CBSE Class 09 Mathematics

Sample Paper 08 (2020-21)

Maximum Marks: 80

Time Allowed: 3 hours

General Instructions:

i. This question paper contains two parts A and B.
ii. Both Part A and Part B have internal choices.

Part – A consists 20 questions

i. Questions 1-16 carry 1 mark each. Internal choice is provided in 5 questions.
ii. Questions 17-20 are based on the case study. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B consists 16 questions

i. Question No 21 to 26 are Very short answer type questions of 2 mark each,
ii. Question No 27 to 33 are Short Answer Type questions of 3 marks each
iii. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
iv. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

Part - A

1. Divide $18\sqrt{21}$ by $6\sqrt{7}$.

OR

Evaluate: $(25)^{\frac{1}{3}} \times (5)^{\frac{1}{3}}$.

2. Find the zero of the polynomial in p(x) = x – 5
3. Fifty seeds were selected at random from each of 5 bags of seeds, and were kept under standardised conditions favourable to germination. After 20 days the number of seeds which had germinated in collection were counted and recorded as follows

Bag	1	2	3	4	5
number of seeds germinated:	40	48	42	39	41

Number of seeds germinated: at least 40 seeds in a bag?

4. Construct an equilateral triangle whose altitude is 4 cm.
5. The perimeter of an isosceles triangle is 42 cm and its base is $1\frac{1}{2}$ times each of the equal sides. Find the area of the triangle. (Given, $\sqrt{7}$ = 2.64.)

OR

A parallelogram and a square have the same area. If the sides of the square measure 40 m and altitude of the parallelogram measures 25 m, find the length of the corresponding base of the parallelogram.

6. The volume of a cuboid is 440 cm^3 and the area of its base is 88 cm^2. Find its height.
7. Simplify: $(\sqrt{11} - \sqrt{5})^2$

OR

Add : $2\sqrt{2} + 5\sqrt{3}$ and $\sqrt{2} - 3\sqrt{3}$

8. Write the following equation in the form ax + by + c = 0 and indicate the values of a, b and c:
   x = 2y
9. In a hot water heating system, there is a cylindrical pipe of length 28 m and diameter 5 cm. Find the radiating surface in the system.

OR

How many lead shots, each 3 mm in diameter, can be made from a cuboid with dimensions (12 cm × 11 cm × 9 cm)?

10. Write the coefficient of y in the expansion of $(5 - y)^2$.
11. If x = 3 and y = 4 is a solution of the equation 5x - 3y = k, find the value of k.
12. Find the following product: $(7a - 5b)(49a^2 + 35ab + 25b^2)$
13. Find the measure of the complementary angle of 60^o.
14. Express equation in the form ax + by + c = 0 and indicate the values of a, b, c in case: 3x + 5y = 7.5

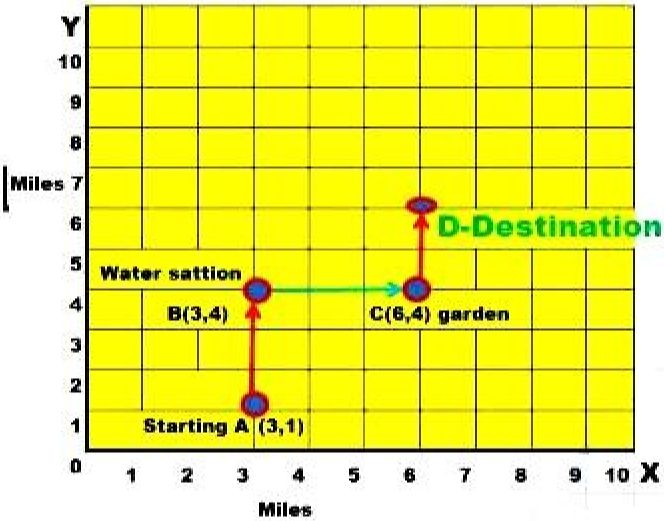
15. How many solutions does the equation $2x + 5y = 8$ has?

16. Find the value of $(1296)^{0.17} \times (1296)^{0.08}$.

OR

Simplify: $3(a^4b^3)^{10} \times 5(a^2b^2)^3$

17. **Read the Source/Text given below and answer any four questions:**



Arun is participating in an **8 miles** walk. The organizers used a square coordinate grid to plot the course. The starting point is at A (3, 1). At B (3, 4), there's a water station to make sure the walkers stay hydrated.

From water station, the walkway turns right and at C (6,4) a garden is situated to keep walkers fresh. From the garden, the walkway turns left and finally, Arun reaches at destination D to complete 8 miles.

i. How far is the water station B from the starting point A?
   a. 4 miles
   b. 3 miles
   c. 1 mile
   d. 5 miles

ii. How far is the water station B from garden C?
   a. 3 miles
   b. 4 miles
   c. 1 mile
   d. 5 miles

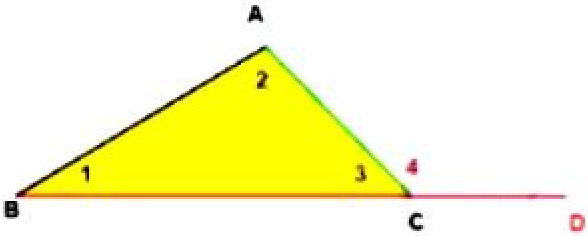
iii. What is the abscissa of destination point D?

a. 3
b. 5
c. 3
d. 6

iv. What is the ordinate of destination point D?
a. 3
b. 2
c. 6
d. 5

v. What are the coordinates of destination point D?
a. (5, 6)
b. (6, 5)
c. (3, 9)
d. (6, 6)

18. **Read the Source/Text given below and answer any four questions:**



Ashok is studying in 9th class in Govt School, Chhatarpur. Once he was at his home and was doing his geometry homework.

He was trying to measure three angles of a triangle using the Dee, but his dee was old and his Dee's numbers were erased and the lines on the dee were visible.

Let us help Ashok to find the angles of the triangle.

He found that the second angle of the triangle was three times as large as the first. The measure of the third angle is double of the first angle.

Now answer the following questions:

i. What was the value of the first angle?
a. 30°
b. 45°
c. 60°
d. 90°

ii. What was the value of the third angle?

a. 30°

b. 45°

c. 60°

d. 90°

iii. What was the value of the second angle?

a. 30°

b. 45°

c. 60°

d. 90°

iv. What was the value of ∠4 as shown the figure?

a. 120°

b. 45°

c. 60°

d. 90°

v. What was the sum of all three angles measured by Ashok using Dee?

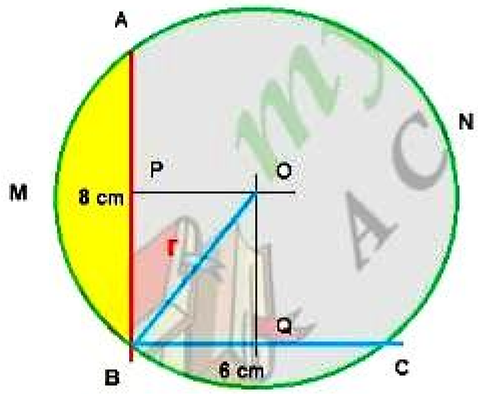
a. 270°

b. 180°

c. 100°

d. 90°

19. **Read the Source/Text given below and answer any four questions:**



As Class IX C' s teacher Mrs Rashmi entered in the class, She told students to do some practice on circle chapter. She Draws two-line AB and BC so that AB = 8 cm and BC = 6 cm. She told all students To make this shape in their notebook and draw a circle passing through the three points A, B and C.

i. Dileep drew AB and BC as per the figure

ii. He drew perpendicular bisectors OP and OQ of the line AB and BC.

iii. OP and OQ intersect at O

iv. Now taking O as centre and OB as radius he drew The circle which passes through A, B and C.

v. He noticed that A, O and C are collinear.

Answer the following questions:

i. What you will call the line AOC?

   a. Arc
   b. Diameter
   c. Radius
   d. Chord

ii. What is the measure of ∠ ABC?

   a. 60°
   b. 90°
   c. 45°
   d. 75°

iii. What you will call the yellow color shaded area AMB?

   a. Arc
   b. Sector
   c. Major segment
   d. Minor Segment

iv. What you will call the grey colour shaded area BCNA?

   a. Arc
   b. Sector
   c. Major segment
   d. Minor Segment

v. What is the radius of the circle?

   a. 4 cm
   b. 3 cm
   c. 7 cm
   d. 5 cm

20. **Read the Source/Text given below and answer any four questions:**

Three coins are tossed simultaneously 200 times with the following frequencies of different outcomes given in the table. Read the data given in the table carefully.

Outcome	3 tails	2 tails	1 tail	no tail
Frequency	20	68	82	30

If the three coins are simultaneously tossed again, compute the probability of

i. getting less than 3 tails.
   a. 0.9
   b. 0.1
   c. 0.01
   d. 0.02
ii. Exactly 2 Heads
   a. 0.68
   b. 0.41
   c. 0.34
   d. 0.5
iii. exactly 1 head
   a. 0.68
   b. 0.86
   c. 0.34
   d. 0.11
iv. At least 1 tail
   a. 0.58
   b. 0
   c. 1
   d. 0.85
v. All heads
   a. 0.51
   b. 0.55
   c. 0.9

d. 0.15

Part - B

21. ABCD is a cyclic quadrilateral in a circle with centre O. Prove that $\angle A + \angle C = 180^\circ$
22. Simplify : $\frac{\sqrt{24}}{8} + \frac{\sqrt{54}}{9}$

OR

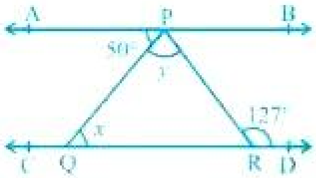
Find the value of a and b: $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = a - 6\sqrt{3}$

23. Factorise: $\left(x^4 + \frac{1}{x^4} + 1\right)$
24. The volume of a cone is 18480 cm^3. If the height of the cone is 40 cm. Find the radius of its base.
25. If each side of an equilateral triangle is tripled then what is the percentage increase in the area of the triangle?

OR

Find the area of a triangle whose sides are 9 cm, 12 cm and 15 cm.

26. Find the measure of all the angles of a parallelogram, if one angle is 24^0 less than twice the smallest angle.
27. In the given figure, if AB || CD, ∠ APQ = 50° and ∠PRD = 127°, find x and y.



28. Draw a right-angled triangle whose hypotenuse measures 6 cm and the length of one of whose sides containing the right angle is 4 cm.

OR

Construct of the angles, using ruler and compasses: 22.5°.

29. Two cones have their heights in the ratio 1 : 3 and the radii of their bases in the ratio 3 : 1. Find the ratio of their volumes.
30. If x + y + z = 0 then show that $x^3 + y^3 + z^3 = 3xyz$.

OR

Factorise: $3x^3 - x^2 - 3x + 1$

31. The lengths of the sides of a triangle are 5 cm, 12 cm, and 13 cm. Find the length of the perpendicular from the opposite vertex to the side whose length is 13 cm.

32. If $\frac{3+\sqrt{7}}{3-\sqrt{7}} = a + b\sqrt{7}$, find the values of a and b.

33. AD, BE and CF, the altitudes of $\triangle$ABC are equal. Prove that $\triangle$ABC is an equilateral triangle.

34. The following table shows the average daily earnings of 40 general stores in a market, during a certain week:

Daily earning (in rupees)	700-750	750-800	800-850	850-900	900-950	950-1000
Number of stores	6	9	2	7	11	5

Draw a histogram to represent the above data.

OR

Find the solutions of the form x = a, y = b for the following equations:

$2x + 5y = 10$ and $2x + 3y = 6$

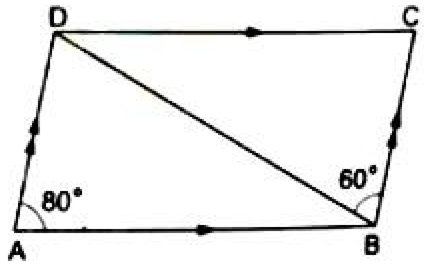
Is there any common solution?

35. The central Board of secondary education has a waiting list of examinations of 150 Persons. Out of these, 60 are women and 90 are men. One examiner is to selected to replace an examiner who has not reported at the centre find the probability that the examiner selected is a:

(i) woman

(ii) man

36. In the adjoining figure, ABCD is a parallelogram in which $\angle DAB = 80^\circ$ and $\angle DBC = 60^\circ$. Calculate $\angle CDB$ and $\angle ADB$.



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Solution

Part - A

1. $\frac{18\sqrt{21}}{6\sqrt{7}} = \left(\frac{18}{6}\right)\left(\frac{\sqrt{21}}{\sqrt{7}}\right) = 3\sqrt{3}$

OR

$$(25)^{\frac{1}{3}} \times (5)^{\frac{1}{3}} = (25 \times 5)^{\frac{1}{3}} = \left(5^3\right)^{\frac{1}{9}} = 5.$$

2. p(x) = x - 5, put p(x)=0

   x - 5 = 0

   x = 5

   Therefore, x = 5 is a zero of the polynomial p(x) = x - 5

3. Number of bags in which at least 40 seeds germinated = 4

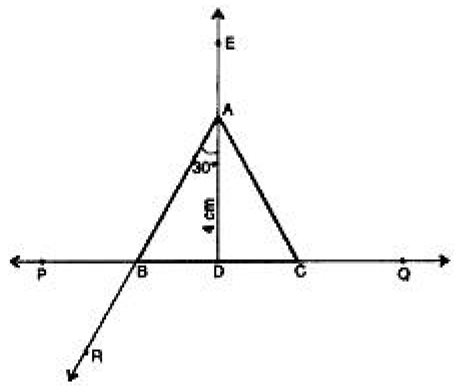
   probability of germination of at least 40 seeds = $\frac{4}{5}$.

4. Given: In an equilateral triangle ABC, altitude AD = 4 cm.

   Required: To construct the triangle ABC.

   Steps of construction:

   i. Draw a line PQ.
   ii. Take a point D on it.
   iii. Draw a ray DE $\perp$ PQ.
   iv. Cut off DA = 4 cm on DE
   v. Construct $\angle$DAR = ($\frac{1}{2} \times 60^{\circ}$) = 30° . Let the ray AR intersect PQ at B.
   vi. Cut off line segment DC = BD.
   vii. Join AC.



ABC is the required triangle.

5. Let the equal sides of the isosceles triangle be a cm each.

$\therefore$ The base of the triangle, $b = \frac{3}{2} a \text{cm}$

Given, the perimeter of triangle = 42

$\Rightarrow a + a + \frac{3}{2}a = 42$

$\Rightarrow \frac{7}{2}a = 42$

$\Rightarrow a = 12$ cm

and $b = \frac{3}{2}(12)\text{cm} = 18$ cm

Area of an isosceles triangle $= \frac{b}{4}\sqrt{4a^2 - b^2}$

$= \frac{18}{4} \times \sqrt{4(12)^2 - 18^2}$ (a = 12 cm and b = 18 cm)

$= 4.5 \times \sqrt{576 - 324}$

$= 4.5 \times \sqrt{252}$

$= 4.5 \times 15.87$

$= 71.42 \text{ cm}^2$

OR

It is given that,

Sides of the square = 40 m

Altitude of the parallelogram = 25 m

Now, given that area of parallelogram and square is same,

Area of the parallelogram = Area of the square

$\Rightarrow$ Base $\times$ Height = $(\text{side})^2$

$\Rightarrow$ Base $\times$ 25 = $(40)^2$

$\Rightarrow$ Base $\times$ 25 = 1600

$\Rightarrow \text{ Base } = \frac{1600}{25}$

$\Rightarrow$ Base = 64 m

Hence, the length of the corresponding base of the parallelogram is 64 m.

6. We have,

Volume = 440 cm^3 and Area of the base = 88 cm^2

$\therefore$ Height = $\frac{Volume}{Area\ of\ the\ base}$

$\Rightarrow$ Height = $\frac{440}{88}$ cm = 5 cm

7. It is given that,

$(\sqrt{11} - \sqrt{5})^2 = (\sqrt{11})^2 - 2 \times \sqrt{11} \times \sqrt{5} + (\sqrt{5})^2$ [Using $(a - b)^2 = a^2 + b^2 - 2ab$]

$\Rightarrow (\sqrt{11} - \sqrt{5})^2 = 11 - 2\sqrt{11 \times 5} + 5 = 16 - 2\sqrt{55}$.

OR

we have.$(2\sqrt{2} + 5\sqrt{3}) + (\sqrt{2} - 3\sqrt{3}) = (2\sqrt{2} + \sqrt{2}) + (5\sqrt{3} - 3\sqrt{3})$ =
$(2 + 1)\sqrt{2} + (5 - 3)\sqrt{3} = 3\sqrt{2} + 2\sqrt{3}$

8. We have,

$x = 2y \Rightarrow x - 2y = 0 \Rightarrow x - 2y + 0 = 0$

On comparing this equation with $ax + by + c = 0$, we get

$a = 1$, $b = -2$ and $c = 0$

9. h = 28 m, 2r = 5 cm

$\therefore r = \frac{5}{2}\ cm = \frac{5}{2 \times 100}\ m = \frac{5}{200}\ m = \frac{1}{40}\ m$

$\therefore$ Total radiating surface in the system$= 2\pi rh$

$= 2 \times \frac{22}{7} \times \frac{1}{40} \times 28$

= 4.4 m^2

OR

Radius of lead shots = $\frac{0.3}{2} = \frac{3}{20}$ cm

The volume of cuboid = Total volume of led shots = no. of lead shots $\times$ The volume of one lead shot ...(1)

Now, the volume of cuboid = $12 \times 11 \times 9$ ...(2)

Then, Volume of one lead shot = $\frac{4}{3} \times \frac{22}{7} \times \left(\frac{3}{20}\right)^3$ ....(3)

Let n be the number of lead shots.

$\therefore 12 \times 11 \times 9 = n \times \frac{4}{3} \times \frac{22}{7} \times \left(\frac{3}{20}\right)^3$ [from (1),(2) & (3)]

n = $\frac{9 \times 11 \times 126 \times 3 \times 7 \times 8000}{4 \times 22 \times 27}$ = 84000

The number of lead shots = 84000

10. $(5 - y)^2 = 25 + y^2 - 10y$. Clearly the coefficient of y is -10.
11. Since x = 3 and y = 4 is a solution of the equation 5x - 3y = k, substituting x = 3 and y = 4 in equation 5x - 3y = k,

    we get 5(3) - 3(4) = k

    $\Rightarrow$ 15 - 12 = k $\Rightarrow$ k = 3 Hence The value of k=3
12. We have,

    $(7a - 5b)(49a^2 + 35ab + 25b^2)$

    $= (7a - 5b)[(7a)^2 + 7a \times 5b + (5b)^2]$

    $= (x - y)(x^2 + xy + y^2)$, where x = 7a and y = 5b

    $= x^3 - y^3$ [$\because (x - y)(x^2 + xy + y^2) = x^3 - y^3$]

    $= (7a)^3 - (5b)^3 = 343a^3 - 125b^3$
13. The measure of the complementary angle $x = (90^o - r^o)$

    Where r^o = given measurement

    $\therefore x = (90^o - 60^o) = 30^o$
14. We have,

    3x + 5y = 7.5

    $\Rightarrow$ 3x + 5y - 7.5 = 0

    $\Rightarrow 3x + 5y - \frac{15}{2} = 0$

    $\Rightarrow$ 6x + 10y - 15 = 0

    On comparing this equation with ax + by + c = 0, we obtain

    a = 6, b = 10 and c = -15
15. The equation 2x + 5y = 8 has infinitely many solutions.
16. $(1296)^{0.17} \times (1296)^{0.08}$

    $= (1296)^{\frac{17}{100}} \times (1296)^{\frac{8}{100}}$

    $= (6^4)^{\frac{17}{100}} \times (6^4)^{\frac{8}{100}}$

    $= 6^{\frac{17}{25}} \times 6^{\frac{8}{25}}$

$= 6^{\frac{17}{25}+\frac{8}{25}}$ [using $a^m \times a^n = a^{m+n}$]

$= 6^{\frac{25}{25}}$

= 6

OR

$3(a^4b^3)^{10} \times 5(a^2b^2)^3$

$= 3(a^{40} b^{30}) \times 5(a^6 b^6)$ [using $(a^m)^n = a^{mn}$]

$= 15(a^{46} b^{36})$ [using $a^m \times a^n = a^{m+n}$]

17. i. (b) 3 miles
    ii. (a) 3 miles
    iii. (d) 6
    iv. (c) 6
    v. (d) (6,6)
18. i. (a) 30°
    ii. (c) 60°
    iii. (d) 90°
    iv. (a) 120°
    v. (b) 180°
19. i. (b) Diameter
    ii. (b) 90°
    iii. (d) Minor segment
    iv. (c) Major segment
    v. (d) 5 cm
20. i. (a) 0.9
    ii. (b) 0.41
    iii. (c) 0.34
    iv. (d) 0.85
    v. (d) 0.15

Part - B

21. Given: ABCD is a cyclic quarilateral in a circle with centre O.

To Prove: $\angle A + \angle C = 180^\circ$

Construction: Join OD and OB.

Proof: By, OD and OB, $\angle DOB = 2\angle C, \angle DOB = 2\angle A$ [angle at the centre is equals to double the angle at the remaining part of the circle]

2($\angle A + \angle C$) = ∠DOB+ reflex ∠DOB = 360° [sum of angles around the point is 360°]

∠A+∠C = 180°

22. $\frac{\sqrt{24}}{8} + \frac{\sqrt{54}}{9} = \frac{\sqrt{4\times6}}{8} + \frac{\sqrt{9\times6}}{9} = \frac{2\sqrt{6}}{8} + \frac{3\sqrt{6}}{9} = \frac{\sqrt{6}}{4} + \frac{\sqrt{6}}{3}$
$= \sqrt{6}\left(\frac{1}{4} + \frac{1}{3}\right) = \sqrt{6}\left(\frac{3+4}{12}\right) = \frac{7\sqrt{6}}{12}$

OR

LHS $= \frac{5+2\sqrt{3}}{7+4\sqrt{3}} = \frac{5+2\sqrt{3}}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}}$
$= \frac{(5+2\sqrt{3})(7-4\sqrt{3})}{(7)^2-(4\sqrt{3})^2}$
$= \frac{35-20\sqrt{3}+14\sqrt{3}-24}{49-48}$
$= \frac{11-6\sqrt{3}}{1} = 11 - 6\sqrt{3}$

Now, $11 - 6\sqrt{3} = a - 6\sqrt{3}$ [comparing LHS and RHS]

By comparing on both sides,

⇒ a = 11

23. We have,
$\left(x^4 + \frac{1}{x^4} + 1\right)$
$= \left(x^4 + \frac{1}{x^4} + 2\right) - 1 = \left(x^2 + \frac{1}{x^2}\right)^2 - 1^2$
$= \left(x^2 + \frac{1}{x^2} - 1\right)\left(x^2 + \frac{1}{x^2} + 1\right)$
$= \left(x^2 + \frac{1}{x^2} - 1\right)\left\{\left(x^2 + \frac{1}{x^2} + 2\right) - 1\right\}$
$= \left(x^2 + \frac{1}{x^2} - 1\right)\left\{\left(x + \frac{1}{x}\right)^2 - 1^2\right\}$
$= \left(x^2 + \frac{1}{x^2} - 1\right)\left(x + \frac{1}{x} - 1\right)\left(x + \frac{1}{x} + 1\right)$
$\therefore \left(x^4 + \frac{1}{x^4} + 1\right) = \left(x^2 + \frac{1}{x^2} - 1\right)\left(x + \frac{1}{x} - 1\right)\left(x + \frac{1}{x} + 1\right)$

This is the required factorisation.

24. Let the radius of the cone be r cm.

We have,

h = Height of the cone = 40 cm and, V = Volume of the cone = 18480 cm^3

$\therefore \frac{1}{3} \times \frac{22}{7} \times r^2 \times 40 = 18480$

$\Rightarrow r^2 = \frac{18480 \times 3 \times 7}{22 \times 40} = 441$

$\Rightarrow r = \sqrt{441} = 21$ cm

25. Area of an equilateral triangle having each side a cm is given by

$A = \frac{\sqrt{3}a^2}{4}$ .....(1)

Now, Area of an equilateral triangle, say A_1 if each side is tripled is given by

b = 3a

$A_1 = \frac{\sqrt{3}b^2}{4}$

$A_1 = \frac{\sqrt{3}}{4}(3a)^2$

$A_1 = \frac{9\sqrt{3}a^2}{4} cm^2$ ...(2)

Therefore, an increase in the area of the triangle

$= A_1 - A$

$= \frac{9\sqrt{3}a^2}{4} - \frac{\sqrt{3}a^2}{4}$ [from (1) and (2)]

$= \frac{8\sqrt{3}a^2}{4}$

Percentage increase in area

$= \frac{\frac{8\sqrt{3}a^2}{4}}{\frac{\sqrt{3}a^2}{4}} \times 100$

= 800 %

OR

Let a = 9 cm, b = 12 cm and c = 15 cm

Since, 2s = a + b + c

$\Rightarrow s = \frac{1}{2}(a + b + c)$

$= \frac{1}{2}(9 + 12 + 15)$

$= \frac{1}{2}(36) = 18$ cm

Now, area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{18(18-9)(18-12)(18-15)}$

$= \sqrt{18 \times 9 \times 6 \times 3}$

= 54 cm^2

26. Let the smallest angle be x.

$\therefore$ the other angle is (2x - 24)

Now,

x + 2x - 24 = 180 [$\because$ Sum of adjacent angle of a parallelogram is 180^{0}]

$\Rightarrow$ 3x - 24 = 180

$\Rightarrow$ 3x = 180 + 24

$\Rightarrow$ 3x = 204

$\Rightarrow x = \frac{204}{3} = 68^{0}$

$\Rightarrow 2x - 24^{0} = 2 \times 68^{0} - 24^{0} = 136^{0} - 24^{0} = 112^{0}$

Hence, four angles are: 68^{0}, 112^{0}, 68^{0}, 112^{0}.

27. We are given that $AB \parallel CD, \angle APQ = 50^{\circ}$ and $\angle$PRD = 127°

We need to find the value of x and y in the figure.

$\angle$APQ = x = 50° (Alternate interior angles)

$\angle$PRD = $\angle$APR = 127° (Alternate interior angles)

$\angle$APR = $\angle$QPR + $\angle$APQ.

127° = y + 50°

$\Rightarrow$ y = 77°.

Therefore, we can conclude that x = 55° and y = 77°

Alternatively, 127° = y + x (because exterior angle is equal to the sum of interior opposite angles).

so, 127° = y + 50°

which gives, x = 50° and y = 77°

28. **Steps of Construction:**

i. Draw a line segment BC = 6 cm.

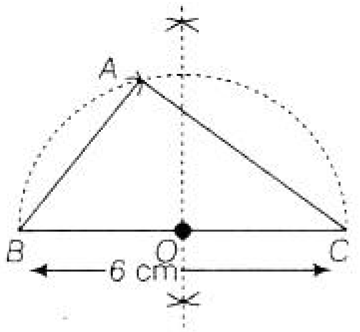
ii. Draw perpendicular bisector of BC which intersects BC at O.

iii. Taking O as centre and radius OB, draw a semi-circle on BC.

iv. Taking B as centre and radius equal to 4 cm, draw an arc, cutting the semi-circle at A. Also, here $\angle A$ would be of 90° as angle drawn in a semi-circle from diameter is always right angle.

v. Join AB and AC.

Thus, ABC is the required right angle triangle.



OR

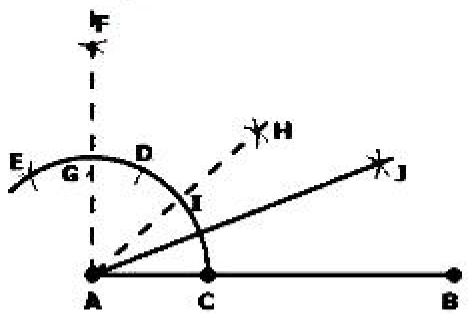
TO CONSTRUCT

- Angle 22.5^{o}

STEP OF CONSTRUCTION

i. Draw a line segment AB.
ii. With centre A and any radius, draw an arc which intersects AB at C.
iii. With centre C and same radius, draw an arc which intersects the previous arc at D.
iv. With centre D and same radius, draw an arc which intersects arc in step 2 at E.
v. With centres E and D and radius more than half of ED, draw arcs intersecting each other at F.
vi. Join AF which intersects arc in step 2 at G.
vii. Now taking G and C as centres, draw arcs with radius more than half the length GC.
viii. Let these arcs intersect each other at H.
ix. Join AH which intersect the arc in step 2 at I.
x. With centres I and C and radius more than half of IC, draw arcs intersecting each other at J.
xi. Join AJ.

Then, $\angle JAB = 22.5^{o}$



29. Let the ratio of height be h

$\therefore$ Height of Ist cone = h

Height of IInd cone = 3h.

Let the ratio of radii be r

$\therefore$ Radius of Ist cone = 3r

And, radius of IInd cone = r

$\therefore$ Ratio of volume = $\frac{v_1}{v_2}$

$\Rightarrow \frac{v_1}{v_2} = \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = \frac{r_1^2 h_1}{r_2^2 h_2}$

= $\frac{(3r)^2 \times h}{(r)^2 \times 3h}$

= $\frac{9r^2 h}{3r^2 h} = \frac{3}{1}$

30. We know that

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

(Using Identity $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$)

$= (0)(x^2 + y^2 + z^2 - xy - yz - zx)$ ($\because x + y + z = 0$)

= 0

$\Rightarrow x^3 + y^3 + z^3 = 3xyz.$

OR

Let $f(x) = 3x^3 - x^2 - 3x + 1$ be the given polynomial. The factors of the constant term + 1 are ±1. The factor of coefficient of x^3 is 3. Hence, possible rational roots of f(x) are: $\pm\frac{1}{3}$.

We have, $f(1) = 3(1)^3 - (1)^2 - 3(1) + 1 = 3 - 1 - 3 + 1 = 0.$

And $f(-1) = 3(-1)^3 - (-1)^2 - 3(-1) + 1 = -3 - 1 + 3 + 1 = 0$

So, (x - 1) and (x + 1) are factors of f(x).

$\Rightarrow$ (x - 1)(x + 1) is also a factor of f(x).

$\Rightarrow x^2 - 1$ is a factor of f(x).

Let us now divide $f(x) = 3x^3 - x^2 - 3x + 1$ by $x^2 - 1$ to get the other factors of f(x).

By long division, we have

$$
\begin{array}{r|l}
x^2 - 1 & 3x^3 - x^2 - 3x + 1 \quad (3x - 1 \\
 & 3x^3 \qquad\quad - 3x \\
 & \underline{-\qquad\qquad +\quad} \\
 & -x^2 + 1 \\
 & -x^2 + 1 \\
 & \underline{+\qquad -\quad} \\
 & 0
\end{array}
$$

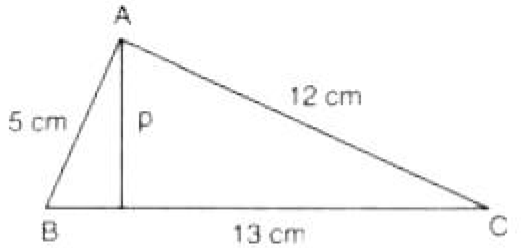
$\therefore 3x^3 - x^2 - 3x + 1 = (x^2 - 1)(3x - 1)$

$\Rightarrow 3x^3 - x^2 - 3x + 1 = (x - 1)(x + 1)(3x - 1)$

Hence, $3x^3 - x^2 - 3x + 1 = (x - 1)(x + 1)(3x - 1)$

31. Here, a = 5, b = 12 and c = 13

$\therefore s = \frac{1}{2}(a + b + c) = \frac{1}{2}(5 + 12 + 13) = 15$



Let A be the area of the given triangle. Then,

$A = \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{15(15-5)(15-12)(15-13)}$

$\Rightarrow A = \sqrt{15 \times 10 \times 3 \times 2} = 30\ cm^2$ .....(i)

Let p be the length of the perpendicular from vertex A on the side BC. Then,

$A = \frac{1}{2} \times (13) \times p$ .....(ii)

From (i) and (ii), we get

$\frac{1}{2} \times 13 \times p = 30$

$\Rightarrow p = \frac{60}{13}$ cm

32. Given, $a + b\sqrt{7} = \frac{3+\sqrt{7}}{3-\sqrt{7}}$

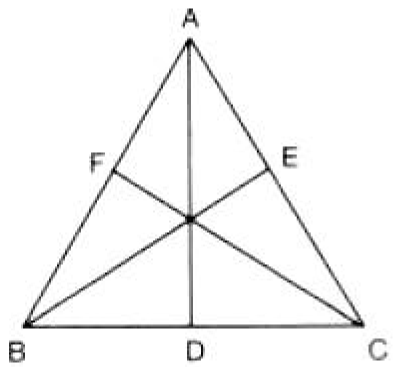
$\Rightarrow \quad a + b\sqrt{7} = \frac{3+\sqrt{7}}{3-\sqrt{7}} \times \frac{3+\sqrt{7}}{3+\sqrt{7}}$ [by rationalising]

$\Rightarrow \quad a + b\sqrt{7} = \frac{(3+\sqrt{7})^2}{(3)^2-(\sqrt{7})^2}$ [$\because (a - b)(a + b) = a^2 - b^2$]

$= \frac{9+7+6\sqrt{7}}{9-7}$ [$\because (a+b)^2 = a^2 + b^2 + 2ab$]

$\Rightarrow \quad a + b\sqrt{7} = \frac{16+6\sqrt{7}}{2} = 8 + 3\sqrt{7}$

On comparing the coefficients of a and b both sides, we get a = 8 and b = $3\sqrt{7}$

33. 

Given: AD, BE and CF, the altitudes of $\triangle$ABC are equal. i.e. AD = BE = CF

To Prove: $\triangle$ABC is an equilateral triangle.

Proof: In the right $\triangle$BEC and $\triangle$BFC, we have,

$\angle BFC = \angle BEC$ [each 90^o]

Hyp. BC = Hyp. BC

BE = CF [Given]

$\triangle BEC \cong \triangle BFC$ [By RHS criterion of congruence]

$\Rightarrow \angle B = \angle C$ [CPCT]

$\Rightarrow$ AC = AB [$\because$ Sides opposite to equal angles are equal] ...(i)

Similarly, $\triangle ABD \cong \triangle ABE$

$\Rightarrow \angle B = \angle A$ [CPCT]

$\Rightarrow$ AC = BC [$\because$ Sides opposite to equal angles are equal] ...(ii)

From (i) and (ii), we get

AB = BC = AC

Hence, $\triangle$ABC is an equilateral triangle.

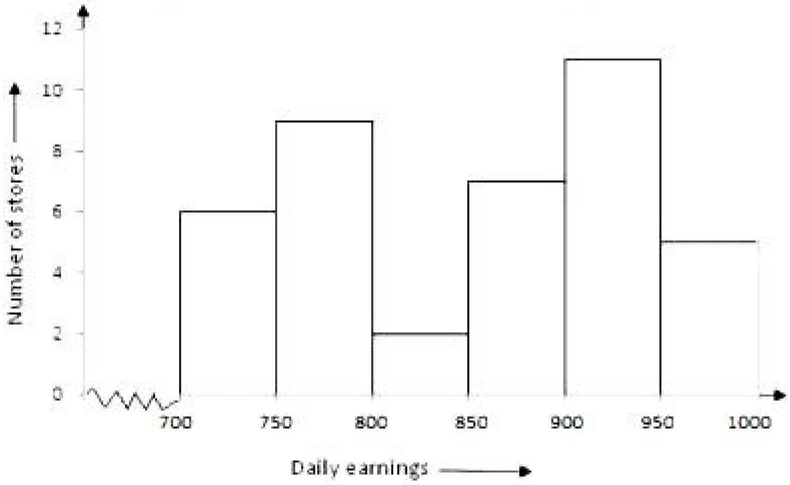
Hence Proved.

34. The following table shows the average daily earnings of 40 general stores in a market, during a certain week:

Daily earning (in ₹)	700-750	750-800	800-850	850-900	900-950	950-1000
Number of stores	6	9	2	7	11	5

Clearly, the given frequency distribution is in the exclusive form. We take class intervals, i.e. daily earnings (in ₹) along x-axis and frequencies i.e. number of stores along y-axis. So , we get the required histogram.

Since the scale on X-axis starts at 700, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 700.



OR

Consider the equation 2x + 5y = 10.

Substituting x = 0 in the equation 2x + 5y = 10, we get

$2 \times 0 + 5y = 10$

$\Rightarrow 5y = 10$

$\Rightarrow y = 2$

Thus, x = 0 and y = 2 is a solution of 2x + 5y = 10.

Substituting y = 0 in 2x + 5y = 10, we get

$2x + 5 \times 0 = 10 \Rightarrow 2x = 10 \Rightarrow x = 5$

Thus, x = 5 and y = 0 is a solution of 2x + 5y = 10.

Thus, x = 5, y = 0 and x = 0, y = 2 are two solutions of 2x + 5y = 10.

Now, Consider the equation 2x + 3y = 6.

Substituting x = 0, in this equation, we get

$2 \times 0 + 3y = 6 \Rightarrow 3y = 6 \Rightarrow y = 2$

So, x = 0, y = 2 is a solution of 2x + 3y = 6

Substituting y = 0 in 2x + 3y = 6, we get

$2x + 3 \times 0 = 6 \Rightarrow 2x = 6 \Rightarrow x = 3$

Thus, x = 0, y = 2 and x = 3, y = 0 are solutions of 2x + 3y = 6

Clearly, x = 0, y = 2 is common solution of the given equations.

35. (i) No. of trials = 150

No. of women = 60

∴ P (The examiner selected is a woman) = $\frac{60}{150}$
$= \frac{2}{5}$
(ii) Number of men = 90
∴ P (The examiner selected is a man) = $\frac{90}{150} = \frac{3}{5}$
P (woman) + P (man) = $\frac{2}{5} + \frac{3}{5} = 1$

36. It is given that ABCD is parallelogram and ∠DAB = 80° and ∠DBC = 60°

We need to find measure of ∠CDB and ∠ADB

In ABCD, AD || BC, BD as transversal,

∠DBC = ∠ADB = 60° ... Alternate interior angles

⇒ ∠ADB = 60° .....(i)

As ∠DAB and ∠ADC are adjacent angles,

∠DAB + ∠ADC = 180°

⇒ ∠ADC = 180° - ∠DAB

⇒ ∠ADC = 180° - 80° = 100°

Also,

∠ADC = ∠ADB + ∠CDB

∴ ∠ADC = 100°

∠ADB + ∠CDB = 100° ..... (ii)

From (i) and (ii), we get:

60° + ∠CDB = 100°

⇒ ∠CDB = 100° − 60° = 40°

Hence, ∠CDB = 40° and ∠ADB = 60°