CBSE Class 09
Mathematics
Sample Paper 12 (2019-20)

Maximum Marks: 80
Time Allowed: 3 hours

General Instructions:

i. All the questions are compulsory.
ii. The question paper consists of 40 questions divided into 4 sections A, B, C, and D.
iii. Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 questions of 4 marks each.
iv. There is no overall choice. However, an internal choice has been provided in two questions of 1 mark each, two questions of 2 marks each, three questions of 3 marks each, and three questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.
v. Use of calculators is not permitted.

Section A

1. Which of the following statement is true?
   a. $\sqrt[3]{ab} = \sqrt{a} \times \sqrt{b}$
   b. $\sqrt{a-b} = \sqrt{a} - \sqrt{b}$
   c. $\sqrt{a+b} = \sqrt{a} + \sqrt{b}$
   d. $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
2. If$x + 1$ is a factor of the polynomial $2x^2 + kx + 1$, then the value of ‘k’ is
   a. 2
   b. -3

c. -2

d. 3

3. In two interior angles on the same side of a transversal intersecting two parallel lines are in the ratio 5 : 4, then the smaller of the two angles is :

   a. 120^0

   b. 60^0

   c. 100^0

   d. 80^0

4. If two circles touches internally then distance between their centers is equal to________.

   a. none

   b. not possible to determine

   c. difference of radil

   d. sum of radil

5. The factors of $12x^2 - x - 6$ are

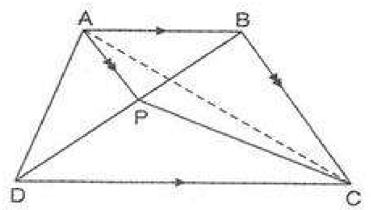
   a. (12x + 1) (x – 6)

   b. (12x – 1) (x + 6)

   c. (3x + 2) (4x – 3)

   d. (3x – 2) (4x + 3)

6. ABCD is a trapezium in which $AB \parallel DC.$ A line through A parallel to BC meets diagonal BD at P. If $ar\ (\triangle BPC) = 5\ cm^2$, then $ar\ (\triangle ABD)$ is



a. $2.5\ cm^2$.

b. $7.5\ cm^2$.

c. $5\,cm^2$.

d. $10\ cm^2$.

7. If $\frac{x}{y} + \frac{y}{x} = -1$ (x, y $\neq$ 0), the value of $x^3 - y^3$ is

a. -1

b. 2

c. 1

d. 0

8. If the perimeter of a rhombus is 20cm and one of the diagonals is 8cm. The area of the rhombus is

a. 48 sq cm

b. 30 sq cm

c. 50 sq cm

d. 24 sq cm

9. The curved surface area of a cylinder and a cone is equal. If their base radius is same, then the ratio of the slant height of the cone to the height of the cylinder is

a. it is 1 : 1

b. it is 2 : 3

c. it is 1 : 2

d. it is 2 : 1

10. Odds against an event are 5 : 8 , then the probability of the occurrence of the event is

a. $\frac{8}{5}$

b. $\frac{8}{13}$

c. $\frac{5}{13}$

d. $\frac{5}{8}$

11. Fill in the blanks:

A terminating decimal is a/an ________ number.

12. Fill in the blanks:

The equation of X-axis is ________.

OR

Fill in the blanks:

The equation of x = 5 in the standard form of linear equation in two variable is ________.

13. Fill in the blanks:

The line segment joining (-4, 5) and (-3, -6) lies completely in __________ quadrants respectively.

14. Fill in the blanks:

Equal chords of a circle are ________ from the centre.

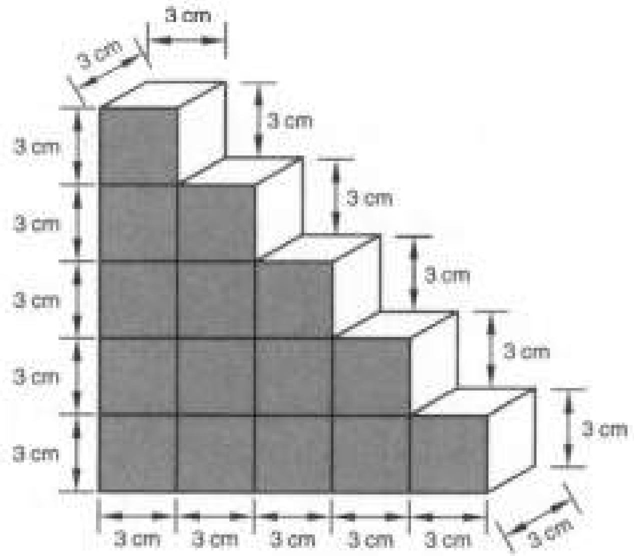
15. Fill in the blanks:

A solid generated by the revolution of a rectangle about one of its sides which is kept fixed, is called a ________.

16. Write the following in decimal form and say what kind of decimal expansion each has: $\frac{36}{100}$

17. Write the degree of each of the following polynomials:
$p(y) = 4 - y^2$

18. A child playing with building blocks, which are of the shape of the cubes, has built a structure as shown in the given figure. If the edge of each cube is 3 cm, find the volume of the structure built by the child.



OR

A cuboid has total surface area of 40 m^2 and its lateral surface area is 26 m^2. Find the area of its base.

19. In a parallelogram ABCD, $\angle D = 135^o$. Determine the measures of $\angle A$ and $\angle B$.

20. How many solutions does the equation 2x + 5y = 8 has?

21. Simplify: $4\sqrt{28} \div 3\sqrt{7}$

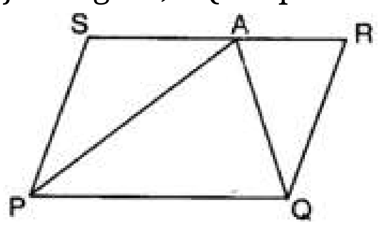
22. Find four solutions for the following equation : x = 0

23. Is (x + 1) is a factor of given polynomial $p(x) = x^4 + x^3 + x^2 + x + 1$?

OR

If x + y + z = 1, xy + yz + zx = -1 and xyz = - 1, find the value of $x^3 + y^3 + z^3$.

24. A farmer having a field in the form of parallelogram PQRS. He planned to built a home for old persons of the village in the field leaving open portion equal to portion covered by the home. For this, he divided the field by taking a point A on RS and joining AP, AQ respectively as shown in figure. How should he do it?

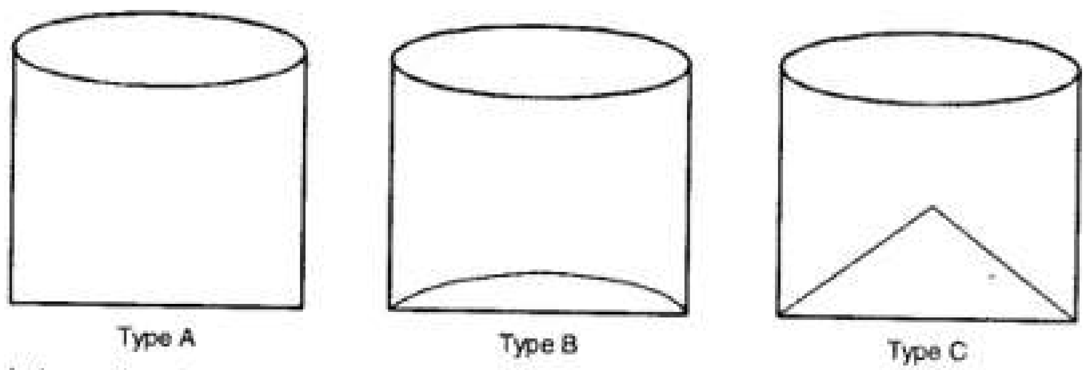


25. The mean of marks scored by 100 students was found to be 40. Later on it was discovered that a score of 53 was misread as 83. Find the correct mean.

OR

The blood groups of 30 students are recorded as follows:
A, B, O, A, O, A, O, B, A, O, B, A, AB, B, A, AB, B, A, B, A, A, O, A, AB, B, A, O, B, A
Prepare a frequency distribution table for the data.

26. Naresh, a juice seller has set up his juice shop. He has three types of glasses (see figure) of inner diameter 5 cm to to serve the customers. The height of the glasses is 10 cm.



Type A
A glass with a plane bottom.

Type B
A glass with hemispherical raised bottom.

Type C
A glass with conical raised bottom of height 1.5 cm.

He decided to serve the customer in 'A' type of glasses. (Take π = 3.14)

i. Find the volume of each type of glass.
ii. Which glass has the minimum capacity?

27. Simplify $\frac{6^{2/3} \times \sqrt[3]{6^7}}{\sqrt[3]{6^6}}$.

OR

Rationalize a denominator of the following: $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

28. Draw the graph of 2x + y = 6. Read two solutions from the graph and verify the same by actual substitution. Also, find the points where the line meets the axes.

29. Find at least 3 solutions for the linear equation in two variables: 2x + 5y = 13.

OR

Find solutions of the form x = a, y = 0 and x = 0, y = b for the following pairs of equations. Do they have any common such solution for equations 9x + 7y = 63 and x + y = 10

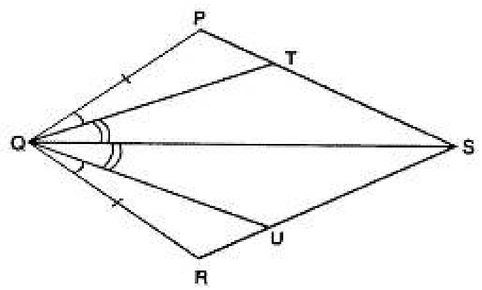
30. Construct a right-angled triangle whose perimeter is equal to 10 cm and one acute angle equal to 60°.

31. In a triangle ∠ABC, ∠A = 50°, ∠B = 60° and ∠C = 70°. Find the measures of the angles of the triangle formed by joining the mid-points of the sides of this triangle.

32. In △ABC, if ∠A = 40° and ∠B = 60°. Determine the longest and shortest sides of the triangle.

OR

In figure, PQRS is a quadrilateral and T and U are respectively points on PS and RS such that PQ = RQ, ∠PQT = ∠RQU and ∠TQS = ∠UQS. Prove that QT = QU.



33. A field in the form of a parallelogram has sides 60 m and 40 m and one of its diagonals

is 80 m long. Find the area of the parallelogram.

34. It is known that a box of 550 bulbs contain 22 defective bulbs. One bulb is taken out at random from the box. Find the probability of getting

(i) Defective bulbs

(ii) Good bulbs

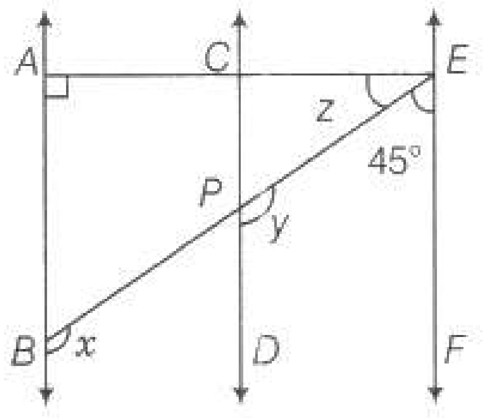
35. ABCD is a cyclic quadrilateral in which BA and CD when produced meet in E and EA = ED. Prove that:

i. AD || BC
ii. EB = EC.

OR

Let the vertex of an angle ABC be located outside a circle and let the sides of the angle intersect equal chords AD and CE with the circle. Prove that $\angle ABC$ is equal to half the difference of the angles subtended by the chords AC and DE at the centre.

36. In the given figure, AB || CD and CD || EF. Also, EA $\perp$ AB. If $\angle$BEF = 45°, then find the values of x, y and z.



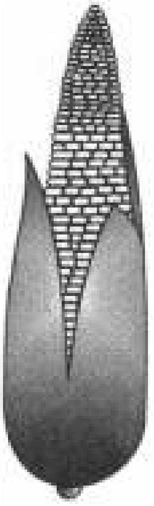
37. If x - 3 and x - $\frac{1}{3}$ are both factors of $px^2 + 5x + r$, then show that p = r

OR

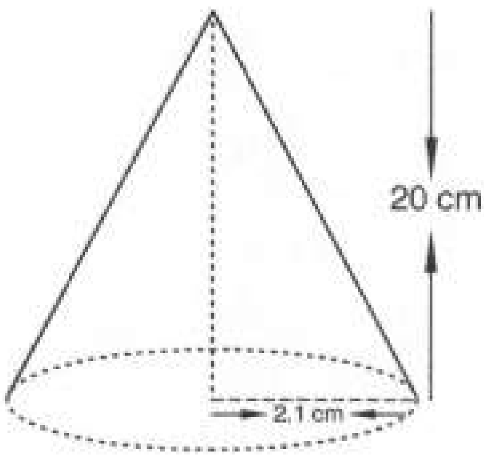
If $f(x) = x^4 - 2x^3 + 3x^2 - ax + b$ is a polynomial such that when it is divided by x - 1 and x + 1, the remainders are respectively 5 and 19. Determine the remainder when f(x) is divided by (x - 2).

38. A corn cob (see Fig.), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length as 20 cm. If each 1 cm^2 of the surface of the cob carries an average of four grains, find how many grains you would find on the entire cob?

i.



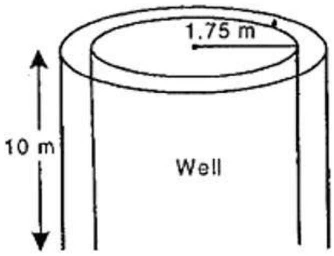
ii.



OR

The inner diameter of a circular well is 3.5 m. It is 10 m deep. Find:

i. its inner curved surface area.
ii. the cost of plastering this curved surface at the rate of Rs. 40 per m^2.



39. O is any point in the interior of $\triangle$ABC. Prove that

 i. AB + AC > OB + OC
 ii. AB + BC + CA > OA +OB + OC
 iii. OA + OB + OC > $\frac{1}{2}$ (AB + BC + CA)

40. For the following data of daily wages (in rupees) received by 30 labours in a certain factory, construct a grouped frequency distribution table by dividing the range into class intervals of equal width, each corresponding to 2 rupees, in such a way that the mid-value of the first class interval corresponds to 12 rupees:
14,16,16,14, 22,13,15, 24,12,23,14, 20,17, 21, 22,18,18,19, 20,17,16,15,11,12, 21, 20, 17,18,19, 23.

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Solution
Section A

1. (d) $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
   Explanation: When we multiply two different root number then only number is multiplied not the root because we have both number power equal,

   √a × √b = √ab

   Or, a½ × b½ = (ab)½

2. (d) 3
   Explanation: If $x + 1$ is a factor of p(x) = $2x^2 + kx + 1$, then

   p(-1) = 0

   $\Rightarrow 2x^2 + kx + 1 = 0$

   $\Rightarrow 2(-1)^2 + k(-1) + 1 = 0$

   $\Rightarrow 2 - k + 1 = 0$

   $\Rightarrow \ k = 3$

3. (d) 80^0
   Explanation: We know that sum of two interior angles on the same side of a transversal intersecting two parallel lines is 180^0

   let the common ratio is x

   so the angles are 5x ,4x

   so 5x + 4x = 180^0

   9x = 180^0

$x = 180^0/9$

$x = 20^0$

so the anges are $5x = 100^0$

$4x = 80^0$

so smallest angle is 80^0

4. (c) difference of radil

   Explanation: Consider, two circles with Centre A & B touches internally at point P,

   Now distance between their Centre i.e. AB can be given as,   AB= AP - BP, where,

   AP= radius of circle A ; BP= radius of circle B

   Thus, we can say that the distance between the centers of two circles touching internally is equal to the difference of their radii.

5. (c) $(3x + 2) (4x – 3)$

   Explanation: $12x^2 - x - 6$

   $= 12x^2 - 9x + 8x - 6$

   $= 3x(4x - 3) + 2(4x - 3)$

   $= (3x + 2) (4x – 3)$

6. (c) $5\, cm^2$.

   Explanation: Since triangles BPC and BAC are on the same base BC and between the same parallels. Therefore,

   $\text{area}\,(\triangle\text{BPC}) = \text{area}\,(\triangle\text{BAC}) = 5$ sq. cm

   Again, since triangles ABD and BAC are on the same base BC and between the same parallels. Therefore,

   $\text{area}\,(\triangle\text{ABD}) = \text{area}\,(\triangle\text{BAC}) = 5$ sq. cm

7. (d) 0

Explanation:

Given: $\frac{x}{y} + \frac{y}{x} = -1$

$\Rightarrow \frac{x^2+y^2}{xy} = -1$

$\Rightarrow x^2 + y^2 = -xy$ ....(i)

Now, $x^3 - y^3 = (x-y)\left(x^2 + y^2 + xy\right)$

$\Rightarrow x^3 - y^3 = (x-y)(-xy+xy)$ [From eq.(i)]

$\Rightarrow x^3 - y^3 = (x-y)(0)$

$\Rightarrow x^3 - y^3 = 0$

8. (d) 24 sq cm

Explanation:

side of rhombus = $\frac{\text{Perimeter}}{4}$

= $\frac{20}{4}$ = 5 cm

diagonal = $2\sqrt{5^2 - 4^4}$ = $2\sqrt{25-16}$ = 2 x 3 = 6 cm

Area of rhombus = $\frac{1}{2}$ x Product of diagonal

= $\frac{1}{2}$ x 8 x 6 = 24 sq. cm

9. (d) it is 2 : 1

Explanation: CSA of cone = CSA of cylinder

πrl = 2πrh

l= 2h

l: h= 2 : 1

10. (b) $\frac{8}{13}$

Explanation:

Odds in favour of event A occurring = $\frac{P(A)}{P(notA)}$

Odds against event A occurring = $\frac{P(notA)}{P(A)}$

Probability of occurring of the event = $\frac{P(A)}{P(A)+P(notA)}$

In the question,
$\frac{P(notA)}{P(A)} = \frac{5}{8}$ (Since we are given odds against the event)

So,the probability of occurring of the event = $\frac{P(A)}{P(A)+P(notA)} = \frac{8}{5+8} = \frac{8}{13}$

11. rational

12. y = 0

OR

x + 0 y - 5 = 0

13. II and III

14. equidistant

15. right circular cylinder

16. On dividing 36 by 100, we get

```
      0.36
100 ) 36
     -0
     360
    -300
      600
     -600
        0
```

So, the answer is 0.36, which is a terminating decimal.

17. $4 - y^2$

We know that the degree of a polynomial is the highest power of the variable in the polynomial.

We can observe that in the polynomial $4 - y^2$, the highest power of the variable y is 2.

Therefore, we conclude that the degree of the polynomial $4 - y^2$ is 2.

18. Volume of each cube = edge $\times$ edge $\times$ edge

= $3 \times 3 \times 3$ cm^3 = 27 cm^3

Number of cubes in the structure = 15

Therefore, volume of the structure = 27×15 cm^3 = 405 cm^3

OR

We have,

Total surface area = 2 (Surface area of base) + (Surface area of 4 walls)

$\Rightarrow$ 40 = 2 (Surface area of base) + (Lateral surface area)

$\Rightarrow$ 40 = 2 (Surface area of base) + 26

$\Rightarrow$ 14 = 2 (Surface area of base)

$\Rightarrow$ Surface area of base = $\frac{14}{2}$ m = 7m^2

19. In parallelogram ABCD,

$\angle D + \angle C = 180^o$ [Adjacent angles are supplementary]

$135^o + \angle C = 180^o$

$\angle C = 180^o - 135^o = 45^o$

$\angle A = \angle C = 45^o$ [Opposite angles of a parallelogram are equal]

$\angle B = \angle D = 135^o$ [Opposite angles of a parallelogram are equal]

20. The equation 2x + 5y = 8 has infinitely many solutions.

21. $4\sqrt{28} \div 3\sqrt{7} = 4\sqrt{2 \times 2 \times 7} \times \frac{1}{3\sqrt{7}}$

$= \frac{8\sqrt{7}}{3\sqrt{7}} = \frac{8}{3}$

22. x = 0 represents y-axis for each point of which x = 0

So, When y = 0, x = 0

When y = 1, x = 0

When y = 2, x = 0

When y = 3, x = 0

∴ (0, 0), (0, 1), (0, 2) and (0, 3) are the four solutions of the equation x = 0.

23. Let $p(x) = x^4 + x^3 + x^2 + x + 1$

The zero of x + 1 is - 1

$p(-1) = (-1)^4 + (-1)^3 + (-1)^2 + (-1) + 1 = 1 - 1 + 1 - 1 + 1 = 1 \neq 0$

∴ By factor theorem, x + 1 is not a factor of $x^4 + x^3 + x^2 + x + 1$.

OR

We know that,

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - zx)$

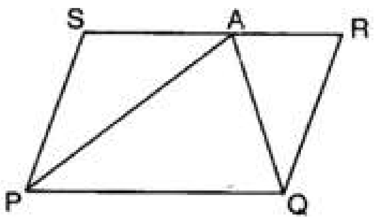
$\Rightarrow x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 + 2xy + 2yz + 2zx - 3xy - 3yz - 3zx)$ [Adding and subtracting 2xy + 2yz + 2zx]

$\Rightarrow x^3 + y^3 + z^3 - 3xyz = (x + y + z)\{(x + y + z)^2 - 3(xy + yz + zx)\}$

$\Rightarrow x^3 + y^3 + z^3 - 3 \times (-1) = 1 \times \{(1)^2 - 3 \times (-1)\}$ [Putting the values of x + y + z, xy + yz + zx and xyz]

$\Rightarrow x^3 + y^3 + z^3 + 3 = 4$

$\Rightarrow x^3 + y^3 + z^3 = 4 - 3 = 1$

24. 

From the given figure,

The field PQRS is divided into three parts, △PAQ, △APS and △AQR.

Now, △PAQ and ||gm PQRS are on the same base and lie between the same parallels.

∴ ar(△PAQ) = $\frac{1}{2}$ ar(||gm PQRS)

ar(△PAQ) = $\frac{1}{2}$ [ar(△APS) + ar(△PAQ) + ar(△AQR)]

ar(△PAQ) = ar(△APS) + ar(△AQR)

He should build the home in portion △APQ and should leave open △APS and △AQR.

25. Mean marks of 100 students = 40

$\Rightarrow$ Sum of marks of 100 students = 100 $\times$ 40 = 4000

Correct value = 53

Incorrect value = 83

Correct sum = 4000 - 83 + 53 = 3970

$\therefore$ Correct mean = $\frac{3970}{100}$ = 39.7

OR

Frequency distribution table

Blood Group	No. of students (frequency)
A B AB O	12 8 4 6
Total	30

26. i. Volume of glass A $= \pi r^2 h$

= 3.14 $\times$ 2.5 $\times$ 2.5 $\times$ 10 = 196.25 cm^3

Volume of hemisphere in glass B $= \frac{2}{3}\pi r^3 = \frac{2}{3} \times 3.14 \times 2.5 \times 2.5 \times 2.5$

= 32.71 cm^3

$\therefore$ Volume of glass B = Volume of glass A - Volume of hemisphere

= 196.25 - 32.71 = 163.54 cm^3

Now, Volume of cone of glass C $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 2.5 \times 2.5 \times 1.5$

= 9.81 cm^3

Volume of glass C = 196.25 - 9.81 = 186.44 cm^3

ii. The glass of type B has minimum capacity of 163.54 cm^3

27. $\frac{6^{2/3} \times \sqrt[3]{6^7}}{\sqrt[3]{6^6}} = \frac{\sqrt[3]{6^2} \times \sqrt[3]{6^7}}{\sqrt[3]{6^6}} = \frac{\sqrt[3]{6^2 \times 6^7}}{\sqrt[3]{6^6}} [\because \sqrt[n]{a} \times \sqrt[n]{b} = \sqrt[n]{a \times b}]$

$= \frac{\sqrt[3]{6^9}}{\sqrt[3]{6^6}}$ [$\because a^m \times a^n = (a)^{m+n}$]

$= \sqrt[3]{\frac{6^9}{6^6}} = \sqrt[3]{6^{9-6}}$

$[\because \frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$ and $a^m / a^n = (a)^{m-n}]$

$= \sqrt[3]{6^3} = 6$ $[\because \sqrt[m]{a^m} = a]$

OR

$\frac{\sqrt{3}-1}{\sqrt{3}+1}$

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

(Multiplying the numerator and denominator by $\sqrt{3}$ - 1)

$= \frac{(\sqrt{3}-1)^2}{(\sqrt{3})^2-(1)^2}$

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

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

28. 2x + y = 6

$\Rightarrow$ y = -2x + 6

Let x = 0 : y = -2(0) + 6 = 0 + 6 = 6

Let x = 1 : y = -2(1) + 6 = -2 + 6 = 4

Let x = -1 : y = -2(-1) + 6 = 6 + 2 = 8

Thus we have the following table :

x	0	1	-1
y	6	4	8

Now, plot the points A(0, 6), B(1, 4) and C(-1, 8) on a graph paper. Join AB and extend it in both the directions.

Then, the line AB is the required graph. We find from the graph that x = 2, y = 2 and x = 3, y = 0 are also the solutions.

Verification : C(2, 2) substitute x = 2, y = 2 in (i), we have

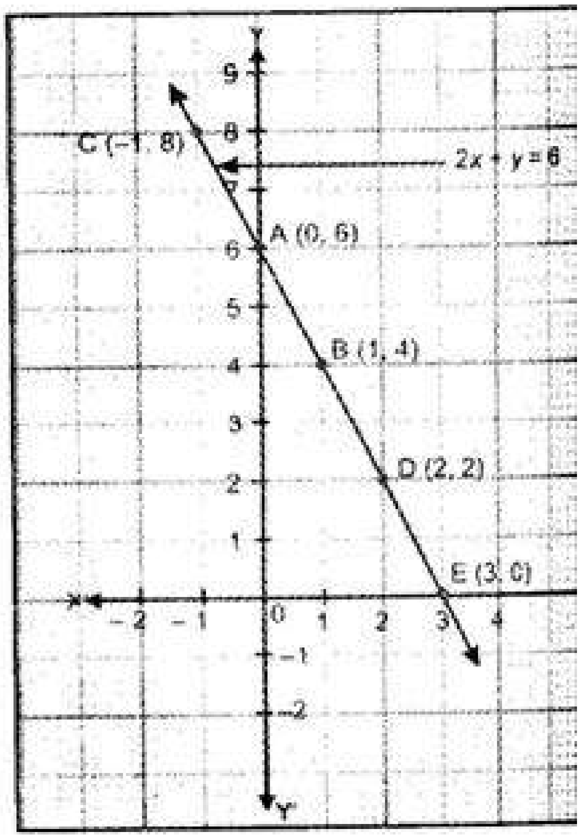
L.H.S. = y = 2 and R.H.S. = 6 - 2x = 6 - 2 $\times$ 2 = 6 - 4 = 2

For D(3, 0) substitute x = 3, y = 0 in (i), we have

L.H.S. = y = 0 and R.H.S. = 6 - 2x = 6 - 2 $\times$ 3 = 6 - 6 = 0

So, L.H.S. = R.H.S. in both the cases.

The line meets the x-axis at (3, 0) and y-axis at (0, 6).



29. 2x + 5y = 13

$\Rightarrow$ 5y = 13 – 2x

$\Rightarrow y = \frac{13-2x}{5}$

Put x = 0, then $y = \frac{13-2(0)}{5} = \frac{13}{5}$

Put x = 1, then $y = \frac{13-2(1)}{5} = \frac{11}{5}$

Put x = 2, then $y = \frac{13-2(2)}{5} = \frac{9}{5}$

Put x = 3, then $y = \frac{13-2(3)}{5} = \frac{7}{5}$

$\therefore \left(0, \frac{13}{5}\right), \left(1, \frac{11}{5}\right), \left(2, \frac{9}{5}\right)$ and $\left(3, \frac{7}{5}\right)$ are the solutions of the equation 2x + 5y = 13.

OR

9x + 7y = 63

put x = 0, we get

9(0) + 7y = 63

⇒ 7y = 63

$\Rightarrow y = \frac{63}{7} = 9$

∴ (0, 9) is a solution.

9x + 7y = 63

Put y = 0, we get

9x + 7(0) = 63

⇒ 9x = 63

$\Rightarrow x = \frac{63}{9} = 7$

∴ (7, 0) is a solution.

x + y = 10

Put x = 0, we get

0 + y = 10

⇒ y = 10

∴ (0, 10) is a solution.

x + y = 10

Put y = 0, we get

x + 0 = 10

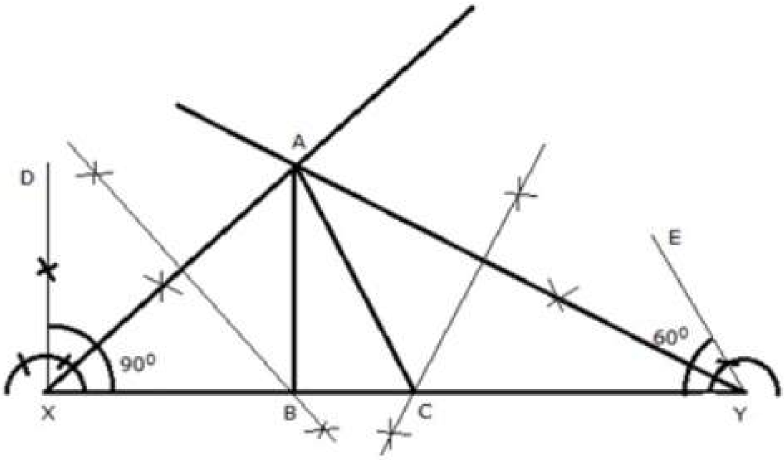
⇒ x = 10

∴ (10, 0) is a solution.

The given equations do not have any common solution.

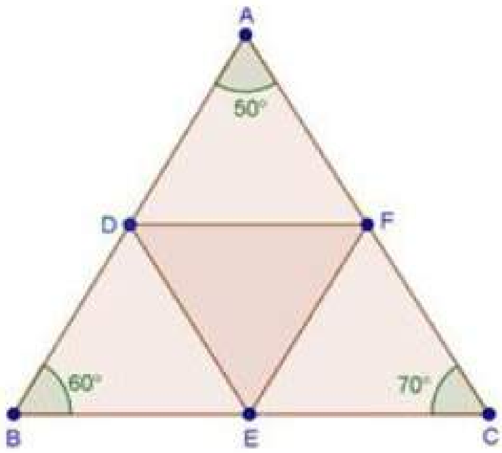
30. Steps of construction:-

i. Draw a line segment XY of 10 cm.
ii. Draw ∠DXY = ∠B = 90^o and ∠EYX = ∠C = 60^o.
iii. Draw the angle bisectors of ∠DXY and ∠EYX which intersect each other at A.
iv. Draw the perpendicular bisectors of AX and AY which intersect XY at B and C respectively.
v. Join AB and AC.



∴ △ABC is the required right-angled triangle.

31.



Given: In a triangle ΔABC, ∠A = 50°, ∠B = 60° and ∠C = 70°.

To Find: The measures of the angles of the triangle formed by joining the mid-points of the sides of this triangle. i.e. ∠D, ∠E, ∠F

In ΔABC, D & E are mid-points of AB and BC

∴ DE || AC, DE = $\frac{1}{2}$ AC [By mid-point theorem]

= DE = $\frac{1}{2}$ AC = CF [∵ F is the mid-point of AC]

In quadrilateral DECF,

DE || AC, DE = CF

Hence DECF is a parallelogram.

∴ ∠C = ∠D = 70° [Opposite angles of a parallelogram]

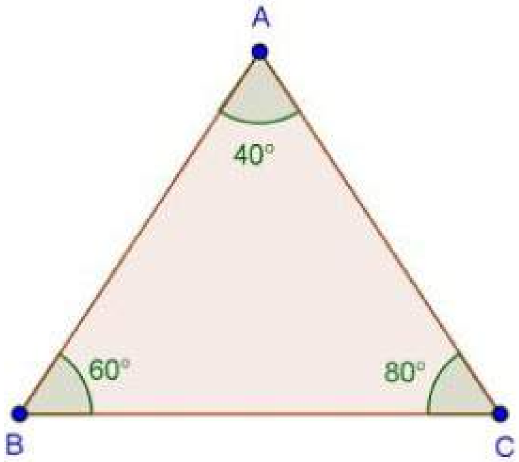
Similarly,

BEFD is a parallelogram, ∠B = ∠F = 60°

ADEF is a parallelogram, ∠A = ∠E = 50°

∴ Angles of ΔDEF,

$\angle D = 70^{o}$, $\angle E = 50^{o}$, $\angle F = 60^{o}$

32. 

Given that in ΔABC, ∠A = 40° and ∠B = 60°

We have to find the longest and shortest side.

We know that,

Sum of angles of a triangle is 180^{o}

i.e. $\angle A + \angle B + \angle C = 180^{o}$

$\therefore \angle C = 180^{o} - \angle A - \angle B$ [Angle sum property of △]

$= 180^{o} - 40^{o} - 60^{o}$ [$\because \angle A = 40^{o}$ and $\angle B = 60^{o}$]

$= 80^{o}$

Now

$\Rightarrow 40° < 60° < 80° \Rightarrow \angle A < \angle B < \angle C$

Thus, ∠C is greatest angle and ∠A is smallest angle.

Now

$\angle A < \angle B < \angle C$, so

BC < AC < AB [∵ Side opposite to greater angle is larger and the side opposite to smaller angle is smaller]

∴ AB is longest and BC is the smallest or shortest side.

OR

In DPQS and DRQS,

PQ = RQ ...[Given]

QS = QS ...[Common]

∠PQT = ∠RQU and ∠TQS = ∠UQS ...[Given]

$\angle$PQT + $\angle$TQS = $\angle$RQU + $\angle$UQS ...[By addition]

$\therefore$ $\angle$PQS = $\angle$RQS

$\therefore$ DPQS = DRQS ...[By SAS property]

$\therefore$ $\angle$QPS = $\angle$QRS ...[c.p.c.t.]

$\Rightarrow$ $\angle$QPT = $\angle$QRU

In DPQT and DRQU,

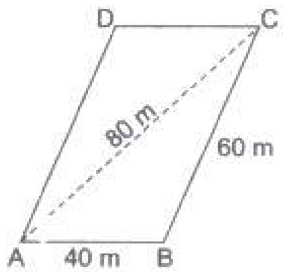
PQ = RQ and $\angle$PQT = $\angle$RQU ...[Given]

$\angle$QPT = $\angle$QRU ...[As proved]

$\therefore$ DPQT $\cong$ DRQU ...[By ASA property]

$\therefore$ QT = QU ...[c.p.c.t.]

33. Let the field be ABCD.



Area of the parallelogram ABCD = 2(area of ΔABC)...(1)

Now, the sides of ΔABC are

a = 40 m, b = 60 m and c = 80 m

$\therefore$ Semi-perimeter of ΔABC,

$s = \frac{a+b+c}{2}$

$= \frac{40+60+80}{2}$

$= \frac{180}{2} = 90m$

$\therefore$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$ [By Heron's Formula]

$= \sqrt{90(90-40)(90-60)(90-80)}$

$= \sqrt{90 \times 50 \times 30 \times 10}$

$= \sqrt{3 \times 30 \times 5 \times 10 \times 30 \times 10}$

$= 300\sqrt{15}\, cm^2 = 1161.895m^2$

Formula equation (1), we get

Area of parallelogram ABCD = 2 $\times$ 1161.895 = 2323.79 m^2.

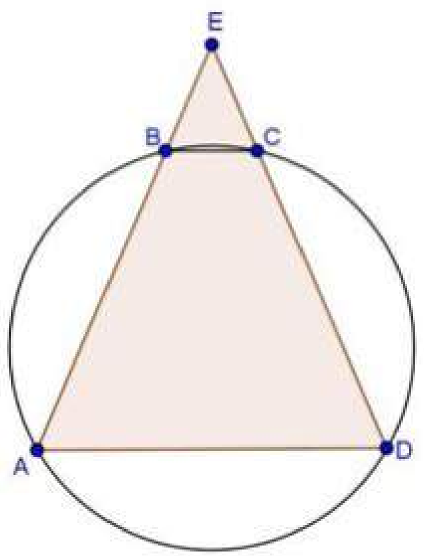
34. Total number of bulbs = 550

Number of defective bulbs = 22

∴No. of good bulbs = 550-22=528

(i) P (of getting defective bulbs) = $\frac{22}{550} = 0.04$

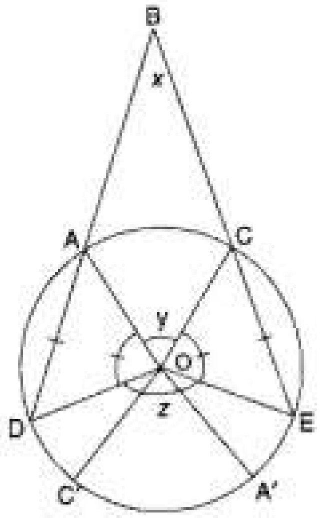
(ii)P (of getting good bulbs) = $\frac{528}{550} = 0.96$

35. 

Given ABCD is a cyclic quadrilateral in which EA = ED.

i. Since EA = ED
   Then, ∠EAD = ∠EDA ...(i) [Opp. angles to equal sides]
   Since, ABCD is a cyclic quadrilateral
   Then, ∠ABC + ∠ADC = 180^0
   But ∠ABC + ∠EBC = 180^0 [Linear pair of angles]
   then, ∠ADC = ∠EBC ...(ii)
   Compare equations (i) and (ii),
   ∠EAD = ∠EBC ...(iii)
   Since, corresponding angles are equal,
   Then, BC | | AD
ii. From equation (iii),
   ∠EAD = ∠EBC ...(iii)
   Similarly ∠EDA = ∠ECB ...(iv)
   Compare equations (i), (iii) and (iv),
   ∠EBC = ∠ECB
   ⇒ EB = EC [Opposite angles to equal sides]

OR



Let $\angle ABC = x, \angle AOC = y$ and $\angle DOE = 2$

$\angle C'OD + \angle A'OE = Z - y$ ---- (1)

Let $\angle C'OD = \theta$

Then $\angle A'OE = z - y - \theta$ |From (1)

$\angle AOD = \pi - (\angle AOC + \angle C'OD) = \pi - (y + \theta)$

$\angle COE = \pi - (\angle C'OA' + \angle A'OE)$

$= \pi - (y + z - y - \theta)$

$= \pi - (z - \theta)$

$\because AD = CE$

$\therefore \angle AOD = \angle COE$ [Equal chords subtend equal angles at the centre]

$\therefore n - (y + \theta) = \pi - (z - \theta)$

$\Rightarrow y + \theta = z - \theta$

$\Rightarrow 2\theta = z - y$

$\Rightarrow \theta = \frac{z-y}{2}$

$\therefore \angle C'OD = \frac{z-y}{2}$

and $\angle A'OE = z - y - \frac{z-y}{2} = \frac{z-y}{2}$

$\therefore \angle AOD = \pi - (y + \theta)$

$= \pi - \left(y + \frac{z-y}{2}\right)$

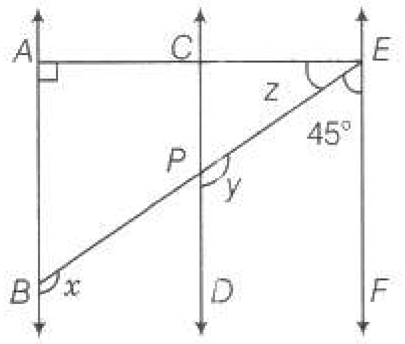
$= \pi - \left(\frac{y+2}{2}\right)$

$= \angle COE$

In $\Delta OAD,$

$\because$ OA = OD [Radii of the same circle]

$\because \angle OAD = \angle ODA$ [Angles opposite to the same sides of a triangle are equal]
In ΔOAD
$\angle OAD + \angle ODA + \angle AOD = \pi$ [Sum of all the angles of a triangle is π radians]
$\Rightarrow \angle OAD + \angle OAD + \pi - \left(\frac{y+z}{2}\right) = \pi$
$\Rightarrow 2\angle OAD = \frac{y+z}{2}$
$\Rightarrow \angle OAD = \frac{y+z}{4}$
Similarly, $\angle OCE = \frac{y+z}{4}$
$\therefore \angle OAB = \pi - \left(\frac{y+2}{4}\right)$
and $\angle OCB = \pi - \left(\frac{y+2}{4}\right)$
In quadrilateral AOCB,
$\angle ABC + \angle OAB + \angle OCB + \angle AOC = 2\pi$ [Sum of all the angles of a quadrilateral is 2π radians]
$\Rightarrow x + \pi - \left(\frac{y+z}{4}\right) + \pi - \left(\frac{y+z}{4}\right) + y = 2\pi$
$\Rightarrow x + y = \frac{y+z}{2}$
$\Rightarrow$ 2x + 2y = y + z
$\Rightarrow$2x = z - y
$\Rightarrow x = \frac{z-y}{2}$
Hence the result.

36. 

Given, CD $\parallel$ EF and EP is a transversal.

$\therefore$ ∠EPD + ∠FEP = 180^{0} [since, sum of interior angles on the same side of the transversal EP is 180^{0}]

$\Rightarrow$ y + 45^{0} = 180^{0} [$\because$ ∠FEP = 45^{0}, given]

$\Rightarrow$ y = 180^{0} - 45^{0} $\Rightarrow$ y = 135^{0}
Also, given AB $\parallel$ CD and BP is a transversal.

So, x = y [corresponding angles axiom]

$\therefore$ x = 135^o

Now, AB $\parallel$ CD and CD $\parallel$ EF

$\therefore$ AB $\parallel$ EF

Then, $\angle$EAB + $\angle$FEA = 180^o

[since, sum of interior angles on the same side of the transversal EA is 180^o]

$\Rightarrow 90^o + z + 45^o = 180^o$ [$\because$ EA $\perp$ AB $\Rightarrow \angle$EAB = 90^o]

$\Rightarrow z + 135^o = 180^o$

$\Rightarrow z = 180^o - 135^o$

$\Rightarrow z = 45^o$

Hence, x = 135^o, y = 135^o and z = 45^o

37. $\because$ x - 3 and x - $\frac{1}{3}$ are factors of
$px^2 + 5x + r$ $\therefore$ x = 3, x = $\frac{1}{3}$
zero of $px^2 + 5x + r$

Putting x = 3 in given polynomial,

$\therefore p(3)^2 + 5 \times 3 + r = 0$

9p + 15 + r = 0

9p + r = - 15 - - - - - (1)

Again putting x = $\frac{1}{3}$ in given polynomial,

$p\left(\frac{1}{3}\right)^2 + 5 \times \frac{1}{3} + r = 0$

$\frac{p}{9} + \frac{5}{3} + r = 0$

$\frac{p+15+9r}{9} = 0$

$p + 9r = -15 - - - - - - (2)$

Fron eq.(1) and eq.(2), we have,

9p + r = p + 9r

9p-p=9r-r

8p=8r

p=r

Hence proved

OR

$f(x) = x^4 - 2x^3 + 3x^2 - ax + b$

When f(x) is divided by x - 1 and x + 1 the remainders are 5 and 19 respectively.

$\therefore$ f(1) = 5 and f(-1) = 19

$\Rightarrow 1^4 - 2 \times 1^3 + 3 \times 1^2 - a \times 1 + b = 5$

and, $(-1)^4 - 2 \times (-1)^3 + 3 \times (-1)^2 - a \times (-1) + b = 19$

$\Rightarrow$ 1 - 2 + 3 - a + b = 5 and 1 + 2 + 3 + a + b = 19

$\Rightarrow$ 2 - a + b = 5 and 6 + a + b = 19 $\Rightarrow$ -a + b = 3 and a + b = 13

Adding these two equations, we get

(-a + b) + (a + b) = 3 + 13 $\Rightarrow$ 2b = 16 $\Rightarrow$ b = 8

Putting b = 8 in - a + b = 3, we get

-a + 8 = 3 $\Rightarrow$ -a = - 5 $\Rightarrow$ a = 5

Putting the values of a and b in f(x), we get,

$f(x) = x^4 - 2x^3 + 3x^2 - 5x + 8$

The remainder when f(x) is divided by (x - 2) is equal to f(2).

So, Remainder = $f(2) = 2^4 - 2\times 2^3 + 3 \times 2^2 - 5 \times 2 + 8 = 16 - 16 + 12 - 10 + 8 = 10$

38. Since the grains of corn are found on the curved surface of the corn cob.

So, Total number of grains on the corn cob = Curved surface area of the corn cob

$\times$ Number of grains of corn on 1 cm^2

Now, we will first find the curved surface area of the corn-cob.

We have, r = 2.1 and h = 20

Let l be the slant height of the conical corn cob. Then,

$l = \sqrt{r^2 + h^2} = \sqrt{(2.1)^2 + (20)^2} = \sqrt{4.41 + 400} = \sqrt{404.41}$ = 20.11

$\therefore$ Curved surface area of the corn cub = $\pi r l$

= $\frac{22}{7} \times 2.1 \times 20.11 \text{ cm}^2$

= 132.726 cm^2 = 132.73 cm^2

Hence, Total number of grains on the corn cob = 132.73 $\times$ 4 = 530.92

So, there would be approximately 531 grains of corn on the cob.

OR

Inner diameter of circular well = 3.5 m

$\therefore$ Inner radius of circular well = $\frac{3.5}{2}$ = 1.75 m

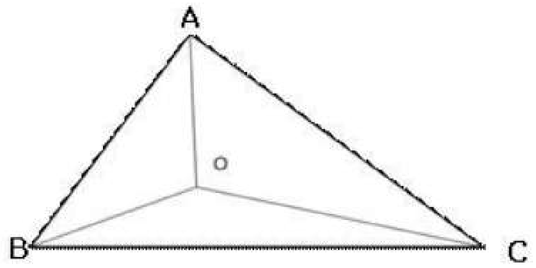
And Depth of the well = 10 m

i. Inner surface area of the well = $2\pi rh$

   = $2 \times \frac{22}{7} \times 1.75 \times 10$ = 110 m^2

ii. Cost of plastering 1 m^2 = Rs.40

   Cost of plastering 100 m^2 = 40 $\times$ 110 = ₹ 4400

39. 

Given: ΔABC and O is a point inside it.

Construction: Join OA, OB and OC

i. In $\triangle$ABC,

   AB + AC > BC ...(i)

   and in $\triangle$OBC,

   OB + OC > BC ...(ii)

   Subtracting (ii) from (i) we get,

   (AB + AC) - (OB + OC) > (BC - BC)

   Thus, AB + AC > OB + OC

ii. AB + AC > OB + OC

   Similarly, AB + BC > OA + OC

   and AC + BC > OA + OB

   Adding both sides of these three inequalities, we get,

   (AB + AC) + (AC + BC) + (AB + BC) > OB + OC + OA + OC + OB + OA.

   i.e., 2(AB + BC + AC) > 2(OA + OB + OC)

   Therefore, AB + BC + AC > OA + OB + OC

iii. In $\triangle$OAB

   OA + OB > AB ...(i)

   In $\triangle$OBC,

OB + OC > BC ...(ii)

and, in $\triangle$OCA,

OC + OA > CA ...(iii)

Adding (i), (ii) and (iii) we get

(OA + OB) + (OB + OC) + (OC + OA) > AB + BC + CA

i.e., 2(OA + OB + OC) > AB + BC + CA

$\Rightarrow$ OA + OB + OC > $\frac{1}{2}$ (AB + BC + CA)

40. We have,

Minimum daily wage = Rs.11, Maximum daily wage = Rs.24

$\therefore$ Range = 24 - 11 = 13

Size of class interval = 2 [Given]

$\therefore$ No. of class intervals = 7 [$\because \frac{Range}{Class\ size} = \frac{13}{2}$ = 6.5]

Since the mid-value of the first-class interval is 12 and the size of the class interval is 2

$\therefore$ Lower limit of first class interval = 12 - $\frac{2}{2}$ = 11

Upper limit of first class interval = 12 + $\frac{2}{2}$ = 13

$\therefore$ First class intervals are

11-12, 13-15, 15-17, 17-19, 19-21, 21-23, 23-25

In view of the above, the frequency distribution table is as given under.

Daily wages (in Rs.)	**Frequency**
11-13	3
13-15	4
15-17	5
17-19	6
19-21	5
21-23	4
23-25	3
Total	**30**