B K BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS

SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

PRE BOARD - II (2024-25)

MATHEMATICS

MARKING SCHEME

B K BIRLA CENTRE FOR EDUCATION (Sarala Birla Group of Schools)

INDIAN PUBLIC SCHOOL CONFERENCE

CLASS: X

TIME: 3 hrs

Section A

1.

(d) an irrational number

Explanation:

To show $1/\sqrt{2}$ is irrational, we have

$\frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

If it is rational,

$\frac{\sqrt{2}}{2} = \frac{a}{2b}$

Assuming a and b are lowest terms

Square both sides, we get

$\frac{2}{4} = \frac{a^2}{4b^2}$

$\Rightarrow 2b^2 = a^2$

So if a^2 is a multiple of 2, so 2 must be a factor of a, so let a = 2n

$2b^2 = (2n)^2$

$\Rightarrow 2b^2 = 4n^2$

$\Rightarrow b^2 = 2n^2$

So, if b^2 is a multiple of 2, so 2 must be a factor of b also.

However, as a and b share a common factor, this is a contradiction, being in the lowest form.

So $\sqrt{2}/2$ is irrational.

2.

(c) -5, 0, 7

Explanation:

The graph intersect the x-axis at three distinct Points -5, 0, 7. So, there are three zeroes of P(x) which are -5, 0, 7.

3. **(a)** 1

Explanation:

The number of solutions of two linear equations representing intersecting lines is 1 because two linear equations representing intersecting lines has a unique solution.

4. **(a)** 1, -8

Explanation:

Given equation is $x^{\frac{2}{3}} + x^{\frac{1}{3}} - 2 = 0$

Let y = $x^{\frac{1}{3}}$

$\therefore$ The given equation becomes $y^2 + y - 2 = 0$

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

$\Rightarrow y = 1$ or $y = -2 \Rightarrow x^{\frac{1}{3}} = 1$ or $x^{\frac{1}{3}} = -2$

$\Rightarrow x = 1$ or $x = -8$

5.

(c) 100

Explanation:

Let nth term of one AP be a_n and nth term of another AP be a'_n,

then $a_{100} - a'_{100} = 100$

$\Rightarrow a + (100 - 1)d - [a' + (100 - 1)d] = 100$

$\Rightarrow a + 99d - a' - 99d = 100$

$\Rightarrow$ a - a' = 100 ... (i)

Now, to find $a_{1000} - a'_{1000}$

$\Rightarrow$ a + (1000 - 1)d - [a' + (1000 - 1)d]

$\Rightarrow$ a + 999d - a' - 999d

$\Rightarrow$ a - a' = 100 [From eq. (i)]

6.

(c) $\sqrt{34}$

Explanation:

In rectangle AOBC, AB is a diagonal.

$\therefore$ AB = $\sqrt{(5-0)^2+(0-3)^2}$

= $\sqrt{25+9}$ = $\sqrt{34}$ units

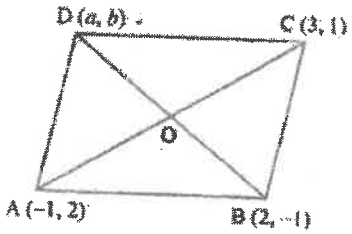
7.

(d) a = 0, b = 4

Explanation:

In parallelogram ABCD, diagonals AC and AD bisect each other at O.

O is mid-point of AC.



$\therefore$ Co-ordinates of O will be

$\left(\frac{-1+3}{2}, \frac{2+1}{2}\right)$ or $\left(\frac{2}{2}, \frac{3}{2}\right)$ or $\left(1, \frac{3}{2}\right)$

$\because$ O is mid-point of BD

$\therefore \frac{2+a}{2} = 1$ and $\frac{-1+b}{2} = \frac{3}{2} \Rightarrow 2 + a = 2$

and -1 + b = 3 $\Rightarrow$ b = 3 + 1 = 4

$\therefore$ a = 0, b = 4

8.

(b) 2

Explanation:

In $\triangle$ABC, DE || BC

$\therefore \frac{AD}{DB} = \frac{AE}{EC}$

$\Rightarrow \frac{x+3}{3x+19} = \frac{x}{3x+4}$

$\Rightarrow$ (x + 3) (3x + 4) = x (3x + 19)

$\Rightarrow 3x^2 + 4x + 9x + 12 = 3x^2 + 19x$

$\Rightarrow 3x^2 + 13x + 12 = 3x^2 + 19x$

$\Rightarrow 12 = 3x^2 + 19x - 3x^2 - 13x$

$\Rightarrow 12 = 6x \Rightarrow x = \frac{12}{6} = 2$

$\therefore$ x = 2

9.

(b) 100°

Explanation:

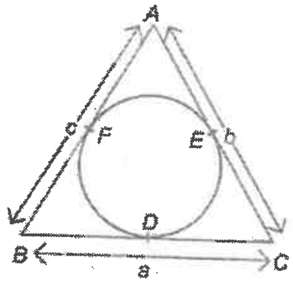
Since Op is perpendicular to PR,

then $\angle$OPR = **90°**

$\Rightarrow\angle$RPQ + $\angle$QPO = **90°**

$\Rightarrow 50° + \angle QPO = 90°$
$\Rightarrow \angle QPO = 40°$
Now, OP = OQ {Radii of same circle]
$\therefore \angle OPQ = \angle OQP = 40°$[Angles opposite to equal sides]
In triangle OPQ,
$\angle POQ + \angle OPQ + \angle OQP = 180°$
$\Rightarrow \angle POQ + 40° + 40° = 180°$
$\Rightarrow \angle POQ = 100°$

10.
(d) s - b
Explanation:



B is external point and BD and BF are tangents and from an external point the tangents drawn to a circle are equal in length.
$\therefore$ BD = BF
Similarly, AF = AE; CD = CE
s = semi-perimeter = $\frac{AB+AC+BC}{2}$
$\Rightarrow$ 2s = AB + AC + BC
$\Rightarrow$ 2s = AF + FB + AE + EC + BD + DC
$\Rightarrow$ 2s = 2AE + 2CE + 2BD
$\Rightarrow$ s = AE + CE + BD
$\Rightarrow$ s = AC + BD $\Rightarrow$ BD = s - b

11.
(b) $\frac{p^2-1}{p^2+1}$
Explanation:
Given: $\sec\theta + \tan\theta = p$
$\Rightarrow \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta} = p$
$\Rightarrow \frac{1+\sin\theta}{\cos\theta} = p$
Squaring both sides, we get
$\Rightarrow \frac{(1+\sin\theta)^2}{\cos^2\theta} = p^2$
$\Rightarrow \frac{(1+\sin\theta)^2}{1-\sin^2\theta} = p^2$
$\Rightarrow \frac{(1+\sin\theta)^2}{(1+\sin\theta)(1-\sin\theta)} = p^2$
$\Rightarrow \frac{1+\sin\theta}{1-\sin\theta} = p^2$
$\Rightarrow 1 + \sin\theta = p^2(1 - \sin\theta)$
$\Rightarrow 1 + \sin\theta = p^2 - p^2\sin\theta$
$\Rightarrow \sin\theta + p^2\sin\theta = p^2 - 1$
$\Rightarrow \sin\theta(1 + p^2) = p^2 - 1$
$\Rightarrow \sin\theta = \frac{p^2-1}{p^2+1}$

12. **(a)** 1
Explanation:

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Given,

$\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta$

$\Rightarrow \sin\theta = \cos^2\theta$

Now, $\cos^2\theta + \cos^4\theta = \sin\theta + \sin^2\theta$ $\{\because \cos^2\theta = \sin\theta\}$

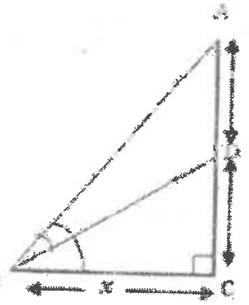
$\Rightarrow \cos^2\theta + \cos^4\theta = 1$

$\{\because \sin\theta + \sin^2\theta = 1$ (given)$\}$

13.

(b) 60°

Explanation:



Here Height of the tower = CD = $\frac{h}{2}$ meters, height of the flagstaff = AD = h meters, angle of elevation of top of the tower = $\angle$DBC = **30°** and angle of elevation of the top of the flagstaff from ground = $\angle$ABC = θ Now, in triangle DBC,

$\tan 30° = \frac{\frac{h}{2}}{x} \Rightarrow x = \frac{h\sqrt{3}}{2}$ .....(i)

Again, In triangle ABC, $\tan\theta = \frac{h+\frac{h}{2}}{x} \Rightarrow \tan\theta = \frac{3h}{2x}$

$\Rightarrow \tan\theta = \frac{3h\times 2}{2\times h\sqrt{3}}$ [From eq. (i)] $x \Rightarrow \tan\theta = \frac{3}{\sqrt{3}} \Rightarrow \tan\theta = \sqrt{3} \Rightarrow \tan\theta = \tan 60°$

$\Rightarrow \theta = 60°$

14.

(b) $\frac{10\pi}{13}$

Explanation:

$\frac{10\pi}{13}$

15. **(a)** $\sqrt{3\pi}$ cm

Explanation:

Let the length of side of square be x cm

Then area of square = x^2 cm^2

Area of sector of circle

$= \frac{\theta}{360°} \times \pi r^2$

$= \frac{90°}{360°} \times \pi r^2$ [$\because$ angle of square = θ = 90°]

$\therefore$ Shaded area = $\frac{\pi\times 4}{4} = \pi$

According to question, Area of square = 3 × shaded area

$\Rightarrow 3\pi = x^2$ $\therefore$ x = $\sqrt{3\pi}$ cm

16.

(d) $\frac{3}{4}$

Explanation:

The possible outcomes when two coins are tossed together are {HH, TT, HT, TH}.

the number of possible outcomes when two coins are tossed is 4 .

Now, the possible outcomes of getting at least one tail are {TT,HT, TH}}, which means the number of favourable outcome is 3

$P = \frac{3}{4}$

Hence, the probability of getting at least one tail is $\frac{3}{4}$.

17.

(b) $\frac{12}{25}$

Explanation:

Total number of tickets = 25.

Multiples of 3 or 5 are 3, 6,9,12,15,18,21, 24, 5,10,20, 25.

Number of these numbers = 12.

P (getting a multiple of 3 or 5) = $\frac{12}{25}$

18.

(d) 424.5

Explanation:

Modal class = class with highest frequency

Modal class = (425 - 449)

But the class interval are not continued. So we subtract 0.5 from lower limit and add 0.5 in upper limit.

So the modal class will be (424.5 - 449.5)

Lower limit = 424.5

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

Explanation:

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

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

Explanation:

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

Section B

21. We know that,

$LCM \times HCF = a \times b$

$\Rightarrow 1449 \times 23 = 161 \times b$

$\Rightarrow b = \frac{1449 \times 23}{161} = 207$

22. Given: In $\triangle$ ABC, O is any Point within it. PQ || AB and PR || AC.

To prove: QR || BC

Proof: In $\triangle$ OAB, we have

∵ PQ || AB ....[Given]

Hence by Thale' Theorem(or BPT), we have

$\frac{OP}{PA} = \frac{OQ}{QB}$ ....(i)

In $\triangle$OAC,

PR || AC, ...[given]

Hence by Thales' Theorem (or BPT), we have

$\frac{OP}{PA} = \frac{OR}{RC}$ ....(ii)

From (i) and (ii), we have $\frac{OQ}{QB} = \frac{OR}{RC}$

∴ By converse of BPT QR||BC Hence proved

23. We know that the lengths of tangents drawn from an external point to a circle are equal.

AQ = AR, ...(i) [tangents from A]

BP = BQ ...(ii) [tangents from B]

CP = CR ... (iii) [tangents from C]

Perimeter of $\triangle ABC$

= AB + BC + AC

= AB + BP + CP + AC

= AB + BQ + CR + AC [using (ii) and (iii)]

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= AQ + AR

= 2AQ [using (i)

$\therefore \quad AQ = \frac{1}{2}$(perimeter of $\triangle ABC$)

24. LHS = $\frac{\tan\theta}{(\sec\theta-1)} + \frac{\tan\theta}{(\sec\theta+1)}$

$= \frac{\frac{\sin\theta}{\cos\theta}}{\left(\frac{1}{\cos\theta}-1\right)} + \frac{\frac{\sin\theta}{\cos\theta}}{\left(\frac{1}{\cos\theta}+1\right)}$

$= \frac{\frac{\sin\theta}{\cos\theta}}{\left(\frac{1-\cos\theta}{\cos\theta}\right)} + \frac{\frac{\sin\theta}{\cos\theta}}{\left(\frac{1+\cos\theta}{\cos\theta}\right)}$

$= \frac{\sin\theta}{1-\cos\theta} + \frac{\sin\theta}{1+\cos\theta}$

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

$= \frac{\sin\theta+\sin\theta\cos\theta+\sin\theta-\sin\theta\cos ec\theta}{\sin^2\theta}$

$= \frac{2\sin\theta}{\sin^2\theta} = \frac{2}{\sin\theta} = 2cosec\theta$ = RHS

Hence Proved.

OR

LHS = (a sin θ + b cos $\theta)^2$ + (a cos θ - b sin $\theta)^2$

= a^2 ($\sin^2\theta + \cos^2\theta$) + b^2 ($\cos^2\theta + \sin^2\theta)^2$

= $a^2 + b^2$ = RHS.

25. We know that area of the sector of the circle of radius $r = \frac{\theta}{360} \times \pi r^2$

Length of the arc $= \frac{\theta}{360} \times 2\pi r$

But we have given that length of the arc = l

So, $l = \frac{\theta}{360} \times 2\pi r$ ...... (1)

Area of the sector $= \frac{\theta}{360} \times \pi r^2$ ....(2)

Now we will adjust 2 in the following way,

Area of the sector $= \frac{\theta}{360} \times \frac{2\pi r^2}{2}$

Area of the sector $= \frac{\theta}{360} \times 2\pi r \times \frac{r}{2}$

From equation (1) we will substitute $\frac{\theta}{360} \times 2\pi r = l$

Area of the sector $= l \times \frac{r}{2}$

Area of the sector $= \frac{1}{2}lr$

Therefore, area of the sector $= \frac{1}{2}lr$

OR

Area of minor sector = $\frac{3.14\times(6)^2\times60^\circ}{360^\circ}$

= 18.84

Hence, area of minor sector is 18.84 cm^2

Area of major sector = Area of circle - Area of minor sector

= 3.14 × $(6)^2$ - 18.84

= 94.2

Hence, area of major sector is 94.2 cm^2

Section C

26. LCM (84, 90, 120)

84 = $2^2 \times 3 \times 7$

90 = $2 \times 3^2 \times 5$

120= $2^3 \times 3 \times 5$

LCM = 2520 min or 42 hours

After 42 h all the bells will ring at same time.

27. $7y^2 - \frac{11}{3}y - \frac{2}{3}$

$= \frac{1}{3}(21y^2 - 11y - 2)$

$= \frac{1}{3}(21y^2 - 14y + 3y - 2)$

$= \frac{1}{3}[7y(3y - 2) + 1(3y - 2)]$

$= \frac{1}{3}(3y - 2)(7y + 1)$

$\Rightarrow y = \frac{2}{3}, \frac{-1}{7}$ are zeroes of the polynomial.

If Given polynimoal is $7y^2 - \frac{11}{3}y - \frac{2}{3}$

Then $a = 7$, $b = -\frac{11}{3}$ and $c = -\frac{2}{3}$

Sum of zeroes $= \frac{2}{3} + \frac{-1}{7} = \frac{14-3}{21} = \frac{11}{21}$ .... (i)

Also, $\frac{-b}{a} = \frac{-\left(\frac{-11}{3}\right)}{7} = \frac{11}{21}$ .... (ii)

From (i) and (ii)

Sum of zeroes $= \frac{-b}{a}$

Now, product of zeroes $= \frac{2}{3} \times \frac{-1}{7} = \frac{-2}{21}$ .... (iii)

Also, $\frac{c}{a} = \frac{\frac{-2}{3}}{7} = \frac{-2}{21}$ .... (iv)

From (iii) and (iv)

Product of zeroes $= \frac{c}{a}$

28. Let the length of a rectangle be x meters and breadth be y meters.

Then, area = xy sq. m

Now,

$xy - (x-5)(y+3) = 8$

$\Rightarrow xy - [xy - 5y + 3x - 15] = 8$

$\Rightarrow xy - xy + 5y - 3x + 15 = 8$

$\Rightarrow 3x - 5y = 7$ ....(i)

And

$(x+3)(y+2) - xy = 74$

$\Rightarrow xy + 3y + 2x + 6 - xy = 74$

$\Rightarrow 2x + 3y = 68$ ....(ii)

Multiplying (i) by 3 and (ii) by 5, we get

$9x - 15y = 21$ ....(iii)

$10x + 15y = 340$ ....(iv)

Adding (iii) and (iv), we get

$19x = 361 \Rightarrow x = \frac{361}{19} = 19$

Putting x = 19 in (iii), we get

$9 \times 19 - 15y = 21$

$\Rightarrow 171 - 15y = 21$

$\Rightarrow y = \frac{150}{15} = 10$

$\therefore$ x = 19 meters and y = 10 meters

Hence, length = 19 m and breadth = 10 m

OR

The given equations are

$6x + 5y = 7x + 3y + 1 = 2(x + 6y - 1)$

Therefore,we have

$6x + 5y = 2(x + 6y - 1)$

$6x + 5y = 2x + 12y - 2$

$6x - 2x + 5y - 12y = -2$

$4x - 7y = -2$ ......(i)

Also,

$7x + 3y + 1 = 2(x + 6y - 1)$

$7x + 3y + 1 = 2x + 12y - 2$

$7x - 2x + 3y - 12y = -2 - 1$

$5x - 9y = -3$ ....(ii)

Multiplying (i) by 9 and (ii) by 7, we get

$36x - 63y = -18$ ......(iii)

$35x - 63y = -21$ .....(iv)

Subtracting (iii) and (iv),we get

$x = 3$

Substituting x = 3 in (i),we get

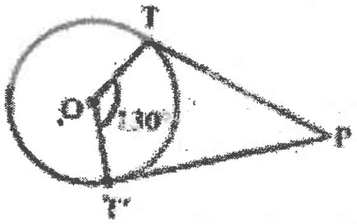
$\Rightarrow 4 \times 3 - 7y = -2$

$\Rightarrow -7y = -2 - 12$

$\Rightarrow -7y = -14$

$\Rightarrow y = 2$

$\therefore$ Solution is x = 3, y = 2

29. 

In $\triangle OTP$ and $\triangle OT'P$,

OT = OT' (radii of the circle)

OP = OP (common)

TP = T'P (tangent from external point are equal)

$\therefore \triangle OTP \cong \triangle OT'P$ (By SSS congruence)

Hence, $\angle OPT = \angle OPT'$ (By CPCT) ..... (i)

Now, $\angle OTP = \angle OT'P = 90^\circ$ (radii is perpendicular to the tangent)

So, $\angle OTP + \angle OT'P + \angle TOT' + \angle TPT' = 360^\circ$

$90^\circ + 90^\circ + 130^\circ + \angle TPT' = 360^\circ$

$\angle TPT' = 360 - 310$

$\angle TPT' = 50^\circ$

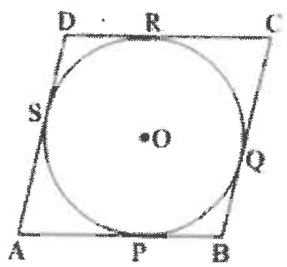
$\therefore \angle OPT = \frac{1}{2}\angle TPT'$ [(from (i)]

$\angle OPT = 25^\circ$.

OR

According to Theorem 10.2: The lengths of tangents drawn from an external point to a circle are equal.

Therefore,



BP = BQ (Tangents from point B)...... (1)

CR = CQ (Tangents from point C)...... (2)

DR = DS (Tangents from point D)...... (3)

AP = AS (Tangents from point A)...... (4)

Adding (1) + (2) + (3) + (4)

BP + CR + DR + AP = BQ + CQ + DS + AS

On re-grouping,

BP + AP + CR + DR = BQ + CQ + DS + AS

AB + CD = BC + AD

Substitute CD = AB and AD = BC since ABCD is a parallelogram, then

AB + AB = BC + BC

2AB = 2BC

AB = BC

$\therefore$ AB = BC = CD = DA

This implies that all the four sides are equal.

We know that, $\sec^2\theta - \tan^2\theta = 1$.......(2)
Now, $\sec\theta + \tan\theta = l$ [from (1)]
$\Rightarrow (\sec\theta + \tan\theta)\,\frac{(\sec\theta - \tan\theta)}{\sec\theta - \tan\theta} = 1$
$\Rightarrow \frac{\sec^2\theta - \tan^2\theta}{\sec\theta - \tan\theta} = l$
$\Rightarrow \frac{1}{\sec\theta - \tan\theta} = l$ [from equation (2)]
or, $\sec\theta - \tan\theta = \frac{1}{l}$ ....(3)
Now, to get $\sec\theta$, eliminating $\tan\theta$ from (1) and (3)
adding (1) and (3) we get :-
$\Rightarrow 2\sec\theta = l + \frac{1}{l}$
$\Rightarrow 2\sec\theta = \frac{l^2+1}{l}$
$\Rightarrow \sec\theta = \frac{l^2+1}{2l}$
Hence, proved.

31.

Marks obtained	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
No. of students	6	10	12	32	2

Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$
l = lower limit of modal class
f_1 = frequency of modal class
f_2 = frequency of next modal class
f_o = frequency of previous modal class
The modal class (mode class) is the class with the highest frequency, thus here modal class = 30 - 40
Mode $= 30 + \left(\frac{32-12}{2\times32-12-2}\right) \times 10$
Mode $= 30 + \left(\frac{20}{50}\right) \times 10$
Mode = 30 + 4
$\therefore$ Mode = 34

Section D

32. Here roots are equal,
$\therefore D = B^2 - 4AC = 0$
Here, $A = 1 + m^2, B = 2mc, C = (c^2 - a^2)$
$\therefore (2mc)^2 - 4(1+m^2)(c^2 - a^2) = 0$
or, $4m^2c^2 - 4(1+m^2)(c^2 - a^2) = 0$
or, $m^2c^2 - (c^2 - a^2 + m^2c^2 - m^2n^2) = 0$
or, $m^2c^2 - c^2 + a^2 - m^2c^2 + m^2a^2 = 0$
or, $-c^2 + a^2 + m^2a^2 = 0$
or, $c^2 = a^2(1+m^2)$
Hence Proved.

OR

Let the present age of father be x years.
Son's present age = (45 - x) years.
Five years ago:
Father's age = (x - 5) years
Son's age = (45 - x - 5) years = (40 - x) years.
According to question,
$\therefore (x - 5)(40 - x) = 124$
$\Rightarrow 40x - x^2 - 200 + 5x = 124$
$\Rightarrow x^2 - 45x + 324 = 0$
Spilting the middle term,
$\Rightarrow x^2 - 36x - 9x + 324 = 0$
$\Rightarrow x(x - 36) - 9(x - 36) = 0$

$\Rightarrow (x - 9)(x - 36) = 0$

$\Rightarrow x = 9$, or 36

We can't take father age as 9 years

So, x = 36, we have

Father's present age = 36 years

Son's present age = 9 years

Hence, Father's present age = 36 years and Son's present age = 9 years.

33.

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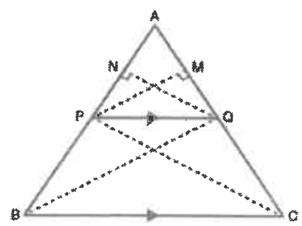
Proof

Now the area of ΔAPQ = 1/2 × AP × QN (Since, area of a triangle= 1/2× Base × Height)



Similarly, area of ΔPBQ= 1/2 × PB × QN

area of ΔAPQ = 1/2 × AQ × PM

Also,area of ΔQCP = 1/2 × QC × PM .... (1)

Now, if we find the ratio of the area of triangles ΔAPQand ΔPBQ, we have

$$\frac{Area\ of\ \Delta APQ}{Area\ of\ \Delta PBQ} = \frac{\frac{1}{2}\times AP\times QN}{\frac{1}{2}\times PB\times QN} = \frac{AP}{PB}$$

Similarly,

$$\frac{Area\ of\ \Delta APQ}{Area\ of\ \Delta QCP} = \frac{\frac{1}{2}\times AQ\times PM}{\frac{1}{2}\times QC\times PM} = \frac{AQ}{QC}\cdots(2)$$

According to the property of triangles, the triangles drawn between the same parallel lines and on the same base have equal areas.

Therefore, we can say that ΔPBQ and QCP have the same area.

area of ΔPBQ = area of ΔQCP ....(3)

Therefore, from the equations (1), (2) and (3) we can say that,

AP/PB = AQ/QC

34. Radius = 7 cm

Height of cylindrical portion = 13 - 7 = 6 cm

Inner surface area of the vessel = $2\pi r^2 + 2\pi rh$

$= 2 \times \frac{22}{7} \times 7 \times 7 + 2 \times \frac{22}{7} \times 7 \times 6$

$= 572\ cm^2$

Volume of the vessel = $\frac{2}{3}\pi r^3 + \pi r^2 h$

$= \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 + \frac{22}{7} \times 7 \times 7 \times 6$

$= \frac{4928}{3}$ or 1642.67 cm^3 approx.

Therefore, inner surface area and volume of the vessel is 572 cm^2 and 1642.67 cm^3 respectively.

OR

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Given,
Radius of cone = Radius of hemisphere = r = 5 cm
Height of cone (h) = 10 cm
No. of cones = 7
Volume of ice cream in one cone = Volume of cone + Volume of hemisphere
$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$
$= \frac{\pi}{3} r^2 (h + 2r)$
$= \frac{22}{7} \times \frac{1}{3} \times 5 \times 5(10 + 2 \times 7)$
$= \frac{22}{7} \times \frac{1}{3} \times 5 \times 5(10 + 10)$
$= \frac{22 \times 25 \times 20}{21}$
$= 523.8 \text{ cm}^3$
Volume of ice cream in 7 cones
$= 523.8 \times 7 \text{ cm}^3$
$= 3666.63 \text{ cm}^3$
= 3.67 litre

35. Since the mode of the given series is 36 and maximum frequency 16 lies in the class 30-40, so the modal class is 30 - 40.
Let the missing frequency be x.
$x_k = 30, h = 10, f_k = 16, f_{k-1} = x, f_{k+1} = 12$
Mode, M $= x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\}$
$36 = 30 + \left\{ 10 \times \frac{(16-x)}{(32-x-12)} \right\}$
$\Rightarrow \frac{10 \times (16-x)}{(20-x)} = 6$
$\Rightarrow 160 - 10x = 120 - 6x$
$\Rightarrow 4x = 40$
$\Rightarrow x = 10$

Section E

36. i. Let 1^{st} year production of TV = x
Production in 6^{th} year = 16000
$t_6 = 16000$
$t_9 = 22{,}600$
$t_6 = a + 5d$
$t_9 = a + 8d$
16000 = x + 5d ...(I)
22600 = x + 8d ...(II)
- - -
-6600 = -3d
d = 2200
Putting d = 2200 in equation ...(i)
16000 = x + 5 × (2200)
16000 = x + 11000
x = 16000 - 11000
x = 5000
∴ Production during 1^{st} year = 5000
ii. Production during 8th year is (a + 7d) = 5000 + 7(2200) = 20400
iii. Production during first 3 year = Production in (1^{st} + 2^{nd} + 3^{rd}) year
Production in 1^{st} year = 5000
Production in 2^{nd} year = 5000 + 2200
= 7200

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Production in 3rd year = 7200 + 2200

= 9400

∴ Production in first 3 year = 5000 + 7200 + 9400

= 21,600

OR

Let in n^{th} year production was = 29,200

$t_n = a + (n - 1)d$

29,200 = 5000 + (n - 1) 2200

29,200 = 5000 + 2200n - 2200

29200 - 2800 = 2200n

26,400 = 2200n

$\therefore n = \frac{26400}{2200}$

n = 12

i.e., in 12^{th} year, the production is 29,200

37. i. Mid point of FG is $\left(\frac{-3+1}{2}, \frac{0+4}{2}\right)$ = (-1, 2)

ii. a. $AC = \sqrt{(-1-3)^2 + (-2-4)^2}$

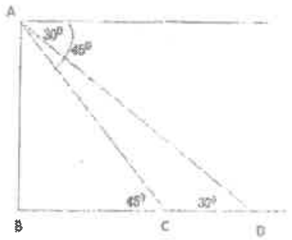
$= \sqrt{52}$ or $2\sqrt{13}$

OR

b. The coordinates of required point are $\left(\frac{1\times3+3\times3}{1+3}, \frac{1\times2+3\times4}{1+3}\right)$ i.e. $\left(3, \frac{7}{2}\right)$

iii. D(-2, -5)

38. i.



The distance of ship from the base of the light house after 6 seconds from the initial position when angle of depression is 45°.

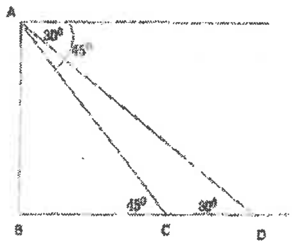
In $\triangle ABC$

$\tan 45^\circ = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{40}{BC}$

$\Rightarrow BC = 40$ m

ii.



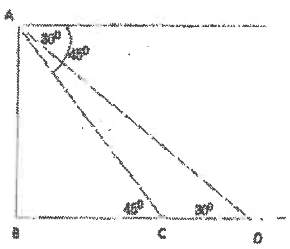
The distance between two positions of ship after 6 seconds

CD = BD - BC

$\Rightarrow CD = 40\sqrt{3} - 40 = 40(\sqrt{3} - 1)$

$\Rightarrow CD = 29.28$ m

iii.



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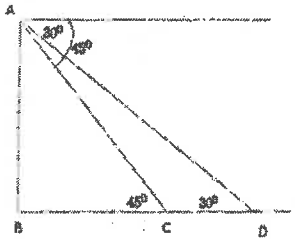
Speed of ship = $\frac{Distance}{Time} = \frac{29.28}{6}$ = 4.88 m/sec

OR



The distance of ship from the base of the light house when angle of depression is 30°.

In $\triangle ABD$

$\tan 30^\circ = \frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{BD}$

$\Rightarrow BD = 40\sqrt{3}$ m