Series JBB/5

SET-3

Code No. **430/5/3**

Roll No. | | | | | | |

Note :

(I) Please check that this question paper contains **20** printed pages.

(II) Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(III) Please check that this question paper contains **40** questions.

(IV) Please write down the Serial Number of the questions in the answer book before attempting it.

(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

MATHEMATICS (BASIC)
HINTS & SOLUTIONS

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

General Instructions:

Read the following instructions very carefully and strictly follow them.

(i) This question paper comprises **Four** Sections — **A, B, C and D** There are 40 questions in the question paper. All questions are compulsory.

(ii) **Section A —** Questions no. **1** to **20** comprises of **20** questions of **one** mark each.

(iii) **Section B —** Questions no. **21** to **26** comprises of **6** questions of **two** mark each.

(iv) **Section C —** Questions no**. 27** to **34** comprises of **8** questions of **three** mark each.

(v) **Section D —** Questions no**. 35** to **40** comprises of **6** questions of **four** mark each.

(vi) There is no overall choice in the question paper. However, an internal choice has been provided in 2 questions of one mark, 2 questions of two marks, 3 questions of three marks and 3 questions of four marks. You have to attempt **only one of the choices** in such questions.

(vii) In addition to this, separate instructions are given with each section and question, wherever necessary.

(viii) Use of calculators is **not** permitted.

SECTION-A

Question numbers 1 to 20 carry 1 mark each.

Choose the correct option in question numbers 1 to 10.

1. If (3, – 6) is the mid-point of the line segment joining (0, 0) and (x, y), then the point (x, y) is

(A) (– 3, 6) (B) (6, – 6) (C) (6, –12) (D) $\left(\frac{3}{2},-3\right)$

Sol. (C) Co-ordinate of midpoint = $\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$

So, $3 = \frac{0+x}{2} \Rightarrow x = 6$

And $-6 = \frac{0+y}{2} \Rightarrow y = -12$

So (x, y) = (6, –12)

2. In the given circle in Figure-1, number of tangents parallel to tangent PQ is

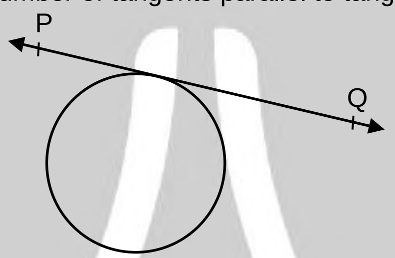


Figure-1

(A) 0 (B) many (C) 2 (D) 1

Sol. (D) 1

3. The discriminant of the quadratic equation $4x^2 - 6x + 3 = 0$ is

(A) 12 (B) 84 (C) $2\sqrt{3}$ (D) – 12

Sol. (D) Discriminant $D = b^2 - 4ac$

$= (-6)^2 - 4(4)(3)$

$= 36 - 48 = -12$

4. For the following frequency distribution :

Class:	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency :	8	10	19	25	8

The upper limit of median class is

(A) 15 (B) 10 (C) 20 (D) 25

Sol. (A)

Class	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency	8	10	19	25	8
C.F.	8	18	37	62	70

N = 70 and $\frac{N}{2}$ = 35 So just greater to 35 is 37

So median class is 10 – 15 upper limit of median class is 15

5. If $\cos A = \frac{\sqrt{3}}{2}$, 0° < A < 90°, then A is equal to

(A) $\frac{\sqrt{3}}{2}$ (B) 30° (C) 60° (D) 1°

Sol. (B)

$\cos A = \frac{\sqrt{3}}{2}$

A = 30°

6. The probability of an impossible event is

(A) 1 (B) $\frac{1}{2}$ (C) not defined (D) 0

Sol. (D) 0

7. If a pair of linear equations is consistent, then the lines represented by them are
(A) parallel (B) intersecting or coincident
(C) always coincident (D) always intersecting

Sol. (B) Intersecting or Coincident

8. The distance between the points (3, – 2) and (– 3, 2) is

(A) $\sqrt{52}$ units (B) $4\sqrt{10}$ units (C) $2\sqrt{10}$ units (D) 40 units

Sol. (A) Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

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

$= \sqrt{36+16} = \sqrt{52}$ Unit

9. 120 can be expressed as a product of its prime factors as
(A) $5 \times 8 \times 3$ (B) 15×2^3 (C) $10 \times 2^2 \times 3$ (D) $5 \times 2^3 \times 3$

Sol. (D) $120 = 2^3 \times 3^1 \times 5^1$

10. The total surface area of a frustum-shaped glass tumbler is ($r_1 > r_2$)

(A) $\pi r_1 l + \pi r_2 l$ (B) $\pi l\,(r_1 + r_2) + \pi r_2^2$ (C) $\frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$ (D) $\sqrt{h^2 + (r_1 - r_2)^2}$

Sol. (B) T.S.A. of Frustum = $\pi(r_1 + r_2)\ell + \pi r_2^2$
$= \pi\ell\,(r_1+r_2) + \pi r_2^2$

Fill in the blanks in question numbers 11 to 15.

11. If 2 is a zero of the polynomial $ax^2 - 2x$, then the value of `a' is_________.

Sol. If 2 is a zero of the Polynomial then its satisfy given Polynomial so
Put P(2) = 0
$a(2)^2 - 2(2) = 0$
$4a - 4 = 0$
a = 1

12. If the radii of two spheres are in the ratio 2 : 3, then the ratio of their respective volumes is _________.

Sol. Volume of sphere = $\frac{4}{3}\pi r^3$

So ratio of volumes = $\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{2}{3}\right)^3 = 8 : 27$

13. A line intersecting a circle in two points is called a_________.

Sol. Secant

14. If ar (ΔPQR) is zero, then the points P, Q and R are_________.

Sol. Collinear

15. All squares are_________. (congruent/similar)

Sol. Similar

Answer the following question numbers 16 to 20 :

16. A coin is tossed twice. Find the probability of getting head both the times.

Sol. total out comes = HH , HT, TH, TT

Probability = $\frac{1}{4}$.

17. Find the radius of the sphere area is 36π cm^2.

Sol. Surface area of sphere = $4\pi r^2 = 36\pi$

$r^2 = 9$

$r = 3$

So radius = 3cm.

18. Find the value of x so that – 6, x, 8 are in A.P.

OR

Find the 11th term of the A.P. – 27, – 22, – 17, – 12, ...

Sol. – 6, x , 8 are in A.P. So

$2x = -6 + 8$

$2x = 2$

$x = 1$

OR

–27 , –22, –17, –12 ....(in A.P.)

$a = -27$, $d = -22 + 27 = 5$

So, $T_n = a + (n - 1)\,d$

$T_{11} = -27 + (11 - 1)5$

$T_{11} = -27 + 50$

$T_{11} = 23$

$T_{11} = 23$

19. In Figure-2, the angle of elevation of the top of a tower AC from a point B on the ground is 60°. If the height of the tower is 20 m, find the distance of the point from the foot of the tower.

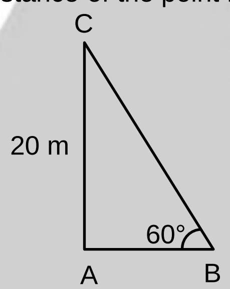
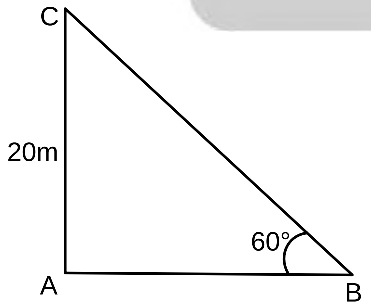


Figure-2

Sol.



In ΔABC

$\tan 60^\circ = \frac{AC}{AB}$

$\sqrt{3} = \frac{20}{AB}$

$AB = \frac{20}{\sqrt{3}}$ or $\frac{20}{3}\sqrt{3} \approx 11.54$

20. Evaluate :
tan 40° × tan 50°

OR

If cos A = sin 42°, then find the value of A.

Sol. Tan 40° × tan 50°
tan 40° × tan (90° – 40°)
tan 40° × cot 40° = 1

OR

cos A = sin 42
cos A = sin (90–48)
cos A = cos 48
on comparing
A = 48°

SECTION- B

Question numbers 21 to 26 carry 2 marks each.

21. If tan (A + B) = $\sqrt{3}$ and tan (A – B) = $\frac{1}{\sqrt{3}}$, $0 < A + B \le 90°$, A > B, then find the values of A and B.

Sol. tan (A + B) = $\sqrt{3}$
A + B = 60° ____ (i)
and tan (A – B) = $\frac{1}{\sqrt{3}}$
A – B = 30° ________ (ii)
from equation (i) & (ii)
A = 45°, B = 15°

22. A letter is selected at random from the set of English alphabets. What is the probability that it is a vowel?

Sol. Total letters in English alphabets = 26
Vowels = 5 (a, e, i, o, u)
So probability = $\frac{5}{26}$

23. Solve for x: $\sqrt{3}x^2 + 14x - 5\sqrt{3} = 0$

Sol. $\sqrt{3}x^2 + 14x - 5\sqrt{3} = 0$
$\sqrt{3}x^2 + 15x - x - 5\sqrt{3} = 0$
$\sqrt{3}x[x + 5\sqrt{3}] - 1(x + 5\sqrt{3}) = 0$
$(x + 5\sqrt{3})(\sqrt{3}x - 1) = 0$
So $x = -5\sqrt{3}$ or $\frac{1}{\sqrt{3}}$

24. Find the mean for the following distribution:

Classes :	5 – 15	15 – 25	25 – 35	35 – 45
Frequency :	2	4	3	1

OR

The following distribution shows the transport expenditure of 100 employees:

Expenditure(in Rs.):	200 – 400	400 – 600	600 – 800	800 – 1000	1000 – 1200
Number of employees :	21	25	19	23	12

Find the mode of the distribution.

Sol.

Classes	(f) Frequency	(x) Class mark	x.f
5-15	2	10	20
15-25	4	20	80
25-35	3	30	90
35-45	1	40	40
	$\sum f = 10$		$\sum f x = 230$

$$\overline{X} = \frac{\sum fx}{\sum f} = \frac{230}{10} = 23$$

$\therefore$ Mean is 23

OR

Expenditure	No. of Employee	
200 – 400	21	← f_0
400 – 600	25	← f_1
600 – 800	19	← f_2
800 – 1000	23	
1000 – 1200	12	

Model Class in 400 – 600

$\therefore$ ℓ = 400 Class size (g) = 600 – 400 = 200

$f_1 = 25$

$f_0 = 21$

$f_2 = 19$

Mode = $\ell + + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$

$= 400 + \frac{25-21}{2(25)-21-19} \times 200$

$= 400 + \frac{4}{50-40} \times 200 = 400 + \frac{4}{10} \times 200$

= 400 + 80

= 480

$\therefore$ Mode is 480

25. Check whether 6^n can end with the digit `0' (zero) for any natural number n.

OR

Find the LCM of 150 and 200.

Sol. Any positive integer ending with the digit zero is divisible by 2 and 5 so its prime factorization must contain the prime 2 and 5.

$6^n = (2 \times 3)^n = 2^n \times 3^n$

$\Rightarrow$ The prime in the factorisation of 6^n is 2 and 3.
$\Rightarrow$ 5 does not occur in the prime factorisation of 6^n for any n.
$\Rightarrow$ 6^n does not end with the digit zero for any natural number n.

OR

$150 = 2 \times 3 \times 5^2$
$200 = 2^3 \times 5^2$
LCM $2^3 \times 3^1 \times 5^2 = 600$

26. In Figure-3, ΔABC and ΔXYZ are shown. If AB = 3 cm, BC = 6 cm, AC = $2\sqrt{3}$ cm , $\angle A = 80°$, $\angle B = 60°$, XY = $4\sqrt{3}$ cm, YZ = 12 cm and XZ = 6 cm, then find the value of $\angle Y$.

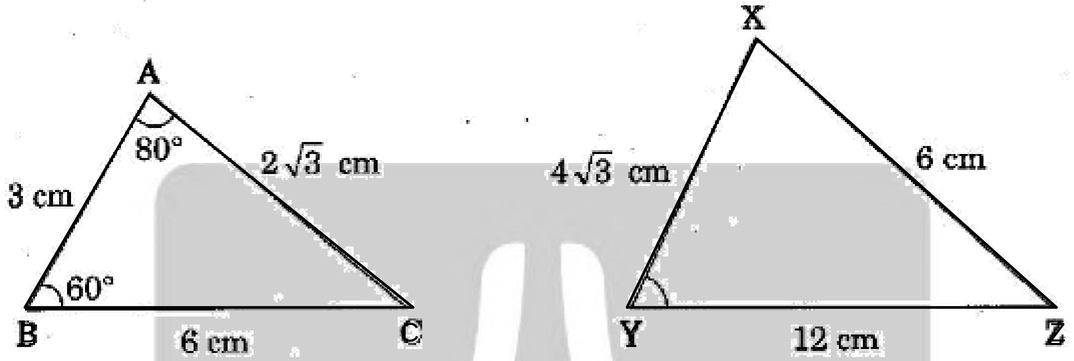


Figure-3

Sol. In Δ ABC and ΔXZY

$\frac{AB}{XZ} = \frac{3}{6} = \frac{1}{2}$

$\frac{BC}{YZ} = \frac{6}{12} = \frac{1}{2}$

$\frac{AC}{XZ} = \frac{2\sqrt{3}}{4\sqrt{3}} = \frac{1}{2}$

By sss

$\Delta ABC \sim \Delta XZY$

$\therefore \angle X = \angle A = 80^o$

$\angle Z = \angle B = 60^o$

By Angle sum property of Δ

In ΔXYZ

$\angle X + \angle Y + \angle Z = 180^o$

$80^o + \angle Y + 60^o = 180^o$

$\angle Y = 180^o - 140^o = 40^o$

SECTION-C

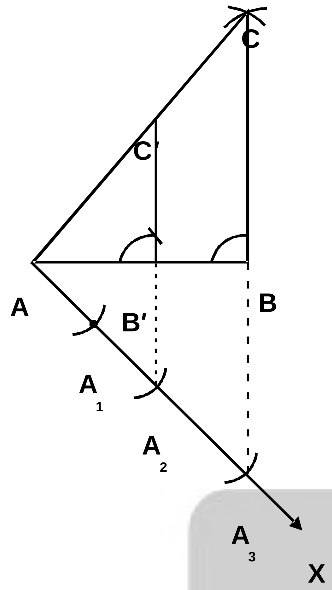
Question numbers 27 to 34 carry 3 marks each.

27. Construct a triangle with its sides 4 cm, 5 cm and 6 cm. Then construct a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

OR

Draw a circle of radius 2.5 cm. Take a point P at a distance of 8 cm from its centre. Construct a pair of tangents from the point P to the circle.

Sol.



Steps of Construction

(i) Draw a line segment AB = 5 cm.

(ii) With A as centre and radius AC = 4 cm, draw an arc.

(iii) With B as centre and BC = 6 cm, draw another arc, intersecting the arc draw in step (ii) at C.

(iv) Join AC and BC to obtain ΔABC.

(v) Below AB, make an acute angle $\angle$BAX.

(vi) Along AX, mark off three points (greater of 2 and 3 in $\frac{2}{3}$) A_1, A_2, A_3 such that $AA_1 = A_1A_2 = A_2A_3$.

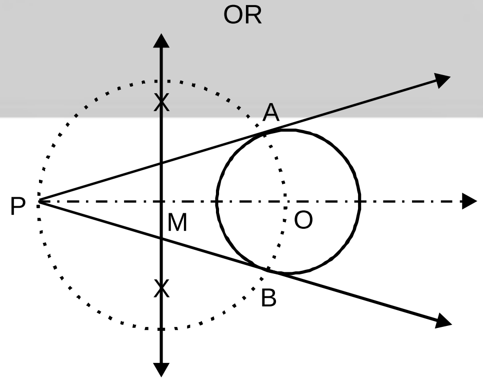
(vii) Join A_3B.

(viii) Draw $A_2B' \parallel A_3B$, meeting AB at B′.

(ix) From B′, draw B′ C′ || BC, meeting AC at C′.

AB′C′ is the required triangle, each of the whose sides is two-third of the corresponding sides of ΔABC.

OR



Steps of Construction

(i) Draw a circle of radius 2.5 cm. Let its centre be O.

(ii) Join OP = 8 cm and bisect it. Let M be mid-point of OP.

(iii) Taking M as centre and MO as radius draw a circle to intersect C in two points, say A and B.

(iv) Join PA and PB. These are the required tangents from P to C (O , r).

28. If the n^th^ terms of two A.P. = 23, 25, 27,....... and 5, 8, 11, 14 are equal. Then find the value of n.

Sol. First A.P. $\Rightarrow$ 23, 25, 27, ...

$a_1 = 23$, $d_1 = 2$

Second A.P. $\Rightarrow$ 5, 8, 11, 14, ...

$a_1 = 5$, $d_1 = 3$

$\because \quad T_{n_1} = T_{n_2}$

$a_1 + (n-1)\,d_1 = a_2 + (n-1)\,d_2$

$23 + (n-1)\,2 = 5 + (n-1)\,3$

$18 = (n-1)$

$n = 19$

29. In Figure-4, AB and CD are two diameters of a circle (with centre O) perpendicular to each other and OD is the diameter of the smaller circle. If OA = 7 cm, then find the area of the shaded region.

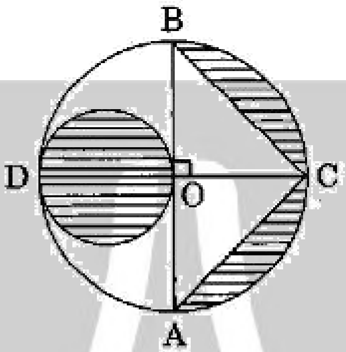


Figure-4

OR

In Figure-5, ABCD is a square with side 7 cm. A circle is drawn circumscribing the square. Find the area of the shaded region.

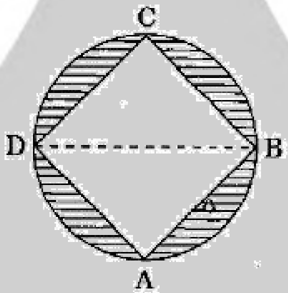
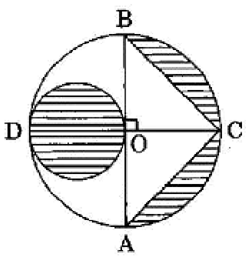


Figure-5

Sol.



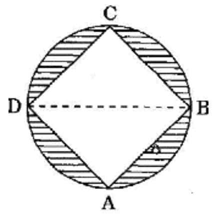
Area of Shaded region = (Area of smaller circle) + (Area of segment AC and AD)

$= \left(\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\right) + 2\left[\frac{1}{4}\left(\frac{22}{7}\times 7\times 7\right) - \left(\frac{1}{2}\times 7\times 7\right)\right]$

$= \frac{77}{2} + 2\left[\frac{77}{2} - \frac{49}{2}\right] = \frac{77}{2} + 28$

$= \frac{133}{2} = 66.5\ \text{cm}^2$

"OR"



Diameter of circle = Diagonal of square

$d = \sqrt{2} \times \text{side}$

$\Rightarrow d = 7\sqrt{2}$ cm

$\Rightarrow r = \dfrac{7}{\sqrt{2}}$ cm

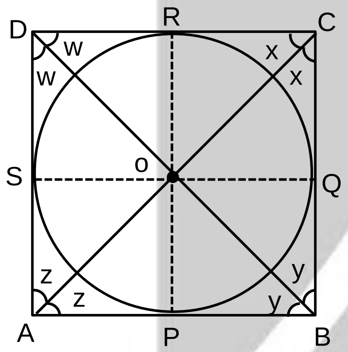
area of shaded portion = area of circle – area of square

$\Rightarrow$ area of shaded portion = $\pi r^2 - \text{side}^2$

$\Rightarrow$ area of shaded portion = $\dfrac{22}{7} \times \dfrac{7}{\sqrt{2}} \times \dfrac{7}{\sqrt{2}} - 7 \times 7 = 77 - 49 = 28$ cm^2

30. Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

Sol.



To prove $\angle AOB + \angle COD = \angle BOC + \angle AOD = 180°$

Let $\angle SDO = \angle ODR = w$

$\angle RCO = \angle QCO = x$

$\angle QBO = \angle PBO = y$

$\angle PAO = \angle OAD = z$

So, $\angle DOC = 180° - w - x$

$\angle BOC = 180° - x - y$

$\angle BOA = 180° - y - z$

$\angle AOD = 180° - w - z$

Now, $\angle AOB + \angle COD = 180° - w - x - y - z + 180°$

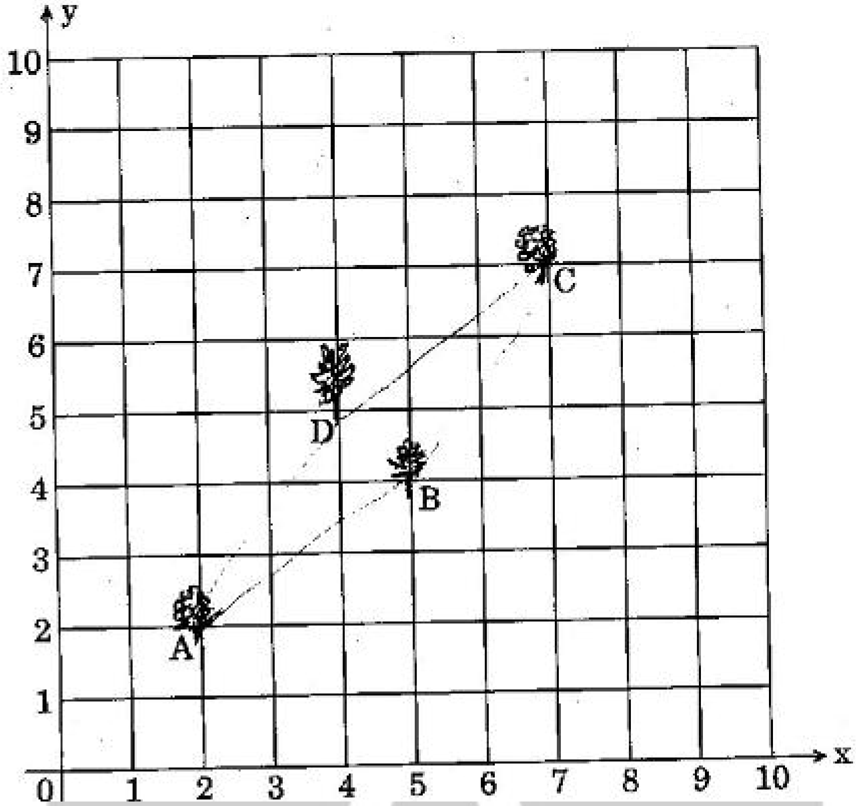
$= 360° - (x + y + z + w)$

$= 360° - \dfrac{360}{2}$ $\quad [\because 2(x + y + z + w) = 360°]$

$= 180°$

Similarly, $\angle BOC + \angle AOD = 180°$

31. Krishna has an apple orchard which has a 10 m x 10 m sized kitchen 3 garden attached to it. She divides it into a 10 x 10 grid and puts soil and manure into it. She grows a lemon plant at A, a coriander plant at B, an onion plant at C and a tomato plant at D. Her husband Ram praised her kitchen garden and points out that on joining A, B, C and D they may form a parallelogram. Look at the below figure carefully and answer the following questions :



(i) Write the coordinates of the points A, B, C and D, using the 10 x 10 grid as coordinate axes.

(ii) Find whether ABCD is a parallelogram or not.

Sol. (i) A = (2,2)

B = (5,4)

C = (7, 7)

D = (4, 5)

(ii) Now AB = $\sqrt{(5-2)^2+(4-2)^2} = \sqrt{9+4} = \sqrt{13}$

BC = $\sqrt{(7-5)^2+(7-4)^2} = \sqrt{4+9} = \sqrt{13}$

CD = $\sqrt{(4-7)^2+(5-7)^2} = \sqrt{9+4} = \sqrt{13}$

DA = $\sqrt{(2-4)^2+(2-5)^2} = \sqrt{4+9} = \sqrt{13}$

$\because$ AB = BC = CD = DA = $\sqrt{13}$

So it is a rhombus.

All rhombus are parallelogram.

So it is also a parallelogram.

32. Prove that : $\frac{\cos A}{1+\sin A}+\frac{1+\sin A}{\cos A}=2\sec A$

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

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

33. Prove that $\sqrt{3}$ is an irrational number.

Sol. Let $\sqrt{3}$ is a rational number

$\therefore \sqrt{3} = \frac{a}{b}$ [where a & b are co-primes & $b \neq 0$]

$a^2 = 3b^2$ ....(i)

$\Rightarrow$ 3 divides a^2

$\Rightarrow$ 3 also divides a

$\Rightarrow a = 3c$ [Where c is any non-zero positive integer]

$\Rightarrow a^2 = 9c^2$

From equation (i)

$3b^2 = 9c^2$

$\Rightarrow b^2 = 3c^2$ $\Rightarrow$ 3 divides b^2

$\Rightarrow$ 3 also divides b

So, 3 is a common factor of a and b.

Our assumption is wrong, because a and b are not co – primes.

It means $\sqrt{3}$ is an irrational number.

34. The difference between two numbers is 26 and the larger number exceeds thrice of the smaller number by 4. Find the numbers.

OR

Solve for x and y :

$\frac{2}{x} + \frac{3}{y}$ and $\frac{5}{x} - \frac{4}{y} = -2$

Sol. Let numbers are x & y, where x > y.

So According to question -

$x - y = 26$ ....(i)

and $x - 3y = 4$ ....(ii)

Put value of x from (i) to (ii)

$26 + y - 3y = 4$

$26 - 2y = 4$

$2y = 22$

$y = 11$

and $x = 26 + 11 = 37$

So numbers are 37 and 11

OR

$\frac{2}{x} + \frac{3}{y} = 13$

multiply the equation by 5

$\frac{10}{x} + \frac{15}{y} = 65$ ....(i)

and $\frac{5}{x} - \frac{4}{y} = -2$

multiple the equation by 2

$\frac{10}{x} - \frac{8}{y} = -4$...............(ii)

Subtract eq. (ii) from (i)

$\frac{15}{y} + \frac{8}{y} = 65 + 4$

$\frac{23}{y} = 69$

$\frac{1}{y} = 3$

$y = \frac{1}{3}$

Put the value of y is eq. (i)

$\frac{2}{x} + \frac{3}{1/3} = 13$

$\frac{2}{x} + 9 = 13$

$\frac{2}{x} = 4$

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

So $x = \frac{1}{2}$ & $y = \frac{1}{3}$

SECTION D

Question numbers 35 to 40 carry 4 marks each.

35. Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

OR

A rectangular park is to be designed whose breadth is 3 m less than its length. Its area is to be 4 square metres more than the area of a park that has already been made in the shape of an isosceles triangle with its base as the breadth of the rectangular park and of altitude 12 m. Find the length and breadth of the park.

Sol. Let the time taken by the smaller pipe to fill the tank be *x* hr.

Time taken by the larger pipe = (*x* - 10) hr

Part of tank filled by smaller pipe in 1 hour = $\frac{1}{x}$

Part of tank filled by larger pipe in 1 hour = $\frac{1}{x-10}$

It is given that the tank can be filled in $9\frac{3}{8} = \frac{75}{8}$ hours by both the pipes together.

Therefore,

$\frac{1}{x} + \frac{1}{x-10} = \frac{8}{75}$

$\frac{x-10+x}{x(x-10)} = \frac{8}{75}$

$\Rightarrow \frac{2x-10}{x(x-10)} = \frac{8}{75}$

$\Rightarrow 75(2x - 10) = 8x^2 - 80x$

$\Rightarrow 150x - 750 = 8x^2 - 80x$

$\Rightarrow 8x^2 - 230x + 750 = 0$

$\Rightarrow 8x^2 - 200x - 30x + 750 = 0$

$\Rightarrow 8x(x - 25) - 30(x - 25) = 0$

$\Rightarrow (x - 25)(8x - 30) = 0$

i.e., $x = 25, \frac{30}{8}$

Time taken by the smaller pipe cannot be $\frac{30}{8}$ = 3.75 hours. As in this case, the time taken by the larger pipe will be negative, which is logically not possible.

so x = 25 hr.

& x – 10 = 15 hr.

OR

Let the length of rectangular park be x

Breath = x – 3

$\therefore$ Base of isosceles Δ = x – 3

Altitude = 12 m

Area of rectangular park = x(x – 3)

Area of isosceles triangle = $\frac{1}{2}\times(x-3)12$

ATP $\rightarrow$ $x(x-3) = \frac{1}{2}(x-3)\times 12 + 4$

$x^2 - 3x = 6x - 18 + 4$

$x^2 - 9x + 14 = 0$

$(x-7)(x-2) = 0$

X = 7, 2

X = 7 x = 2 (not possible)

$\therefore$ Length = 7m

Breadth = 7 – 3 = 4 m

36. A cylindrical bucket, 32 cm high and with radius of base 18 cm, is filled with sand. The bucket is emptied on the ground and a conical heap of sand is formed. If the height of the conical heap is 34 cm, then find the radius and slant height of the heap.

Sol. Volume of cylinder bucket = volume of conical heap

$\pi(18)^2(32) = \frac{1}{3}\pi(r^2)(24)$

$r^2 = \frac{18\times18\times32\times3}{24}$

r = 18 × 2

r = 36cm

Now, slant height $\ell = \sqrt{h^2+r^2}$

$= \sqrt{24^2+36^2}$

$= \sqrt{576+1296}$

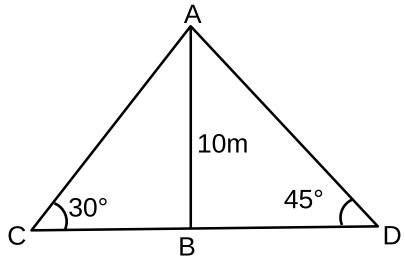
$= \sqrt{1872}$

$= 12\sqrt{13}$ cm

$\simeq$ 43.26cm

37. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45°, respectively. If the bridge is at a height of 10 m from the banks, then find the width of the river (use $\sqrt{3}$ = 1.73)

Sol.



Let AB is bridge & C & D are opposite sides of banks.

Now, in ΔABC tan 30° = $\frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{10}{BC}$

BC = $10\sqrt{3}$

in ΔABD

tan 45° = $\frac{AB}{BD}$

1 = $\frac{10}{BD}$

BD = 10

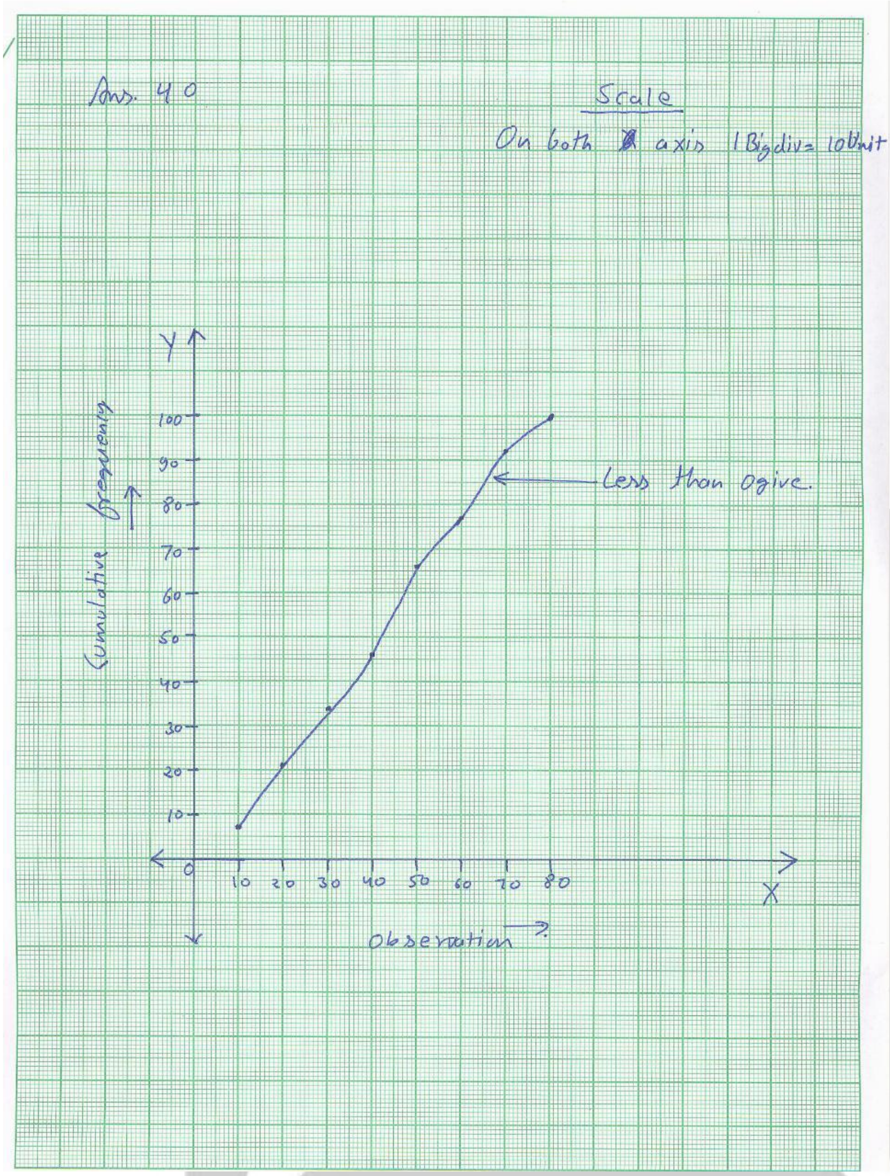
So width of river = $10\sqrt{3}$ + 1 = 10($\sqrt{3}$ + 1) ≅ 27.32m

38. Draw a `less than' ogive for the following frequency distribution:

Classes:	**0 – 10**	**10–20**	**20 – 30**	**30–40**	**40–50**	**50–60**	**60–70**	**70-80**
Frequency:	**7**	**14**	**13**	**12**	**20**	**11**	**15**	**8**

Sol.

Observation	**Cumulative Frequency**
Less than 10	7
Less than 20	21
Less than 30	34
Less than 40	46
Less than 50	66
Less than 60	77
Less than 70	92
Less than 80	100



39. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, prove that the other two sides are divided in the same ratio.

OR

In Figure-6, in an equilateral triangle ABC, AD ⊥ BC, BE ⊥ AC and CF ⊥ AB. Prove that $4(AD^2 + BE^2 + CF^2) = 9\,AB^2$

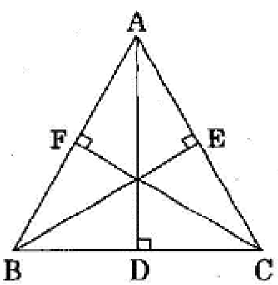
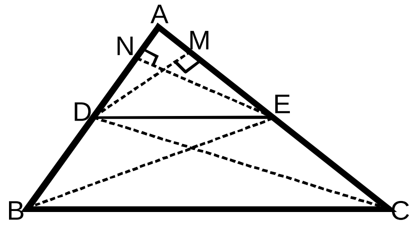


Figure-6

Sol. Given: A ΔABC in which a line parallel to side BC intersects other two sides AB and AC at D and E respectively.

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$.



Construction : Join BE and CD and draw DM ⊥ AC and EN ⊥ AB.

Proof : Area of Δ ADE $= \frac{1}{2}$ (base × height) = $\frac{1}{2}$ AD × EN.

Area of Δ ADE is denoted as ar(ADE).

So, ar(ADE) = $\frac{1}{2}$ AD × EN and ar(BDE) = $\frac{1}{2}$ DB × EN.

Therefore, $\frac{ar(ADE)}{ar(BDE)} = \frac{\frac{1}{2}AD \times EN}{\frac{1}{2}DB \times EN} = \frac{AD}{DB}$ ... (i)

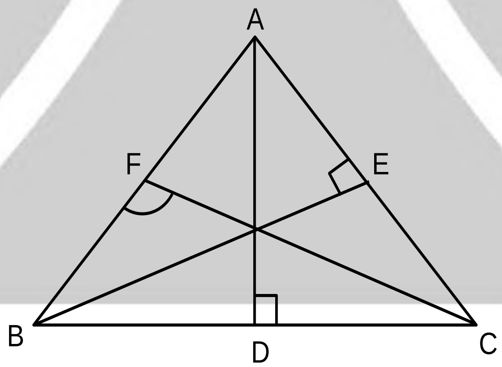
Similarly, ar(ADE) = $\frac{1}{2}$ AE × DM and ar(DEC) = $\frac{1}{2}$ EC × DM.

And $\frac{ar(ADE)}{ar(DEC)} = \frac{\frac{1}{2}AE \times DM}{\frac{1}{2}EC \times DM} = \frac{AE}{EC}$ ... (ii)

Note that Δ BDE and Δ DEC are on the same base DE and between the two parallel lines BC and DE.
So, ar(BDE) = ar(DEC) ... (iii)
Therefore, from (i), (ii) and (iii), we have :

$\mathbf{\frac{AD}{DB} = \frac{AE}{EC}}$ Hence Proved.

OR



In ΔABD
$AD^2 = AB^2 - BD^2$ ______(1)
$BE^2 = BC^2 - CE^2$ ____(2)
$CF^2 = AC^2 - AF^2$ _______(3)
Adding eq. (1), (2) and (3)
$AD + BE + CF^2 = AB^2 - BD^2 + BC^2 - CE^2 + AC^2 - AF^2$

$= AB^2 - \frac{AB^2}{4} + AB^2 - \frac{AB^2}{4} + AB^2 - \frac{AB^2}{4}$

$4(AD^2 + BE^2 + CF^2) = 9AB^2$

40. Find other zeroes of the polynomial
$p(x) = 3x^4 - 4x^3 - 10x^2 + 8x + 8$,
if two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

OR

Divide the polynomial $g(x) = x^3 - 3x^2 + x + 2$ by the polynomial $x^2 - 2x + 1$ and verify the division algorithm.

Sol. $p(x) = 3x^4 - 4x^3 - 10x^2 + 8x + 8$

Two factors are $\left(x-\sqrt{2}\right)\left(x+\sqrt{2}\right)$

$= x^2 - 2$

$$
\begin{array}{r|l}
x^2 - 2 & 3x^4 - 4x^3 - 10x^2 + 8x + 8 \;\big(\; 3x^2 - 4x - 4 \\
 & \underset{-}{3x^4} \quad\quad \underset{+}{\mp} 6x^2 \\
\hline
 & -4x^3 - 4x^2 + 8x + 8 \\
 & \underset{+}{-} 4x^3 \quad\quad \underset{-}{+} 8x \\
\hline
 & -4x^2 + 8 \\
 & -4x^2 + 8 \\
\hline
 & 0
\end{array}
$$

$\therefore$ other factor is $3x^2 - 4x - 4$

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

So other two zeros are $\frac{-2}{3}, 2$

OR

$$
\begin{array}{r|l}
x^2 - 2x + 1 & x^3 - 3x^2 + x + 2 \;\big(\; x - 1 \\
 & x^3 - 2x^2 + x \\
 & - \quad + \quad - \\
\hline
 & -x^2 + 2 \\
 & -x^2 + 2x - 1 \\
 & + \quad - \quad + \\
\hline
 & -2x + 3
\end{array}
$$

So, quoticut = $x - 1$ and remainder = $-2x + 3$

Justification :-

Dividenal = $x^3 - 3x^2 + x + 2$

and $\Rightarrow$ divisor × quotient + remainder

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

$\Rightarrow x^3 - 3x^2 + x + 2$ = Divided