Class IX Session 2025-26
Subject - Mathematics
Sample Question Paper - 3

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1,1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

Section A

1. The product of a nonzero rational number with an irrational number is always a/an **[1]**

   a) natural number   b) whole number

   c) irrational number   d) rational number

2. How many lines pass through two points? **[1]**

   a) three   b) only one

   c) two   d) many

3. The perpendicular distance of the point P(-2, -3) from the y-axis is **[1]**

   a) 3 units   b) -3

   c) -2   d) 2 units

4. In a bar graph if 1 cm represents 30 km, then the length of bar needed to represent 75 km is **[1]**

a) 2 cm | b) 3 cm
c) 2.5 cm | d) 3.5 cm

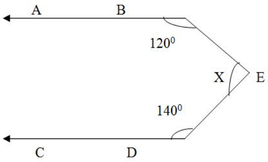
5. How many linear equations in ‘x’ and ‘y’ can be satisfied by x = 1, y = 2? **[1]**

a) Three | b) Infinitely many
c) Two | d) Only one

6. According to Euclid's axioms, the ________ is greater than the part. **[1]**

a) Semi | b) half
c) large | d) whole

7. In figure, AB and CD are parallel to each other. The value of x is: **[1]**



a) 100° | b) 90°
c) 120° | d) 140°

8. Two adjacent angles of a parallelogram are in the ratio 4 : 5. The angles are **[1]**

a) 60°, 120° | b) 80°, 100°
c) 90°, 90° | d) 40°, 140°

9. If one of the zeroes of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is **[1]**

a) 10 | b) -10
c) -7 | d) -2

10. The point which lies on y-axis at a distance of 3 units in the negative direction of y-axis is **[1]**

a) (0, 3) | b) (3, 0)
c) (-3, 0) | d) (0, -3)

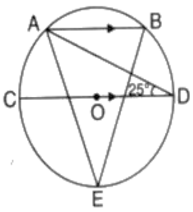
11. ABCD is a Trapezium in which AB$\|$ DC and $\angle A = \angle B = 45^o$. Find angles C and D of the Trapezium **[1]**

a) $135^o, 135^o$ | b) $200^o, 50^o$
c) $120^o, 120^o$ | d) $150^o, 150^o$

12. Opposite angles of a Quadrilateral ABCD are equal. If AB = 4cm, find the length of CD. **[1]**

a) 2 cm | b) 5 cm
c) 4 cm | d) 3 cm

13. In the given figure, AB $\|$ CD and O is the centre of the circle. If $\angle ADC = 25^o$, then the measure of $\angle AEB$ is **[1]**



a) 25^o | b) 60^o

c) 40^o d) 80^o

14. The value of $x^{p-q} x^{q-r} x^{r-p}$ is equal to [1]

a) x^{pqr} b) 0

c) 1 d) x

15. If (a, 4) lies on the graph of 3x + y = 10, then the value of a is [1]

a) 4 b) 1

c) 2 d) 3

16. Which of the following is not possible in case of triangle ABC? [1]

a) AB = 5cm, BC = 8cm, CA = 7cm. b) AB = 2 cm, BC = 4 cm, CA = 7 cm.

c) $\angle A = 50°$, $\angle B = 60°$, $\angle C = 70°$ d) AB = 3cm, BC = 4cm, CA = 5cm.

17. In a histogram, which of the following is proportional to the frequency of the corresponding class? [1]

a) Width of the rectangle b) Length of the rectangle

c) Area of the rectangle d) Perimeter of the rectangle

18. A cone and a hemisphere have equal bases and equal volumes the ratio of their heights is [1]

a) $\sqrt{2} : 1$ b) 4 : 1

c) 2 : 1 d) 1 : 2

19. **Assertion (A):** The sides of a triangle are in the ratio of 25 : 14 : 12 and its perimeter is 510 cm. Then the area of the triangle is 4449.08 cm^2. [1]

Reason (R): Perimeter of a triangle = a + b + c, where a, b, c are sides of a triangle.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) R is not the correct explanation of A.

d) A is false but R is true.

20. **Assertion (A):** A linear equation 2x + 3y = 5 has a unique solution. [1]

Reason (R): A linear equation in two variables has infinitely many solutions.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

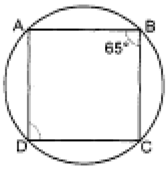
c) A is true but R is false.

d) A is false but R is true.

Section B

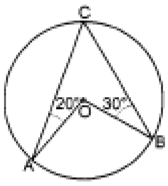
21. The altitude of an equilateral triangle is $3\sqrt{3}$ cm. Find its area. [2]

22. In given figure, ABCD is a cyclic quadrilateral in which AB || CD. If $\angle B = 65°$, then find other angles. [2]



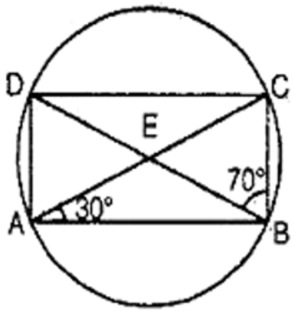
23. If the radius and slant height of a cone are in the ratio 7 : 13 and its curved surface area is 286 cm^2, find its radius. [2]

24. In the given figure, If O is the centre of the circle then find $\angle AOB$. [2]



OR

ABCD is a cyclic quadrilateral whose diagonals intersect at a point E. ∠DBC = 70° ∠BAC is 30° find∠BCD. Further if AB = BC, find ∠ECD.



25. Express the linear equation x = 3y in the form ax + by + c = 0 and indicate the value of a, b and c in case. **[2]**

OR

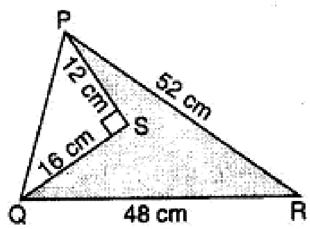
The cost of a notebook is twice the cost of a pen. Write a linear equation in two variables to represent this statement. (Take the cost of a notebook to be ₹ x and that of a pen to be ₹ y).

Section C

26. Find the values of a and b in each of $\frac{3-\sqrt{5}}{3+2\sqrt{5}}=a\sqrt{5}-\frac{b}{11}$ **[3]**

27. Prove that: $a^3+b^3+c^3-3abc=\frac{1}{2}(a+b+c)\left\{(a-b)^2+(b-c)^2+(c-a)^2\right\}$ **[3]**

28. Find the area of the shaded region in figure. **[3]**



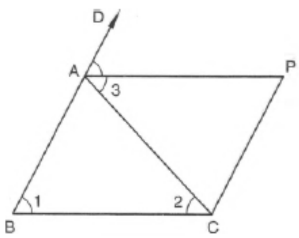
OR

The sides of a triangular field are 41m, 40m and 9m. Find the number of rose beds that can be prepared in the field, if each rose bed on an average needs 900 cm^2 space.

29. If the work done by a body on application of a constant force is directly proportional to the distance traveled by the body, express this in the form of an equation in two variables and draw the graph of the same by taking the constant force as 5 units. Also read from the graph the work done when the distance traveled by the body is 2 units. **[3]**

30. In the figure, ABC is an isosceles triangle in which AB = AC. CP || AB and AP is the bisector of exterior ∠CAD of △ABC. **[3]**

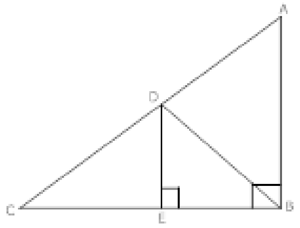
Prove that (i) ∠PAC = ∠BCA and (ii) ABCP is a parallelogram.



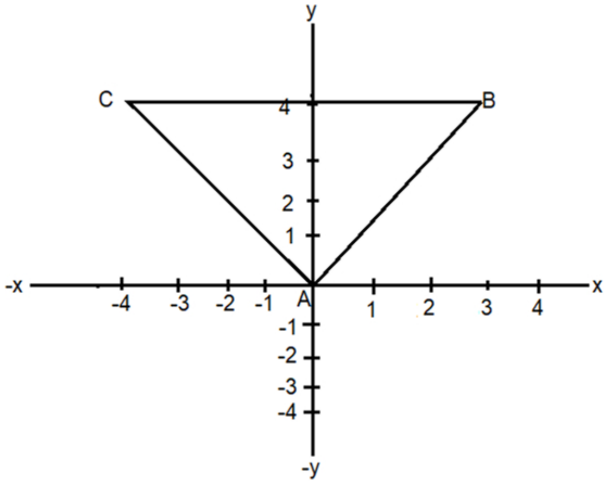
OR

In fig $\angle B$ is a right angle in $\triangle ABC$ and D is the mid-point of AC. Also, DE || AB and DE intersects BC at E. show that

i. E is the mid-point of BC
ii. $DE \perp BC$
iii. BD = AD



31. In fig find the vertices' co-ordinates of $\triangle ABC$ **[3]**



Section D

32. Represent each of the numbers $\sqrt{2}, \sqrt{3}$ and $\sqrt{5}$ on the real line. **[5]**

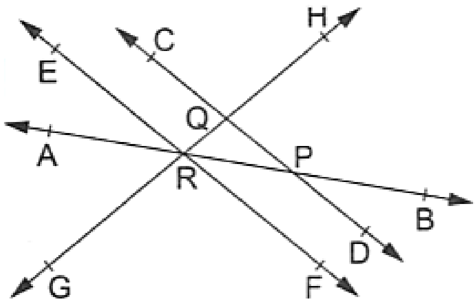
OR

If $a = \frac{1}{7-4\sqrt{3}}$ and $b = \frac{1}{7+4\sqrt{3}}$, then find the value of:

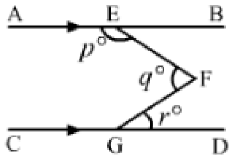
i. $a^2 + b^2$
ii. $a^3 + b^3$

33. In the adjoining figure, name: **[5]**

i. Two pairs of intersecting lines and their corresponding points of intersection
ii. Three concurrent lines and their points of intersection
iii. Three rays
iv. Two line segments

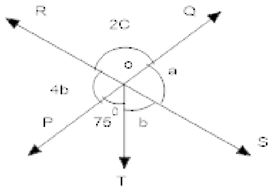


34. In the given figure, AB || CD. Prove that p + q - r = 180. **[5]**



OR

In fig two straight lines PQ and RS intersect each other at O, if ∠POT = 75° Find the values of a, b and c

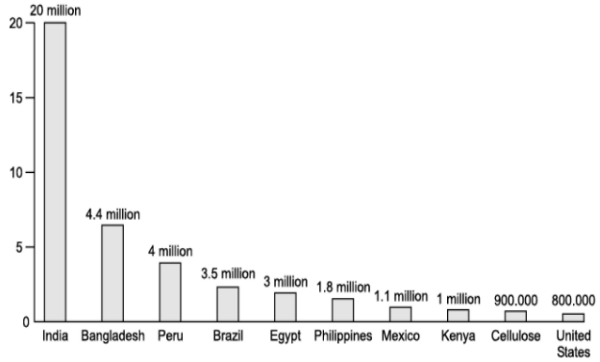


35. If $(ax^3 + bx^2 - 5x + 2)$ has $(x + 2)$ as a factor and leaves a remainder 12 when divided by $(x - 2)$, find the values of a and b. **[5]**

Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

Child labour refers to any work or activity that deprives children of their childhood. It is a violation of children's rights. This can them mentally or physically. It also exposes them to hazardous situations or stops them from going to school. Naman got data on the number of child labors (in million) in different country that is given below.



i. What is the difference between highest no child labor and the minimum no of child labor? (1)
ii. What is the percentage of no. of child labor in Peru over the no. of child labor in India? (1)
iii. What is the total no. of child labor in the countries having child labor more than 2 million? (2)

OR

How many countries are having child labor more than Mexico? (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

Vinod and Basant have an adventure tourism business in Rishikesh. They have a resort in Rishikesh but now they are planning to build some tent houses too.

The newly built tent house will have all the basic amenities and it will attract the young tourists coming for adventure. Their conical tent is 9 m high and the radius of its base is 12 m.

i. What is the cost of the canvas required to make it, if 1 m^2 canvas costs ₹ 10? (1)

ii. How many persons can be accommodated in the tent, if each person requires 2 m^2 on the ground? (1)

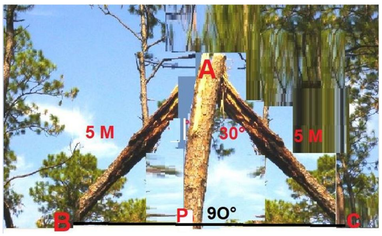
iii. How many persons can be accommodated in the tent, if each person requires 15 m^3 of space to breathe in? (2)

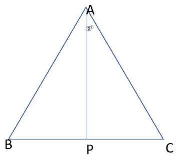
OR

If each person requires 20 m^3 of space to breathe in and 100 person can be accommodated then what should be height of tent? (2)

38. **Read the following text carefully and answer the questions that follow:** **[4]**

In a forest, a big tree got broken due to heavy rain and wind. Due to this rain the big branches AB and AC with lengths 5m fell down on the ground. Branch AC makes an angle of 30° with the main tree AP. The distance of Point B from P is 4 m. You can observe that ΔABP is congruent to ΔACP.





i. Show that $\triangle$ACP and $\triangle$ABP are congruent. (1)

ii. Find the value of $\angle$ACP? (1)

iii. Find the value of $\angle$BAP? (2)

OR

What is the total height of the tree? (2)

Solution

Section A

1.

(c) irrational number

Explanation:

The product of a non-zero rational number with an irrational number is always an irrational number.

2.

(b) only one

Explanation:

only one because if a line is passing through two points then that two points are solution of a single linear equation so only one line passes over two given points.

3.

(d) 2 units

Explanation:

Perpendicular distance of any point from y-axis is the given x-coordinate of point,

So distance=2unit

4.

(c) 2.5 cm

Explanation:

1 cm = 30 km

So for 75 km

$\frac{75}{30}$ = 2.5 cm

5.

(b) Infinitely many

Explanation:

There are many linear equations in ‘x’ and ‘y’ can be satisfied by x = 1, y = 2

for example

x + y = 3 x - y =-1

2x + y =4

and so on there are infinte number of examples

6.

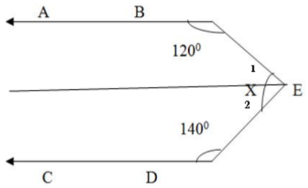
(d) whole

Explanation:

whole

7. **(a)** 100°

Explanation:



let us draw a line from point E parallel to line AB , CD

$X = \angle 1 + \angle 2$

$AB \parallel EF$

$\angle 1 + 120° = 180°$ (co - interior angle)

$\angle 1 = 180° - 120°$

$\angle 1 = 60°$

$CD \parallel EF$

$\angle 2 + 140° = 180°$ (co - interior angle)

$\angle 2 = 180° - 140°$

$\angle 1 = 40°$

$X = \angle 1 + \angle 2$

$X = 60° + 40°$

8.

(b) 80°, 100°

Explanation:

Let the adjacent angles of a parallelogram be 4x and 5x and sum of adjacent angles of parallelogram is 180°.

$\therefore 4x + 5x = 180°$

$\Rightarrow 9x = 180° \Rightarrow x = 20°$

$\therefore$ Angles are 80° and 100°.

9.

(b) -10

Explanation:

Since x = 2 is a zero. Put x = 2 in the equation

$(2)^2 + 3(2) + k = 0$

$4 + 6 + k = 0$

$k = -10$

10.

(d) (0, -3)

Explanation:

At the y-axis, the value of x co-ordinate is 0, y-axis at a distance of 3 units in the negative direction, so the co-ordinate of the y-axis is -3.

So the co-ordinate of the point is (0, -3).

11. **(a)** 135^o, 135^o

Explanation:

AB is parallel to DC.

angle A + angle D = 180^o (co-interior angle)

angle D = $180^o - 45^o = 135^o$

Similarly by following same argument, angle C = 135^o

12.

(c) 4 cm

Explanation:

A quadrilateral with both pair of opposite angles equal is a parallelogram.

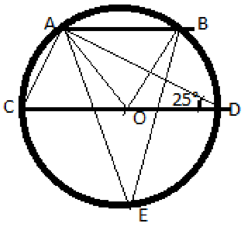
In a parallelogram, opposite sides are equal.

So, AB = CD = 4 cm

13.

(c) 40^o

Explanation:



Here, AB || CD and $\angle ADC = 25^o$,
So, $\angle DAB = 25^o$, (opposite interior angles are equal)
Now, $\angle ADC = 25^o$, so, $\angle AOC$ = 50° (Angle subtended by arc AC at centre is twice the angle subtended at circumference)
Similarly, $\angle DAB = 25^o$, So, $\angle DOB = 50^o$ (Angle subtended by arc BD at centre is twice the angle subtended at circumference)
$\angle AOB$ + $\angle DOB$ + $\angle AOC$ = 180° (All lie in straight line)
$\angle AOB$ = 180 - 50 - 50 = 80°
Now, $\angle AEB$ = 40° (Angle subtended by arc AB at centre is twice the angle subtended at circumference)

14.

(c) 1
Explanation:
$x^{p-q} x^{q-r} x^{r-p}$
$=x^{p-q+q-r+r-p}$
$= x^0$
=1

15.

(c) 2
Explanation:
Given, (a, 4) lies on the graph of 3x + y=10
Thus it is a solution
= 3a + 4 = 10
= a = 2

16.

(b) AB = 2 cm, BC = 4 cm, CA = 7 cm.
Explanation:
Sum of any two sides is greater than third side, but here 2 + 4 < 7.

17.

(c) Area of the rectangle
Explanation:
In, Histogram each rectangle is drawn, where width equivalent to class interval and height equivalent to the frequency of the class.

18.

(d) 1 : 2
Explanation:
Volume of a hemisphere = $(2/3)\pi r^3$
Volume of a right circular cone = $(1/3)\pi r^2 h$
Given, cone and a hemisphere have equal bases and equal volume
Height of a hemisphere is the radius and equal bases implies equal base radius.
$(2/3)\pi r^3 = (1/3)\pi r^2 h$
$\Rightarrow$ r : h = 1 : 2

19. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

510 = a + b + c

510 = 25x + 14x + 12x

510 = 51x

x = 10

Three side of the triangle are

25x = 25 $\times$ 10 = 250 cm

14x = 14 $\times$ 10 = 140 cm and

12x = 12 $\times$ 10 = 120 cm

s = $\frac{250+140+120}{2}$ = 255 cm

Area = $\sqrt{255 \times 5 \times 115 \times 135}$

= 4449.08 cm^2

20.

(d) A is false but R is true.

Explanation:

A is false but R is true.

Section B

21. In Equilateral Triangle , a is side of triangle.

Altitude $= \frac{\sqrt{3}a}{2}$

$\Rightarrow \quad \frac{\sqrt{3}}{2}a = 3\sqrt{3}$

$\Rightarrow \quad a = 6\text{cm}$

Area of an equilateral triangle = $\frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times 6^2 = 9\sqrt{3}\text{cm}^2$

Hence area of an equilateral triangle is $9\sqrt{3}\text{cm}^2$.

22. From the given figure we have,

$\angle$B + $\angle$D= 180° .... (opposite angles of the cyclic quadrilateral)

$\Rightarrow$ 65° + $\angle$D = 180° $\angle$D = 180°- 65° = 115°

Since AB || CD and BC is the transversel

$\therefore$ $\angle$B + $\angle$C = 180° $\Rightarrow$ 65° + $\angle$C = 180°

$\Rightarrow$ $\angle$C = 180° - 65°

$\Rightarrow$ $\angle$C = 115°

Now, $\angle$A +115° = 180° ....(opposite angles of cyclic quadrilateral)

$\Rightarrow$ $\angle$A =180° - 115°

$\Rightarrow$ $\angle$A = 65°

Hence $\angle$C = 115°, $\angle$D = 115° and $\angle$A = 65°

23. We are given that,Two ratio in radius and slant height of a cone = 7 : 13

Let radius (r) = 7x

and slant height (1) = 3x

Curved surface area = πrl

$= \frac{22}{7} \times 7x \times 13x = 286$

$286x^2$ = 286

$x^2 = \frac{286}{286} = 1$

$\therefore x = \sqrt{1} = 1$

Therefore Radius = 7x = 7 $\times$ 1 = 7 cm

24. From the given figure, we have

OA = OC ....(radii of the semi-circle)

$\therefore$ $\angle$OCA = $\angle$OAC $\Rightarrow$ $\angle$OCA = 20°

Also, we have

OB = OC ....(radii of the semi-circle)

$\therefore \angle OCB = \angle OBC$
$\Rightarrow \angle OCB = 30°$
Now, $\angle ACB = \angle OCA + \angle OCB$
$\Rightarrow \angle ACB = 20° + 30° = 50°$
$\angle AOB = 2\angle ACB = 2 \times 50° = 100°$

OR

Here, $\angle DBC = 70°$ and $\angle BAC = 30°$
And $\angle DAC = \angle DBC = 70°$ [Angles in same segment]
Now ABCD is a cyclic quadrilateral.
$\therefore \angle DAB + \angle BCD = 180°$
[Sum of opposite angles of a cyclic quadrilateral is supplementary]
$\Rightarrow 100° + \angle BCD = 180°$
$\Rightarrow \angle BCD = 80°$
Again, in triangle ABC, AB = BC
Therefore, $\angle BCA = \angle BAC$ [Opposite angles of opposite sides are equal]
So, $\angle BCA = 30°$
Now, $\angle BCD = \angle BCA + \angle ECD$
$\Rightarrow 80° = 30° + \angle ECD$
$\Rightarrow \angle ECD = 50°$

25.

We need to express the linear equation $x = 3y$ in the form ax + by + c = 0 and indicate the values of a, b and c
$x = 3y$ can also be written as $x - 3y + 0 = 0$.
We need to compare the equation $x - 3y + 0 = 0$ with the general equation ax + by + c = 0, to get the values of a, b and c.
Therefore, we can conclude that $a = 1, b = -3$ and $c = 0$

OR

Let the cost of a notebook be ₹ x.
Let the cost of a pen be ₹ y.
We need to write a linear equation in two variables to represent the statement, “Cost of a notebook is twice the cost of a pen”.
Therefore, we can conclude that the required statement will be **x = 2y.**

Section C

26. LHS $= \frac{3-\sqrt{5}}{3+2\sqrt{5}} = \frac{3-\sqrt{5}}{3+2\sqrt{5}} \times \frac{3-2\sqrt{5}}{3-2\sqrt{5}}$
$= \frac{(3-\sqrt{5})(3-2\sqrt{5})}{(3)^2-(2\sqrt{5})^2}$
$= \frac{9-6\sqrt{5}-3\sqrt{5}+10}{9-20} = \frac{19-9\sqrt{5}}{-11}$
Now, $\frac{19-9\sqrt{5}}{-11} = a\sqrt{5} - \frac{b}{11}$
$\Rightarrow \frac{-19}{11} + \frac{9}{11}\sqrt{5} = a\sqrt{5} - \frac{b}{11}$
$\Rightarrow \frac{9}{11}\sqrt{5} - \frac{19}{11} = a\sqrt{5} - \frac{b}{11}$
Hence, $a = \frac{9}{11}$.
b = 19

27. We have,
$a^3 + b^3 + c^3 - 3abc$
$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$
$= \frac{1}{2}(a + b + c)(2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ca)$
$= \frac{1}{2}(a + b + c)\{(a^2 - 2ab + b^2) + (b^2 - 2bc + c^2) + (c^2 - 2ca + a^2)\}$
$= \frac{1}{2}(a + b + c)\{(a - b)^2 + (b - c)^2 + (c - a)^2\}$

28. In right triangle PSQ,
$PQ^2 = PS^2 + QS^2$ ...[By Pythagoras theorem]
$= (12)^2 + (16)^2$
$= 144 + 256 = 400$
$\Rightarrow PQ = \sqrt{400} = 20$ cm
Now, for ΔPQR

a = 20 cm, b = 48 cm, c = 52 cm

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

$= \frac{20+48+52}{2}$ = 60 cm

$\therefore$ Area of ΔPQR

$= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{60(60-20)(60-48)(60-52)}$

$= \sqrt{60(40)(12)(8)}$

$= \sqrt{(6 \times 10)(4 \times 10)(6 \times 2)(8)}$

= 6 $\times$ 10 $\times$ 8 = 480 cm^2

Area of Δ PSQ =$\frac{1}{2}$ $\times$ Base $\times$ Altitude

= $\frac{1}{2}$ $\times$ 16 $\times$ 12 = 96 cm^2

$\therefore$ Area of the shaded portion

= Area of ΔPQR - Area of ΔPSQ

= 480 - 96 = 384 cm^2

OR

Let a = 41m, b = 40m, c = 9m.

$s = \frac{a+b+c}{2} = \frac{41+40+9}{2} = \frac{90}{2}$

s = 45m

Area of triangular field$= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{45(45-41)(45-40)(45-9)}$

$= \sqrt{45 \times 4 \times 5 \times 36}$

=180 m^2

=1800000 cm^2

Number of rose beds$= \frac{\text{Total area}}{\text{Area needed for one rose bed}} = \frac{1800000}{900} = 2000$

29. Let the work done by the constant force be y units and the distance traveled by the body be x units.

Constant force = 5 units

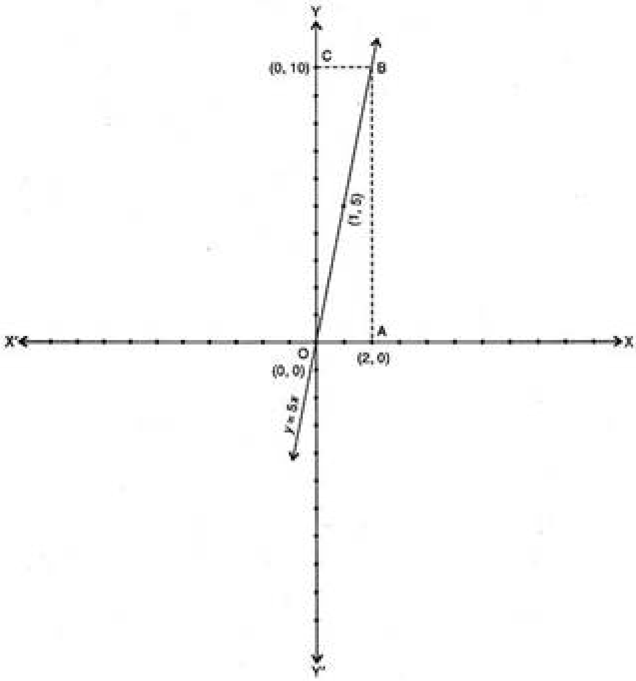
We know that

Work done = Force × Displacement

$\Rightarrow$ y = 5x

x	0	1
y	0	5

We plot the points (0, 0) and (1, 5) on the graph paper and join the same by a ruler to get the line which is the graph of the equation y = 5x.



Let A → (2, 0), Through A, draw a line parallel to OY to intersect the graph of the equation y = 5x at B. Through B, draw a line parallel to OX to intersect OY at C. Then,

C → (0, 10)

∴ Work done when the distance travelled by the body is 2 units = 10 units.

30. **GIVEN** An isosceles △ ABC having AB = AC. AP is the bisector of ext ∠CAD and CP || AB

TO PROVE ∠PAC = ∠BCA and ABCP is a parallelogram.

PROOF

i. In △ ABC, we have
   AB = AC [Given]
   ⇒ ∠1 = ∠2 [∵ Angles opposite to equal sides in a △ are equal] ....(i)
   In a triangle, an exterior angle is equal to the sum of two opposite interior angles.
   ∴ In △ABC, we have
   ∠CAD = ∠1 + ∠2
   ⇒ ∠CAD = 2 ∠2 [using (i)]
   ⇒ 2 ∠3 = 2 ∠2 [∵ AP is the bisector of ext. ∠CAD ∴ ∠CAD = 2∠3]
   ⇒ ∠3 = ∠2
   ⇒ ∠PAC = ∠BCA

ii. We observe that AC intersects lines AP and BC at A and C respectively such that ∠3 =∠2 i.e., alternate interior angles are equal.
   ∴ AP || BC
   But, CP || AB [Given]
   Thus, ABCP is a quadrilateral such that AP || BC and CP || AB.
   Hence, ABCP is a parallelogram.

OR

Proof: ∵ DE || AB: and D is midpoints of AC

In △DCE and △DBE

CE = BE

DE = DE (Common side)

And ∠DEC = ∠ DEB = 90°

∴ △DCE ≅ △DBE

∴ CD = BD

Therefore, we can easily say that E is the midpoint of BC.(Proof of (i))

Also, DE is perpendicular to BC. (Proof of (ii))

Since triangle ABD is an equilateral triangle then all sides are equal.

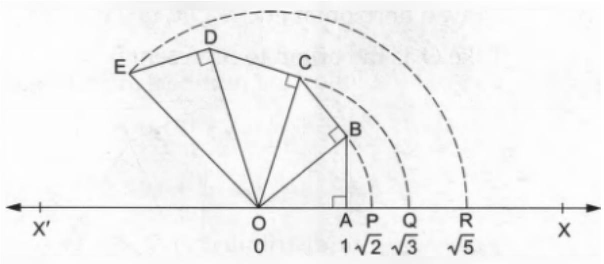
So, BD = AD (Proof of (iii))

Hence proved.

31. (A) (0, 0) (B) (3, 4) (c) (-4, 4)

Section D

32. Let X'OX be a horizontal line, taken as the x-axis and let O be the origin. Let O represent 0.



Take OA = 1 unit and draw AB ⊥OA such that AB = 1 unit.

Join OB. Then,by Pythagoras Theorem

$OB = \sqrt{OA^2 + AB^2} = \sqrt{1^2 + 1^2} = \sqrt{2}$ units

With O as centre and OB as radius, draw an arc, meeting OX at P.

Then, OP = OB=$\sqrt{2}$ units

Thus, the point P represents $\sqrt{2}$ on the real line.

Now, draw BC ⊥OB such that BC = 1 unit.

Join OC. Then by Pythagoras Theorem

$OC = \sqrt{OB^2 + BC^2} = \sqrt{(\sqrt{2})^2 + 1^2} = \sqrt{3}$ units

With O as centre and OC as radius, draw an arc, meeting OX at Q. Then,

OQ = OC =$\sqrt{3}$ units

Thus, the point Q represents $\sqrt{3}$ on the real line

Now, draw CD ⊥ OC such that CD = 1 unit.

Join OD. Then,by Pythagoras Theorem

$OD = \sqrt{OC^2 + CD^2} = \sqrt{(\sqrt{3})^2 + 1^2} = \sqrt{4} = 2$ units

Now, draw DE ⊥ OD such that DE = 1 unit.

Join OE. Then,

$OE = \sqrt{OD^2 + DE^2} = \sqrt{2^2 + 1^2} = \sqrt{5}$ units.

With O as centre and OE as radius, draw an arc, meeting OX

at R. Then, OR = OE = $\sqrt{5}$ units.

Thus, the point R represents $\sqrt{5}$ on the real line.

Hence, the points P, Q, R represent the numbers $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$respectively.

OR

Given, $a = \frac{1}{7-4\sqrt{3}}$ and $b = \frac{1}{7+4\sqrt{3}}$,

Now, $a = \frac{1}{7-4\sqrt{3}} = \frac{1}{7-4\sqrt{3}} \times \frac{7+4\sqrt{3}}{7+4\sqrt{3}} = \frac{7+4\sqrt{3}}{7^2-(4\sqrt{3})^2}$

$= \frac{7+4\sqrt{3}}{49-16\times3} = \frac{7+4\sqrt{3}}{49-48}$

$\therefore a = \frac{1}{7-4\sqrt{3}} = 7 + 4\sqrt{3}$

Now, $b = \frac{1}{7+4\sqrt{3}} = \frac{1}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}} = \frac{7-4\sqrt{3}}{7^2-(4\sqrt{3})^2}$

$= \frac{7-4\sqrt{3}}{49-16\times3} = \frac{7-4\sqrt{3}}{49-48}$

$\therefore b = \frac{1}{7+4\sqrt{3}} = 7 - 4\sqrt{3}$

$a + b = 7 + 4\sqrt{3} + 7 - 4\sqrt{3} = 14$

$ab = (7 + 4\sqrt{3})(7 - 4\sqrt{3})$

= 7^2 -$(4(\sqrt{3}))^2$

$= 49 - 16 \times 3 = 49 - 48$

⇒ ab = 1

Now, $a^2 + b^2 = (a + b)^2 - 2ab$

= $(14)^2$ - 2 × 1

= 196 - 2

$\therefore a^2 + b^2 = 194$

Also, $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$

$= (14)^3 - 3 \times 1\ (14)$

= 2744 - 42

= 2702

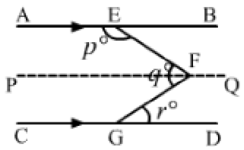
33. i. $\overleftrightarrow{EF}$, $\overleftrightarrow{GH}$ and their corresponding point of intersection is R.

$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ and their corresponding point of intersection is P.

ii. $\overleftrightarrow{AB}$, $\overleftrightarrow{EF}$, $\overleftrightarrow{GH}$ and their point of intersection is R.

iii. Three rays are: $\overrightarrow{RB}$, $\overrightarrow{RH}$, $\overrightarrow{RG}$

iv. Two line segments are: $\overline{RQ}$, $\overline{RP}$.

34. 

Draw PFQ || AB || CD

Now, PFQ || AB and EF is the transversal.

Then,

$\angle AEF + \angle EFP = 180^\circ$ ...(i)

[Angles on the same side of a transversal line are supplementary]

Also, PFQ || CD.

$\angle PFG = \angle FGD = r^\circ$ [Alternate Angles]

and $\angle EFP = \angle EFG - \angle PFG = q^\circ - r^\circ$

putting the value of ∠EFP in equation (i)

we get,

p° + q °- r° = 180° [∠AEF = p°]

OR

PQ intersect RS at O

$\therefore \angle QOS = \angle POR$ [vert'ically opposite angles]

a = 4b ...(1)

Also,

a + b + 75° = 180° [∵POQ is a straight lines]

∴ a + b = 180° - 75°

= 105°

Using, (1)

4b + b = 105°

5b = 105°

Or

b = = $\frac{105^\circ}{5}$ = 21°

Now a=4b

a = 4 × 21°

a = 84°

Again,∠QOR and ∠QOS

∴ a + 2c = 180°

Using, (2) 84° + 2c = 180°

2c = 180° - 84°

2c = 96°

c = $\frac{96^0}{2}$ = 48°c

Hence,

a = 84°, b = 21° and c = 48°

35. Let $p(x) = ax^3 + bx^2 - 5x + 2$, g(x) = x + 2 and h(x) = x - 2. Then, g(x) = 0 ⇒ x + 2 = 0 ⇒ x = -2

h(x) = 0 ⇒ x - 2 = 0 ⇒ x = 2

(x + 2) is a factor of p(x) ⇒ p(-2) = 0

Now ,p(-2) = 0 ⇒ a × $(-2)^3$ + b × $(-2)^2$ - 5 × (-2) + 2) = 0

⇒ -8a + 4b +12 = 0

⇒ 8a - 4b = 12 ⇒ 2a - b = 3 ...(i)

When p(x) is divided by (x - 2), then the remainder is p(2)

∴ p(2) = 12 ⇒ (a × 2^3) + (b × 2^2) - (5 × 2) + 2) = 12

⇒ 8a + 4b = 20 ⇒ 2a + b = 5 ...(ii)

On solving (i) and (ii), we get a = 2 and b = 1

Section E

36. i. The highest no child labor are in India and the lowest no child labor are in United states

No of child labor in India = 20,000,000

No of child labor in United states = 8,00,000

The difference = 20,000,000 - 8,00,000

= 19,200,000

ii. No. of child labor in Peru = 4,000,000

No. of child labor in India = 20,00,000

The percentage = $\frac{4000000}{20000000} \times 100 = 20\%$

iii. The countries having child labor more than 2 million are

Egypt = 3 Million

Brazil = 3.5 million

Peru = 4 million

Bangladesh = 4.4 million

India = 20 million

Total no of these labor child = 3 + 3.5 + 4 + 4.4 + 20 = 34.9 Million.

OR

The countries having child labor more than Mexico are:

Philippines = 1.8 Million

Egypt = 3 Million

Brazil = 3.5 million

Peru = 4 million

Bangladesh = 4.4 million

India = 20 million

Thus 6 countries are having child labor more than Mexico.

37. i. We have,

r = Radius of the base of the conical tent = 12 m

h = Height of the conical tent = 9 m

∴ l = Slant height of the conical tent = $\sqrt{r^2 + h^2}$

= $\sqrt{12^2 + 9^2}\text{m} = \sqrt{225}\text{m}$ = 15

Area of lateral surface = πrl = $\frac{22}{7} \times 12 \times 15\ \text{m}^2 = 565.7\ \text{m}^2$

∴ Total cost of canvas = ₹(565.2 × 10) = ₹ 5652

ii. We have,

r = Radius of the base of the conical tent = 12 m

h = Height of the conical tent = 9 m

∴ l = Slant height of the conical tent = $\sqrt{r^2 + h^2}$

= $\sqrt{12^2 + 9^2}\text{m} = \sqrt{225}\text{m}$ = 15

Area of the base of the conical tent = πr^2 = $\frac{22}{7} \times 12 \times 12\ \text{m}^2 = 452.16\ \text{m}^2$

Since each person requires 2 sq. meters of floor area.

∴ Max. no. of persons who will have enough space on the ground = $\frac{452.16}{2}$ = 226

iii. We have,

r = Radius of the base of the conical tent = 12 m

h = Height of the conical tent = 9 m.

∴ l = Slant height of the conical tent = $\sqrt{r^2 + h^2}$

$= \sqrt{12^2 + 9^2}\text{m} = \sqrt{225}\text{m}$ = 15

Volume of the conical tent = $\frac{1}{3}$ $\times$ Area of the base $\times$ Height

$\Rightarrow$ Volume of the conical tent = $\frac{1}{3}$ $\times$ 452.16 $\times$ 9 m^3

We have, Air space required person = 15 m^3

$\therefore$ No. of persons who will have enough air space to breathe in = $\frac{1356.48}{15}$ = 90

Hence, 90 persons can be accommodated.

OR

We have,

r = Radius of the base of the conical tent = 12 m

h = Height of the conical tent = 9 m.

$\therefore$ l = Slant height of the conical tent = $\sqrt{r^2 + h^2}$

$= \sqrt{12^2 + 9^2}\text{m} = \sqrt{225}\text{m}$ = 15

Let new height is H and radius = 12 m

Each person requires 20 m^3 of space to breathe

Thus volume of air required for 100 persons = 20 $\times$ 100 = 2000 m^3

2000 = $\frac{1}{3}\pi \times r^2 h$

2000 = $\frac{1056h}{7}$

h = 13.25 m

Thus new height would be 13.25 m.

38. i. In $\triangle$ACP and $\triangle$ABP

AB = AC (Given)

AP = AP (common)

$\angle$APB = $\angle$APC = 90^o

By RHS criteria $\triangle$ACP $\cong$ $\triangle$ABP

ii. In $\triangle$ACP

$\angle$APC + $\angle$PAC + $\angle$ACP = 180^o

$\Rightarrow$ 90^o + 30^o + $\angle$ACP = 180^o (angle sum property of $\triangle$)

$\Rightarrow$ $\angle$ACP = 180^o - 120^o = 60^o

$\angle$ACP = 60^o

iii. $\triangle$ACP $\cong$ $\triangle$ABP

Corresponding part of congruent triangle

$\angle$BAP = $\angle$CAP

$\angle$BAP = 30^o (given $\angle$CAP = 30^o)

OR

$\triangle$ACP

$AC^2 = AP^2 + PC^2$

$\Rightarrow$ 25 = AP^2 + 16

$\Rightarrow$ AP^2 = 25 − 16 = 9

$\Rightarrow$ AP = 3

Total height of the tree = AP + 5 = 3 + 5 = 8 m