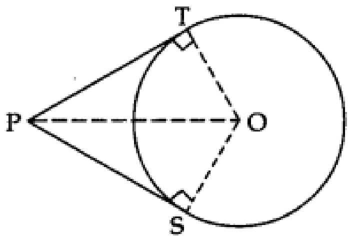
OR

If AD and PM are medians of triangles ABC and PQR , respectively where $\triangle ABC \sim \triangle PQR$, prove that AB/PQ=AD/PM.

Solution: *Consider the triangles △ABC and △PQR*
AD and PM being the mediums from vertex A and P respectively.
Given : △ABC~△PQR
To prove : AB/PQ=AD/PM
It is given that △ABC~△PQR
⇒ABPQ=BCQR=ACPR
[from the side-ratio property of similar △ s]
⇒∠A=∠P,∠B=∠Q,∠C=∠R.......(A)
BC=2BD;QR=2 QM [P,M being the mid points of BC q QR respectively]
⇒AB/PQ=2BD/2QM=AC/PR
⇒AB/PQ=BD/QM=ACPR........(1)
Now in △ABDq△PQM
ABPQ=BPQM........[from (1)]
∠B=∠Q........[from (A)]
⇒△ABD~△PQM [By SAS property of similar △ s] from the side property of similar △ s Hence proved
$\boxed{AB/PQ=AD/PM}$

29. Prove that "the lengths of the tangents drawn from an external point to the circles are equal".

Given: PT and PS are tangents from an external point P to the circle with centre O.
To prove: PT = PS
Construction: Join O to P, T and S.



Proof: In ΔOTP and ΔOSP.
OT = OS …[radii of the same circle]
OP = OP …[common]
∠OTP = ∠OSP …[each 90°]
ΔOTP ≡ ΔOSP …[R.H.S.]
PT = PS …[c.p.c.t.]

30. Prove that $\frac{cosA}{1+sinA} + \frac{1+SinA}{cosA} = 2secA$.

Solution:

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

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

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

$= 2secA$

OR

Evaluate: $\frac{5cos^2 60+4sec^2 30-tan^2 45}{sins^2 30+cos2\ 30}$

Solution: we have $\frac{5cos^2 60+4sec^2 30-tan^2 45}{sins^2 30+cos2\ 30}$

$= \mathbf{5x\frac{1}{4} +4(\frac{4}{3}) -1}$

$= \mathbf{\frac{67}{12}}$

31. Find the mean for the following grouped data.

Class interval	Frequency
2-6	2
6-10	5
10-14	6
14-18	5
18-22	2
	N=20

Solution: We have formula by direct method,
mean $\bar{x} = \frac{\Sigma fx}{n}$

C.I	f	x (midpoint of C.I)	fx
2-6	2	4	8
6-10	5	8	40
10-14	6	12	72
14-18	5	16	80
18-22	2	20	40
	N=20		$\sum fx = 240$

mean $\bar{x} = \frac{\Sigma fx}{n}$

$= \frac{\cancel{240}}{\cancel{20}}$

Mean= 12.

OR

Solution:

C.I	f	
0-6	6	
6-12	8	f_0
12-18	10	f_1
18-24	9	f_2
24-30	7	

l=12 and h=6, then by formula

Mode=l+$\left\{\frac{f_1-f_0}{2f_1-f_0-f_2}\right\}$xh.

$= 12+\left\{\frac{10-8}{2x10-8-9}\right\}$x6.

$= 12+\frac{2}{20-17}$ x 6

$= 12+\frac{2}{3}$x6

= 12+4

= 16

Mode= 16

32. Find the ratio in which the lines segment joining the points A(1, -5) and B(-4, 5) is divided by x-axis. Also find the coordinates of the point of division.

Solution: given that A(1, -5 and B(-4, 5) which is divides by x-axis

The coordinates of the point P(x, y) which divides the line segment joining the points A(x_1, y_1) and B(x_2, y_2), internally, in the ratio m_1: m_2 is given by the Section Formula:

P(x, y) = [(mx_2 + nx_1) / m + n, (my_2 + ny_1) / m + n]

Let the ratio be k : 1

Let the line segment be AB joining A (1, - 5) and B (- 4, 5)

By using the Section formula,

P (x, y) = [(mx_2 + nx_1) / m + n, (my_2 + ny_1) / m + n]

m = k, n = 1

Therefore, the coordinates of the point of division is

(x, 0) = [(- 4k + 1) / (k + 1), (5k - 5) / (k + 1)] ---------- (1)

We know that y-coordinate of any point on x-axis is 0.

Therefore, (5k - 5) / (k + 1) = 0

5k = 5

k = 1

Therefore, the x-axis divides the line segment in the ratio of 1 : 1.

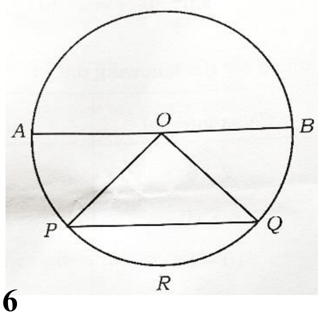
To find the coordinates let's substitute the value of k in equation(1)

Required point = [(- 4(1) + 1) / (1 + 1), (5(1) - 5) / (1 + 1)]

= [(- 4 + 1) / 2, (5 - 5) / 2]

= [- 3/2, 0]

33. In the given figure, the length of a semicircular arc of a circle with centre O is 44cm. if ⌊OPQ=45, Find the area of the segment PRQ.



Solution: $\pi r=44$ and $r=14cm$

Given that if ⌊OPQ=45 then ⌊OQR=45 (Isosceles triangle)

At O, centre it should be 90.

We have to find area of segment PRQ.

Area of segment = Ar of sector – ar of triangle POQ

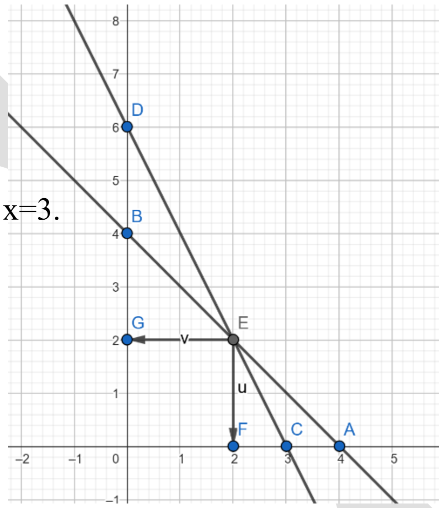
= 154-98

= 56 sq cm.

V. Answer the following questions **4x4=16**

34. Find the solution of the pair of linear equations by graphical method.

$x+y=4$ and $2x+y=6$



Solution:

We have $x+y=4$

For this we should have to find some solutions

If x=0, then y=4, and y=0, then x=4

Similarly for $2x+y=6$, if x=0, then y=6, if y=0 then x=3.

Tables are

x	0	4
y	4	0

And

x	0	3
y	6	0

Then by graphical method

x=2 and y=2

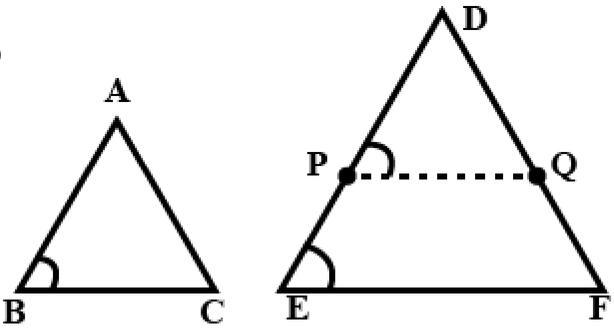
35. Prove that "If in two triangles, corresponding angles are equal then corresponding sides are in the same ratio(proportion) and hence the two triangles are similar".

Solution: Two△les△ABC&△DEFsuchthat

∠A=∠D,∠B=∠E&∠C=∠F

Draw P and Q on DE & D F such that DP=AB

&DQ=AC resp. Join PQ



In △ABC&△DPQAB=DP(by construction)

∠A=∠D(given)

AC=DQ(by construction)

⟹△ABC≅△DPQ(by SAS criterion)

∠B=∠P{by CPCT}

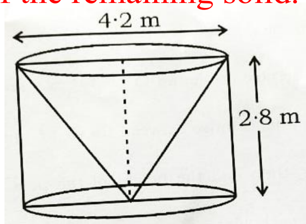
∠B=∠E(given) implies ∠P=∠E

For lines PQ and EF with transversal PE,

∠P&∠E are corresponding angles and they

Are equal. Hence, PQ||EF.

36. From a solid cylinder of height 2.8m and diameter is 4.2m, a conical cavity of same height and same diameter is hollowed out. Find the total surface area of the remaining solid.



Solution: Given that Cone, r=2.1m, h=2.8m and l=?

Cylinder, H=2.8m and r=2.1m

Total surface area = CSAcone+CSAcylinder+Areacylindertop

$=\pi rl+2\pi rh+\pi r^2$

r= Radius of cone and cylinder=2.1cm;

h = Height of cylinder and cone =2.8 cm;

l = Slant height of cone $=\sqrt{(2.1)^2+(2.8)^2}=3.5cm$

Hence TSA $=\pi r(l+2h+r)=73.92cm^2$

37. In an arithmetic progression 4^{th} term is 11 and 7^{th} term exceeds the twice of the 4^{th} term by 4. Write an arithmetic progression. Also show that sum of the first term and 13^{th} term of the progression is equal to twice its 7^{th} term.

Solution: Given $a_4=11$ and $a_7=2(a_4)+4$

$a+3d=11$ -------------→(1) and $-4=a$

put $a=-4$ in above equation we get $d=5$

now we have to show $a+a_{13}=2(a_7)$

$$a+a+12d= 2(a+6d)$$
$$2a+12d= 2a+12d$$

Hence the proof

OR

An arithmetic progression consists of 30 terms in which the sum of the 4^{th} and 8^{th} terms is 24 and the sum of the 6^{th} and 10^{th} terms is 44. Find the last three terms of the progression.

Solution: we have $a_4+a_8=24$ and $a_6+a_{10}=44$

$a+5d=12$ -------→(1) and $a+7d=22$ ------------.(2)

solving both we get $d=5$ and $a=-13$

So we have to find last three terms of this A.P, it means a30, a29 and a28

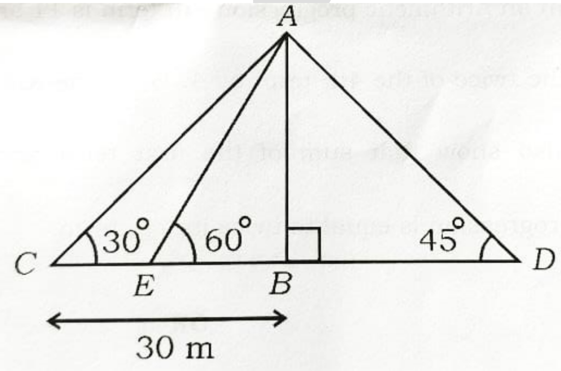
$a_{30}= a+29d = -13+29x5 = -13+145 = 132$

$a_{29}= a+28d = -13+28x5 = -13+140 = 127$

$a_{28}= a+27d = -13+27x5 = -13+135 = 122$

Hence last three terms are 122, 127 and 132

38. A pole AB is standing vertically on the level ground. Three wires from the top of the pole are stretched and tied to three different pegs on the ground. The angles of elevation from the pegs to the top of the pole are found to be 30^0, 60^0 and 45^0. If the distance between the peg C and the foot B of the pole is 30m, then find the height of the pole AB and also find the length of each wire.



Solution: In the given figure, In ABC $Tan30=\frac{AB}{BC}$

$$\frac{1}{\sqrt{3}}=\frac{AB}{30}$$
$$AB=10\sqrt{3}\text{ m}$$

In triangle ABD, $Tan45=\frac{AB}{BD}$

$$1=\frac{10\sqrt{3}}{DB}$$
$$DB=10\sqrt{3}\text{ m}$$

To find AD, in triangle ABD, $\sin45=\frac{10\sqrt{3}}{AD}$

$$AD=10\sqrt{6}\text{m}$$

To find AC, $\sin 30=\frac{10\sqrt{3}}{AC}$

$$AC=20\sqrt{3}\text{m}$$

To find AE, $\sin 60=\frac{10\sqrt{3}}{AE}$

$$AE=20\text{m}$$

Thus lengths of each wire $20\sqrt{3}$m, 20m and $10\sqrt{6}$m respectively. And height is $10\sqrt{3}$ m

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Note: This key answers not by board, its prepared by me.

Shiva.T, Maths teacher M.sc, B.Ed, MMDRS HARAPANAHALLI TOWN Vijayanagara Dist
Mobile No.99161429.

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