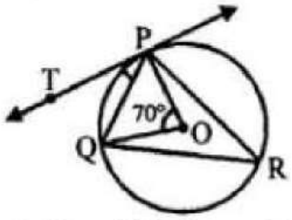
SOLUTIONS
MATHEMATICS

1. (4)

O is the centre of circle, PQ is a chord, PT is tangent.



$\angle POQ = 70°$, then $\angle TPQ = ?$

Take a point R on the major segment and join PR and QR

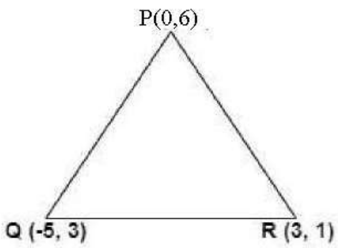
arc PQ subtends $\angle POQ$ at the centre and $\angle PRQ$ at the remaining part of the circle

$\angle PRQ = \frac{1}{2}\angle POQ = \frac{1}{2} \times 70° = 35°$

But $\angle TPQ = \angle PRQ$ (Angles in the alternate segment)

$\angle TPQ = 35°$

2. (4)



$PQ = \sqrt{(-5)^2 + (-3)^2} = \sqrt{25+9} = \sqrt{34}$

$QR = \sqrt{8^2 + 2^2} = \sqrt{64+4} = \sqrt{68}$

$PR = \sqrt{3^2 + 5^2} = \sqrt{9+25} = \sqrt{34}$

PQ = PR

$QR^2 = PQ^2 + PR^2$

$(\sqrt{68})^2 = (\sqrt{34})^2 + (\sqrt{34})^2$

68 = 68

$\triangle PQR$ is a Isosceles right angle triangle

3. (3)

The distance between $(at^2, 2at)$ and $\left(\frac{a}{t^2}, \frac{-2a}{t}\right)$

$$= \sqrt{\left(\frac{a}{t^2} - at^2\right)^2 + \left(\frac{-2a}{t} - 2at\right)^2} \quad = a\sqrt{\frac{1}{t^4} + t^4 - 2 + \frac{4}{t^2} + 4t^2 + 8}$$

$$= a\sqrt{\frac{1}{t^4} + t^4 + \frac{4}{t^2} + 4t^2 + 6} \qquad = a\sqrt{\frac{1}{t^4} + t^4 + 4 + 2 + \frac{4}{t^2} + 4t^2}$$

$$= a\sqrt{\left(t^2 + \frac{1}{t^2} + 2\right)^2} = a\left(t^2 + \frac{1}{t^2} + 2\right) \quad = a\left(t + \frac{1}{t}\right)^2 \text{ units}$$

4. **(4)**

$P = \frac{7}{10}$

5. **(2)**

The point lies on x-axis
Its ordinate is zero
Let this point divides the line segment joining the points (3, 6) and (12, -3) in the ratio m : n

$$\therefore 0 = \frac{my_2 + ny_1}{m+n} \Rightarrow 0 = \frac{m(-3) + n \times 6}{m+n}$$

$$\Rightarrow -3m + 6n = 0 \Rightarrow 6n = 3m$$

$$\Rightarrow \frac{m}{n} = \frac{6}{3} = \frac{2}{1}$$

$\therefore$ Ratio = 2 : 1

6. **(4)**

Number of all possible outcomes = 6.
Even numbers are 2,4, 6. Their number is 3.

$\therefore$ P (getting an even number) = $\frac{3}{6} = \frac{1}{2}$

7. **(1)**

Explanation: Let the radii of the base of the cylinder and cone be 3r and 4r and their heights be 2h and 3h, respectively.

Then, ratio of their volumes = $\dfrac{\pi(3r)^2 \times (2h)}{\frac{1}{3}\pi(4r)^2 \times (3h)}$

$$= \frac{9r^2 \times 2 \times 3}{16r^2 \times 3} = \frac{9}{8} = 9 : 8$$

8. **(3)**

Explanation: If the system has a unique solution, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Here $a_1 = 6, a_2 = k, b_1 = -2$
and $b_2 = -1$

$\therefore \frac{6}{k} \neq \frac{-2}{-1} \Rightarrow 3k \neq 6 \Rightarrow k \neq 3$

$2k \neq 6$
$k \neq 3$

9. **(3)**

Sum of roots $= \frac{-2}{k}$ and products of roots $= \frac{3k}{k} = 3$

$\therefore \quad \frac{-2}{k} = 3 \Rightarrow k = \frac{-2}{3}.$

10. **(1)**

Explanation: Here, $ax^2 + ax + 2 = 0$….. (1)
$x^2 + x + b = 0$….. (2)
Putting the value of x = 1 in equation (2) we get
$1^2 + 1 + b = 0$
$2 + b = 0$
$b = -2$
Now, putting the value of x = 1 in equation (1) we get
$a + a + 2 = 0$
$2a + 2 = 0$
$a = \frac{-2}{2}$
$= -1$
Then, $ab = (-1) \times (-2) = 2$

11. **(1)**

$P = \frac{5\,(\text{Balls other than red and black})}{15\,(\text{Total no of balls})} = \frac{1}{3}$

12. **(2)**

Explanation: Let the two numbers be x and y.
It is given that:
x = 54
HCF = 27
LCM = 162
We know,
$x \times y = HCF \times LCM$
$\Rightarrow 54 \times y = 27 \times 162 \Rightarrow \quad 54y = 4374$
$\Rightarrow \quad \therefore y = \frac{4374}{54} = 81$

13. (1)

Explanation: Since, the point, where the perpendicular bisector of a line segment joining the points A(2, 5) and B(4, 7) cuts, is the mid-point of that line segment.

$\therefore$ Coordinates of Mid-point of line segment AB = $\left(\frac{2+4}{2}, \frac{5+7}{2}\right) = (3, 6)$

14. (2)

Explanation: $(\cos 0^{\circ} + \sin 30^{\circ} + \sin 45^{\circ})(\sin 90^{\circ} + \cos 60^{\circ} - \cos 45^{\circ}) = ?$

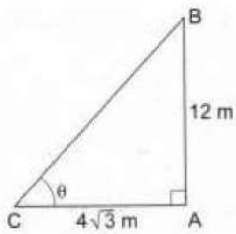
$$= \left(1 + \frac{1}{2} + \frac{1}{\sqrt{2}}\right)\left(1 + \frac{1}{2} - \frac{1}{\sqrt{2}}\right) = \left(\frac{3}{2} + \frac{1}{\sqrt{2}}\right)\left(\frac{3}{2} - \frac{1}{\sqrt{2}}\right) = \left(\frac{9}{4} - \frac{1}{2}\right) = \frac{7}{4}$$

15. (4)

Explanation: In case of a moderately skewed distribution, the difference between mean and mode is almost equal to three times the
difference between the mean and median. Thus, the empirical mean median mode relation is given as:
Mean – Mode = 3 (Mean – Median)
i.e, Mode = 3 Median - 2 Mean

16. (4)

Explanation:
Let AB be the pole and AC be its shadow.
AB = 12 m and AC = $4\sqrt{3}$ m.



Let $\angle ACB = \theta$. Then, $\tan\theta = \frac{AB}{AC} = \frac{12}{4\sqrt{3}}$

$\Rightarrow \tan\theta = \frac{12}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \sqrt{3} = \tan 60^{\circ} \Rightarrow \theta = 60^{\circ}$

17. (2)

Explanation: Here, a unique solution of each variable of a pair of linear equations is given, therefore, it has one solution to a system of linear equations.

18. (2)

Let rational number + irrational number = rational number
And we know " rational number can be expressed in the form of PQ, where p, q are any integers,
So, we can express our assumption As : PQ + x = ab (Here x is a irrational number) x - ab - PQ So,
x is a rational number, but that contradicts our starting assumption. Hence rational number + irrational number = irrational number.

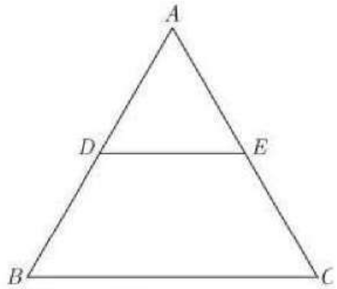
19. (3)

Explanation: Here, reason is not true.
$\sqrt{9} = \pm 3$, which is not an irrational number.
A is true but R is false.

20. (1)

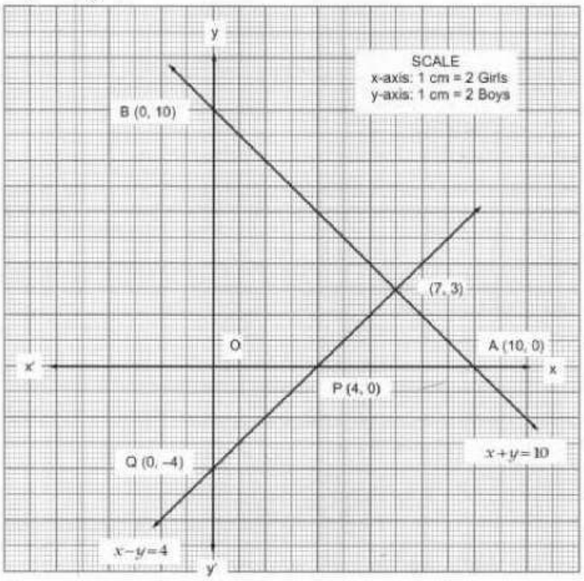
Explanation: Reason is true: [This is Thale's Theorem]
For Assertion
Since, DE || BC by Thale's Theorem

$$\frac{AD}{DB} = \frac{AE}{EC}$$
$$\frac{DB}{AD} = \frac{EC}{AE}$$
$$1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$$
$$\frac{AD+DB}{AD} = \frac{AE+EC}{AE}$$
$$\frac{AB}{AD} = \frac{AC}{AE}$$



Assertion is true.
Since, reason gives Assertion.

21. Formulation: Let the number of girls be x and the number of boys be y.
It is given that total ten students took part in the quiz.
∴ Number of girls + Number of boys = 10
i.e. x + y = 10
It is also given that the number of girls is 4 more than the number of boys.
∴ Number of girls = Number of boys + 4
i.e. x = y + 4
or, x - y = 4



22. Total No of students = 40
Students who have 100% attendance = 13
Students who do social work = 15
Students participate in Adult Education = 5
So the remaining no. students who participate in educational cultural program = 40 - (13 + 15 + 5) = 7
Let K be the events of selecting the student who participates in an educational cultural program.
Then outcomes favoring K = 7

$$P(K) = \frac{\text{No. of favorable outcomes}}{\text{Total No of outcomes}} = \frac{7}{40}$$

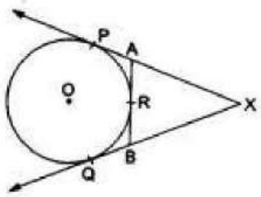
23. Comparing polynomial $x^2 - 2x - 8$ with general form of quadratic polynomial $ax^2 + bx + c$,
We get a = 1, b = -2 and c = -8
We have, $x^2 - 2x - 8$
$= x^2 - 4x + 2x - 8$
$= x(x - 4) + 2(x - 4)$
$= (x - 4)(x + 2)$
Now, for zeroes of polynomial, we have;
$(x - 4)(x + 2) = 0$
$x - 4 = 0$ or $x + 2 = 0$
$x = 4$ or $x = -2$
$\Rightarrow x = 4, -2$ are two zeroes.
a = 1, b = -2 and c = -8
Sum of zeroes = $4 + (-2) = 2$

$$\text{Sum of zeroes} = \frac{-(-2)}{1} = \frac{-b}{a} = \frac{-\text{ Coefficient of } x}{\text{Coefficient of } x^2}$$

Product of zeroes = $4 \times (-2) = -8$

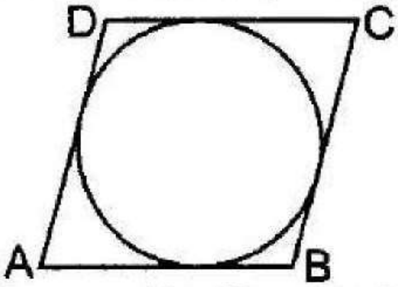
$$\text{Product of zeroes} = \frac{-8}{1} = \frac{c}{a} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$$

24.



We know that the lengths of tangents drawn from an exterior point to a circle are equal.
XP = XQ, ...(i) [tangents from X]
AP = AR, ... (ii) [tangents from A]
BR = BQ. ... (in) [tangents from B]
Now, XP = XQ $\Rightarrow$ XA + AP = XB + BQ
XA + AR = XB + BR [using (ii) and (iii)]

Let ABCD be the quadrilateral circumscribing the circle with centre O. The quadrilateral touches the circle at points P, Q, R, S.



To prove: $AB + CD = AD + BC$

proof: lengths of tangents drawn from an external point are equal

Hence, $AP = AS$ ...(i)

$BP = BQ$ ...(ii)

$CR = CQ$...(iii)

$DR = DS$...(iv)

Adding (i) + (ii) + (iii) + (iv), we get

$AB + BP + CR + DR = AS + BQ + CQ + DSAB + CD = AD + BC$

Hence proved

25. At mid-point of AB $= \left(\dfrac{\frac{x}{2}+x+1}{2}\right) = 5$

or, x = 6

$$\left(\dfrac{\frac{y+1}{2}+y-3}{2}\right) = -2$$

or, y + 1 + 2y - 6 = -8

y = -1

OR

Using distance formula, we obtain

$$AB = \sqrt{\left(at_2^2 - at_1^2\right)^2 + \left(2at_2 - 2at_1\right)^2}$$

$$\Rightarrow AB = \sqrt{a^2\left(t_2 - t_1\right)^2\left(t_2 + t_1\right)^2 + 4a^2\left(t_2 - t_1\right)^2}$$

$$\Rightarrow AB = a\left(t_2 - t_1\right)\sqrt{\left(t_2 + t_1\right)^2 + 4}$$

26. Let the fraction be $\frac{x}{y}$

Then, according to the question,

$\frac{x+1}{y-1} = 1$......(1)

$\frac{x}{y+1} = \frac{1}{2}$.........(2)

$\Rightarrow$ x + 1 = y - 1 ....(3)

2x = y + 1................(4)

$\Rightarrow$ x - y = - 2................(5)

2x - y = 1......................(^)

Substituting equation (5) from equation (6), we get x =3

Substituting this value of x in equation (5), we get

3 - y = -2

$\Rightarrow$ y = 3 + 2

$\Rightarrow$ y = 5

Hence, the required fraction is $\frac{3}{5}$

Verification: Substituting the value of x = 3 and y = 5,

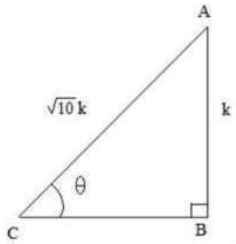
we find that both the equations(1) and (2) are satisfied as shown below:

$\frac{x+1}{y-1} = \frac{3+1}{5-1} = \frac{4}{4} = 1$

$\frac{x}{y+1} = \frac{3}{5+1} = \frac{3}{6} = \frac{1}{2}$

Hence, the solution is correct.

27. Let us first draw a right $\triangle$ABC, right angled at B and $\angle C = \theta$.



Now, we know that $cosec\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{AC}{AB} = \frac{\sqrt{10}}{1}$.

So, if AC = ($\sqrt{10}$)k, then AB = k, where k is a positive number.

Now, by using Pythagoras theorem, we have:

$AC^2 = AB^2 + BC^2$

$\Rightarrow BC^2 = AC^2 - AB^2 = 10k^2 - k^2$

$\Rightarrow BC^2 = 9k^2$

$\Rightarrow$ BC = 3k

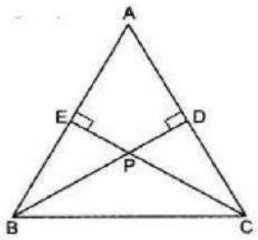
Now, finding the other T-ratios using their definitions, we get:

$\tan\theta = \frac{AB}{BC} = \frac{k}{3k} = \frac{1}{3}$

$\cos\theta = \frac{BC}{AC} = \frac{3k}{\sqrt{10k}} = \frac{3}{\sqrt{10}}$

$$\therefore \sin\theta = \frac{1}{\cos ec\theta} = \frac{1}{\sqrt{10}}, \cot\theta = \frac{1}{\tan\theta} = 3 \text{ and } \sec\theta = \frac{1}{\cos\theta} = \frac{\sqrt{10}}{3}$$

28. **GIVEN** A ΔABC in which $BD \perp AC$ and $CE \perp AB$ and BD and CE intersect at P.
TO PROVE BP × PD = EP × PC
PROOF In ΔEPB and ΔDPC, we have

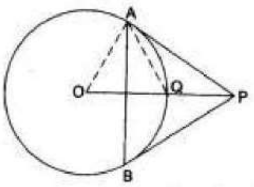


$\angle$PEB = $\angle$PDC [Each equal to 90°]
$\angle$EPB = $\angle$DPC [Vertically opposite angles]
Thus, by AA-criterion of similarity, we obtain
$\Delta EPB \sim \Delta DPC$

$$\frac{EP}{DP} = \frac{PB}{PC}$$

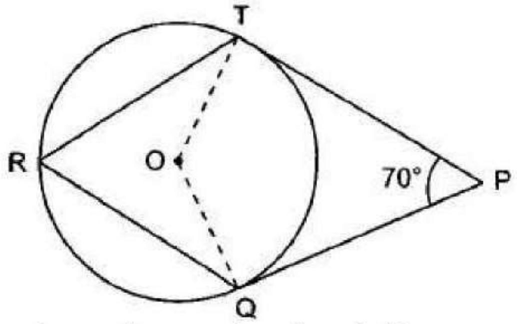
$\Rightarrow$ BP × PD = EP × PC

29.



Let OP meet the circle at Q.
Join OA and AQ.
Clearly, $OA \perp AP$
$\Rightarrow \angle OAP = 90°$ [radius through the point of contact is perpendicular to the tangent].
Now, OQ = QP = r.
Thus, Q is the midpoint of the hypotenuse OP of $\triangle OAP$
So Q is equidistant from O, A and P.
$\therefore$ QA = OQ = QP = r
$\Rightarrow$ OA = OQ = QA = r
$\Rightarrow$ ΔAOQ is equilateral
$\Rightarrow$ $\angle$AOQ = 60° [$\because$ each angle of an equilateral triangle is 60^{o}]
$\Rightarrow$ $\angle$AOP = 60°
$\Rightarrow$ $\angle$APO = 30° $\left[\because \angle AOP + \angle OAP + \angle APO = 180°\right]$
$\Rightarrow \angle APB = 2$
$\angle APO$ =60°
Also, PA = PB
$\Rightarrow \angle PAB = \angle PBA$ =60°.
Hence, $\triangle PAB$ is an equilateral triangle.

OR



we know that , angle subtended by an arc at centre of the circle is twice the angle subtended by it in alternate segment.

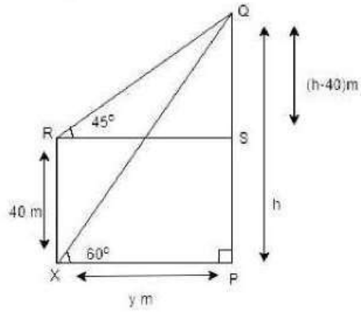
$\angle TOQ + \angle TPQ = 180°$

$\Rightarrow \angle TOQ = 110°$

$\angle TOQ = 2\angle TRQ$

$\Rightarrow 110° = 2\angle TRQ \Rightarrow \angle TRQ = 55°$

30. Let h be the height of the tower.
i.e, PQ = h m and let PX = y m
Now, draw $RS \parallel XP$,
Then, we have RX =SP = 40 m, $\angle QXP = 60^o$ and $\angle QRS = 45^o$



In right angled $\triangle XPQ$,

$$\tan 60^o = \frac{P}{B} = \frac{PQ}{XP}$$

$$\Rightarrow \frac{\sqrt{3}}{1} = \frac{h}{y} \; [\because \tan 60^o = \sqrt{3}]$$

$$\Rightarrow y = \frac{h}{\sqrt{3}} ..(i)$$

In right angled $\triangle RSQ$,

$$\tan 45^o = \frac{P}{B} = \frac{QS}{RS}$$

$$\Rightarrow \tan 45^o = \frac{PQ - SP}{XP}$$

$$\Rightarrow 1 = \frac{h-40}{y}$$

$$\Rightarrow y = h - 40 ....(ii)$$

Now,solve Eq(i) and Eq(ii) , to find h and y.

$$\frac{h}{\sqrt{3}} = h - 40$$

$(\sqrt{3} - 1)\, h = 40\sqrt{3}$

$$h = \frac{40\sqrt{3}}{\sqrt{3}-1} = \frac{40(1.732)}{1.732-1} = \frac{68.28}{0.732} = 94.64$$

$\Rightarrow y = 94.64 - 40$
$\Rightarrow y = 54.64$
$\Rightarrow PQ = 94.64\ m\ and\ PX = 54.64\ m$

31. HCF $= \left(x^2 - x - 12\right) = (x+3)(x-4)$

$P(x) = \left(x^2 - 5x + 4\right)\left(x^2 + 5x + a\right)$

$= (x-4)(x-1)\left(x^2 + 5x + a\right)$

Since, $(x+3)(x-4)$ is the HCF of $P(x)$ and $Q(x)$therefore,
(x+3) and (x-4) are factors of p(x), As (x-4) is already seen
in p(x) and (x+3) is also a factor of p(x).
Thus, by factor theorem, x + 3 = 0 $\Rightarrow x = -3 i,e \cdot P(-3) = 0$
Hence, $P(-3) = (-7)(-4)(9 - 15 + a) = 0$
$\Rightarrow 28(-6 + a) = 0 \quad \Rightarrow a = 6$

Again, Q(x) = $\left(x^2 + 5x + 6\right)\left(x^2 - 5x - 2b\right)$

$= (x+2)(x+3)\left(x^2 - 5x - 2b\right)$

Since, $x - 4$ is a factor of $Q(x)$
$x - 4 = 0 \Rightarrow x = 4$, by factor theorem Q(4) must equal to 0.
$Q(4) = (6)(7)(16 - 20 - 2b) = 0$
$\Rightarrow 42(-4 - 2b) = 0 \Rightarrow 2b = -4 \Rightarrow b = -2$
Hence, a = 6, b = -2

OR

Let us assume that $2 - \sqrt{3}$ is rational.

Then, there exist positive co-primes a and b such that

$2 - \sqrt{3} = \frac{a}{b}$

$\sqrt{3} = 2 - \frac{a}{b}$

As 2 and $\frac{a}{b}$ are rational number .

So, $\sqrt{3}$ is also rational number .

But $\sqrt{3}$ is not rational number .

Since a rational number cannot be equal to an irrational number. Our assumption that $2 - \sqrt{3}$ is rational wrong .

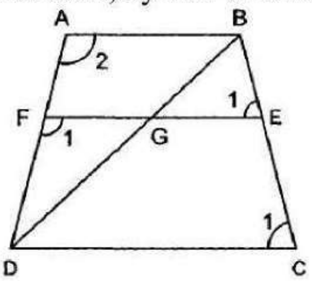
Hence $2 - \sqrt{3}$ is irrational

32. In ΔDFG and Δ DAB, we have

$\angle 1 = \angle 2$ [$\because$ $AB \parallel DC \parallel EF$ $\therefore$ $\angle 1$ and $\angle 2$ are corresponding angles]

$\angle FDG = \angle ADB$ [Common]

Therefore, by AA-criterion of similarity, we have



$\therefore \quad \Delta DFG \sim \Delta DAB$

$$\Rightarrow \quad \frac{DF}{DA} = \frac{FG}{AB} \text{................ ..(i)}$$

In trapezium ABCD, we have

$EF \parallel AB \parallel DC$

$$\therefore \quad \frac{AF}{DF} = \frac{BE}{EC}$$

$$\Rightarrow \quad \frac{AF}{DF} = \frac{3}{4} \quad \left[\because \frac{BE}{EC} = \frac{3}{4} (\text{ given }) \right]$$

$$\Rightarrow \quad \frac{AF}{DF} + 1 = \frac{3}{4} + 1 \text{ [Adding 1 on both sides]}$$

$$\Rightarrow \quad \frac{AF+DF}{DF} = \frac{7}{4}$$

$$\Rightarrow \quad \frac{AD}{DF} = \frac{7}{4} \Rightarrow \frac{DF}{AD} = \frac{4}{7} \text{ ....(ii)}$$

From (i) and (ii), we get

$$\frac{FG}{AB} = \frac{4}{7} \Rightarrow FG = \frac{4}{7} AB \text{ ....(iii)}$$

So far as the given figure is concerned , in ΔBEG and ΔBCD, we have

$\angle BEG = \angle BCD$ [Corresponding angles]

$\angle B = \angle B$ [Common]

$\therefore \quad \Delta BEG \sim \Delta BCD$ [By AA-criterion of similarity]

$$\Rightarrow \quad \frac{BE}{BC} = \frac{EG}{CD}$$

$$\Rightarrow \quad \frac{3}{7} = \frac{EG}{CD} \quad \left[\because \frac{BE}{EC} = \frac{3}{4} \Rightarrow \frac{EC}{BE} = \frac{4}{3} \Rightarrow \frac{EC}{BE} + 1 = \frac{4}{3} + 1 \Rightarrow \frac{BC}{BE} = \frac{7}{3} \right]$$

$$\Rightarrow \quad EG = \frac{3}{7} \text{CD}$$

$\Rightarrow \quad EG = \frac{3}{7} \times 2AB$ [$\because$ CD = 2 AB (given)]

$\Rightarrow \quad EG = \frac{6}{7}AB$ ....(iv)

Adding (iii) and (iv), we get

$FG + EG = \frac{4}{7}AB + \frac{6}{7}AB \Rightarrow EF = \frac{10}{7}AB \Rightarrow 7FE = 10AB$

33. The given equation is:

$\frac{3}{x+1} - \frac{1}{2} = \frac{2}{3x-1} \Rightarrow \frac{3}{x+1} - \frac{2}{3x-1} = \frac{1}{2}$

$\Rightarrow \frac{3(3x-1)-2(x+1)}{(x+1)(3x-1)} = \frac{1}{2}$ (By cross multiplication method)

$\Rightarrow \frac{9x-3-2x-2}{3x^2-x+3x-1} = \frac{1}{2} \Rightarrow \frac{7x-5}{3x^2+2x-1} = \frac{1}{2}$

$\Rightarrow$ 14x - 10 = 3x^2 + 2x - 1 $\Rightarrow$ 3x^2 + 2x - 1 - 14x +10 = 0

$\Rightarrow$ 3x^2 - 12x + 9 = 0 $\qquad \Rightarrow$ x^2 - 4x + 3 = 0

Now by factorization method we have,

x^2 - 3x - x + 3 = 0

$\Rightarrow$ x(x - 3) -1(x - 3) = 0

$\Rightarrow$ (x - 3) (x - 1) = 0

$\Rightarrow$ x - 3 = 0 or x - 1 = 0

Therefore either x = 3 or x = 1

OR

We, $A = \left(c^2 - ab\right)$, B = $-2(a^2 - bc)$, $C = b^2 - ac$

For real equal roots, $D = B^2 - 4AC = 0$

$\Rightarrow \quad \left[-2\left(a^2 - bc\right)\right]^2 - 4\left(c^2 - ab\right)\left(b^2 - ac\right) = 0$

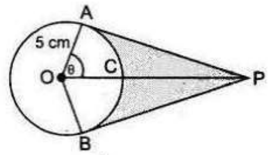
$\Rightarrow 4\left(a^4 + b^2c^2 - 2a^2bc\right) - 4\left(b^2c^2 - c^3a - ab^3 - a^2bc\right) = 0$

$\Rightarrow 4\left[a^4 + b^2c^2 - 2x^2bc - b^2c^2 + c^3a + ab^3 - a^2bc\right) = 0$

$\Rightarrow 4\left[a^4 + ac^3 + ab^3 - 3a^2bc\right] = 0$

$\Rightarrow a\left(a^3 + c^3 + b^3 - 3abc\right) = 0$

$\Rightarrow a = 0$ or $a^3 + b^3 + c^3 = 3abc$

34. 

$\cos\theta = \frac{1}{2}$ or, $\theta = 60°$

Reflex $\angle AOB = 120°$

$\therefore$ ADB $= \frac{2 \times 3.14 \times 5 \times 240}{360} = 20.93$ cm

Hence length of elastic in contact = 20.93 cm

Now, AP $= 5\sqrt{3}$cm

a (△OAP) $= \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} \times 5 \times 5\sqrt{3} = \frac{25\sqrt{3}}{2}$

Area (△OAP + △OBP) $= 2 \times \frac{25\sqrt{3}}{2} = 25\sqrt{3} = 43.25$ cm^2

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

$= \frac{25 \times 3.14 \times 120}{360} = 26.16$ cm^2

Shaded Area = 43.25 - 26.16 = 17.09 cm^2

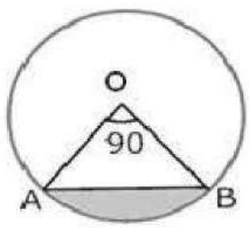
OR

i. Area of minor sector $= \frac{\theta}{360}\pi r^2$

$= \frac{90}{360}(3.14)(10)^2$

$= \frac{1}{4} \times 3.14 \times 100$

$= \frac{314}{4}$



= 78.50 = 78.5 cm^2

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

$= \pi(10)^2 - \frac{90}{360}\pi(10)^2 = 3.14\ (100) - \frac{1}{4}(3.14)\ (100)$

$= 314 - 78.50 = 235.5$ cm^2

iii. We know that area of minor segment

= Area of minor sector OAB - Area of ΔOAB

$\because$ area of ΔOAB = $\frac{1}{2}(OA)(OB)\sin\angle AOB$

$= \frac{1}{2}(OA)(OB)\left(\because \angle AOB = 90°\right)$

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

$= \frac{1}{4}(3.14)\ (100) - 50 = 25(3.14) - 50 = 78.50 - 50 = 28.5\ cm^2$

iv. Area of major segment = Area of the circle - Area of minor segment

$= \pi(10)^2 - 28.5$

$= 100(3.14) - 28.5$

$= 314 - 28.5 = 285.5\ cm^2$

35.

	Number of letters	Number of surnames f_i	Cumulative frequency	
	1-4	6	6=6	
	4-7	30	6+30=36	
Median class	7-10	40	36+40=76	$50 = \frac{n}{2}$
	10-13	16	76+16=92	
	13-16	4	92+4=96	
	16-19	4	96+4=100	
	Total	n = 100		

(i) Here,

$\ell = 7$, n = 100, f = 40, cf = 36, h = 3

$$\text{Median} = \ell + \left\{\frac{\frac{n}{2} - cf}{f}\right\} \times h \quad = 7 + \left\{\frac{50-36}{40}\right\} \times 3 = 7 + \frac{21}{20} = 8.05$$

(ii) Modal class is (7 – 10).

$\ell = 7$, $f_m = 40$, $f_1 = 30$, $f_2 = 16$, h = 3

$$\text{Mode} = \ell + \left\{\frac{f_m - f_1}{2f_m - f_1 - f_2}\right\} \times h \quad = 7 + \left\{\frac{40-30}{80-30-16}\right\} \times 3 = 7 + \frac{30}{34} = 7.88$$

36. (i) Number of bricks in the bottom row = 30. in the next row = 29, and so on.
Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27, ...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1
Suppose number of rows is n, then sum of number of bricks in n rows should be 360.
i.e. $S_n = 360$

$\Rightarrow \frac{n}{2}[2 \times 30 + (n-1)(-1)] = 360 \; \{S_n = \frac{n}{2}(2a + (n-1)d)\}$

$\Rightarrow 720 = n(60 - n + 1)$

$\Rightarrow 720 = 60n - n^2 + n$

$\Rightarrow n^2 - 61n + 720 = 0$

$\Rightarrow n^2 - 16n - 45n + 720 = 0$ [by factorization]

$\Rightarrow n(n-16) - 45(n-16) = 0$

$\Rightarrow (n-16)(n-45) = 0$

$\Rightarrow (n-16) = 0$ or $(n-45) = 0$

$\Rightarrow n = 16$ or $n = 45$

Hence, number of rows is either 45 or 16.
n = 45 not possible so n = 16

$a_{45} = 30 + (45-1)(-1) \; \{a_n = a + (n-1)d\}$

$= 30 - 44 = -14$ [$\because$ The number of logs cannot be negative]

Hence the number of rows is 16.

(ii) Number of bricks in the bottom row = 30. in the next row = 29, and so on.
Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27,...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1
Suppose number of rows is n, then sum of number of bricks in n rows should be 360.
Number of bricks on top row are $n = 16$,

$a_{16} = 30 + (16 - 1)(-1) \; \{a_n = a + (n - 1)d\}$

$= 30 - 15 = 15$

Hence, and number of bricks in the top row is 15.

OR

Number of bricks in the bottom row = 30. in the next row = 29, and so on.
Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27,...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1.
Suppose number of rows is n, then sum of number of bricks in n rows should be 360.

$a_n = 26$, a = 30, d = -1

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

$\Rightarrow 26 = 30 + (n - 1) \times -1$

$\Rightarrow 26 - 30 = -n + 1$

$\Rightarrow$ n = 5

Hence 26 bricks are in 5th row.

(iii) Number of bricks in the bottom row = 30. in the next row = 29, and so on.
therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27, ...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1.
Suppose number of rows is n, then sum of number of bricks in n rows should be 360
Number of bricks in 10th row a = 30, d = -1, n = 10

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

$\Rightarrow a_{10} = 30 + 9 \times -1$

$\Rightarrow a_{10} = 30 - 9 = 21$

Therefore, number of bricks in 10th row are 21.

37. (i) Volume of Hermika = side^3 = 10 × 10 × 10 = 1000 m^3

(ii) r = radius of cylinder = 24, h = height = 16

Volume of cylinder = $\pi r^2 h$

$\Rightarrow V = \frac{22}{7} \times 24 \times 24 \times 14 = 25344$ m^3

(iii) Volume of brick = 0.01 m^3

$\Rightarrow$ n = Number of bricks used for making cylindrical base = $\frac{\text{Volume of cylinder}}{\text{Volume of one brick}}$

$\Rightarrow n = \frac{25344}{0.01} = 2534400$

OR

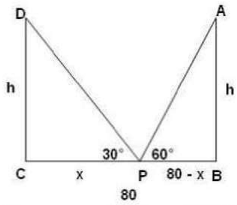
Since Anda is hespherical in shape r = radius = 21

V = Volume of Anda = $\frac{2}{3} \times \pi \times r^3$

$\Rightarrow V = \frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$

$\Rightarrow V = 44 \times 21 \times 21 = 19404$ m^3

38. (i)



Suppose AB and CD are the two towers of equal height h m. BC be the 80 m wide road.
P is any point on the road. Let CP be x m, therefore BP = (80 – x).

Also, ∠APB = 60^o and ∠DPC = 30^o

In right angled triangle DCP,

$\tan 30^o = \frac{CD}{CP} \quad \Rightarrow \frac{h}{x} = \frac{1}{\sqrt{3}}$

$\Rightarrow h = \frac{x}{\sqrt{3}}$ ....(i)

In right angled triangle ABP,

$\tan 60^o = \frac{AB}{AP}$ $\Rightarrow \frac{h}{80-x} = \sqrt{3}$

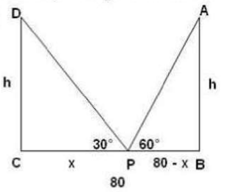
$\Rightarrow h = \sqrt{3}(80-x)$ $\Rightarrow \frac{x}{\sqrt{3}} = \sqrt{3}(80-x)$

$\Rightarrow x = 3(80-x)$ $\Rightarrow x = 240 - 3x$

$\Rightarrow x + 3x = 240$ $\Rightarrow 4x = 240$

$\Rightarrow x = 60$

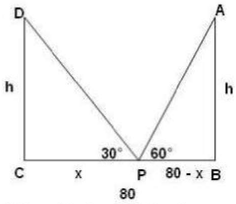
Thus, the position of the point P is 60 m from C.

(ii) 

Height of the tower, h = $\frac{x}{\sqrt{3}} = \frac{60}{\sqrt{3}} = 20\sqrt{3}$

The height of each tower is $20\sqrt{3}$ m.

OR

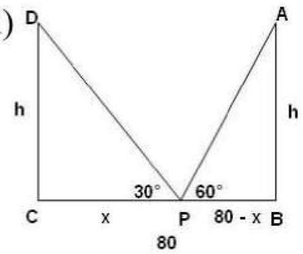


The distance between Neeta and top of tower CD.

In $\triangle CDP$

$\sin 30^o = \frac{CD}{PD}$ $\Rightarrow PD = \frac{CD}{\sin 30^0}$ $\Rightarrow PD = \frac{20\sqrt{3}}{\frac{1}{2}} = 40\sqrt{3}$

$\Rightarrow PD = 40\sqrt{3}$

(iii) 

The distance between Neeta and top of tower AB.

In $\triangle ABP$

$\sin 60^o = \frac{AB}{AP}$ $\Rightarrow AP = \frac{AB}{\sin 60^0}$ $\Rightarrow AP = \frac{20\sqrt{3}}{\frac{\sqrt{3}}{2}}$

$\Rightarrow$ AP = 40 m