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FINAL EXAMINATION
YEAR 2019-20
Std. : X (CBSE)
Subject : Mathematics
MODEL ANSWER

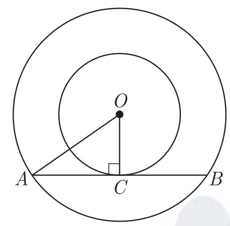
C

Section - A

1) (d) $\frac{23}{8}$ For terminating decimal expansion denominator must have only 2 or only 5 or 2 and 5 as factor.

Here $\frac{23}{8} = \frac{23}{(2)^3}$. (1)

2) (b) As per the given question we draw the figure as mentioned.
Here AB is the chord of large circle which touch the smaller circle at point C.
We can see easily that $\triangle AOC$ is right angled triangle.
Here, $AO = 5$ cm, $OC = 3$ cm



$$AC = \sqrt{AO^2 - OC^2}$$ (1/2)

$$AC = \sqrt{5^2 - 3^2}$$

$$AC = \sqrt{25-9} = \sqrt{16} = 4\text{cm}$$ (1/2)

Length of the chord $AB = 8$ cm

3) (b) 7. Let x be the upper limit and y be the lower limit. Since the mid value of the class is 10.

Here $\frac{x+y}{2} = 10$ (1/2)

$x + y = 20$ ---- (i) and $x - y = 6$ ----- (ii) (Width of the class = 6)
By solving eq. (i) and (ii) we get $y = 7$.
Hence lower limit of the class is 7. (1/2)

4) (c) 0. For all $x \in N$, $(12)^{3x}$ ends with the either 8 or 2 and $(18)^{3x}$ ends with either 2 or 8.
If $(12)^{3x}$ ends with 8, then $(18)^{3x}$ ends with 2.
If $(12)^{3x}$ ends with 2, then $(18)^{3x}$ ends with 8.
Thus, $(12)^{3x} + (18)^{3x}$ ends with 0 only. (1)

5) (c) 7 : 1. $\frac{3x+4y}{x+2y} = \frac{9}{4}$ (1/2)

Hence, $12x + 16y = 9x + 18y$
$3x = 2y$

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

Substitute $x = \frac{2}{3}y$ in the required expression.

$$\frac{3\frac{2}{3}y + 5y}{3\frac{2}{3}y - y} = \frac{7y}{y} = \frac{7}{1} = 7:1$$ (1/2)

6) (b) $\frac{\text{DF}}{\text{PQ}} = \frac{EF}{RQ}$. Because $\triangle DEF \sim \triangle QRP$. (1)

7) (a) 0. $\triangle ABC$ is right angled at C,

$A + B + C = 180^\circ$

$A + B = 180^\circ - 90^\circ = 90^\circ$

$\cos(A + B) = \cos 90^\circ = 0$ $(\because \angle C = 90^\circ)$ (1)

8) (d) 9.5. $= \sin^2 5^\circ + \sin^2 10^\circ + \sin^2 15^\circ + ... + \sin^2 90^\circ$

$= (\sin^2 5^\circ + \sin^2 85^\circ) + (\sin^2 10^\circ + \sin^2 80^\circ) + ... + (\sin^2 40^\circ + \sin^2 50^\circ) + \sin^2 45^\circ + \sin^2 90^\circ$ $(^1/_2)$

$= (\sin^2 5^\circ + \sin^2 85^\circ) + (\sin^2 10^\circ + \cos^2 10^\circ) + ... + (\sin^2 40^\circ + \cos^2 40^\circ) + \left(\frac{1}{\sqrt{2}}\right)^2 + 1$

$= 1 + 1 + 1 + ...$ 8 times $+ \frac{1}{2} + 1 = 9\frac{1}{2} = 9.5$ $(^1/_2)$

9) (a) -6 and 1 Since, $C(y, -1)$ is the mid-point of $P(4, x)$ and $Q(-2, 4)$.

We have, $\frac{4-2}{2} = y$ $(^1/_2)$

and $\frac{4+x}{2} = -1$

$\therefore$ $y = 1$ and $x = -6$. $(^1/_2)$

10) (b) (2, 0) Let $P(x, 0)$ be a point on X-axis such that,

$AP = BP$

$AP^2 = BP^2$

$(x + 2)^2 + (0 - 3)^2 = (x - 5)^2 + (0 + 4)^2$ $(^1/_2)$

$x^2 + 4x + 4 + 9 = x^2 - 10x + 25 + 16$

$14x = 28$

$x = 2$

Hence, required point = (2, 0) $(^1/_2)$

11) 27. (1)

12) $p(x) = x^3 + 7kx^2 - 4kx + 12$

$p(-3) = (-3)^3 + 7k(-3)^2 - 4k(-3) + 12$

$\because$ $(x + 3)$ is a factor

$\therefore$ $p(-3) = 0$

$\Rightarrow$ $-27 + 63k + 12k + 12 = 0$

$\Rightarrow$ $75k - 15 = 0 \Rightarrow k = \frac{1}{5}$ (1)

13) 12/5. (1)

14) Let numbers be $a - d$, a and $a + d$.

$\Rightarrow$ $a - d + a + a + d = 24$

$\Rightarrow$ $3a = 24 \Rightarrow a = 8$

$\therefore$ Middle term = 8 (1)

15) No. of days in a non-leap year = 365

No. of complete weeks = 52 (52 x 7 = 364)

No. of days left = 1

$\therefore$ Probability of this day being a Monday

= Probability of 53 Mondays = $\frac{1}{7}$ (1)

16) No, because HCF is always a factor of LCM. But 18 is not a factor of 380. (1)

17) Let the triangles be $\triangle ABC$ and $\triangle DEF$

$$\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \left(\frac{5}{6}\right)^2 = \frac{25}{36}$$ $\therefore$ Ratio of their areas = 25 : 36 (1)

18) As we know that,
Area of circle = $\pi\ r^2$,
Let the radius of circle with centre $C = R$
According to question we have,
$\pi(8)^2 + \pi(15)^2 = \pi\ R^2$ $(^1/_2)$
$64\pi + 225\pi = \pi\ R^2$
$289\pi = \pi\ R^2$
$R^2 = 289$ or $R = 17$ cm
Circumference of the circle $2\ \pi\ \text{R} = 2\pi \times 17 = 34\pi$ cm $(^1/_2)$

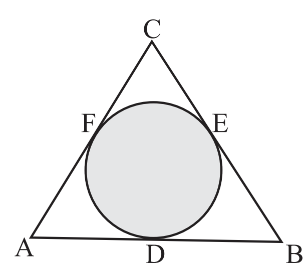
19) (b) 15 $a_1 = 2 \text{ x } 1 + 1 = 3$
$a_2 = 2 \text{ x } 2 + 1 = 5$
$a_3 = 2 \text{ x } 3 + 1 = 7$
$\therefore$ Sum = 3 + 5 + 7 = 15 (1)

20) (c) no real roots Given equation is,
$(x^2 + 1)^2 - x^2 = 0$
$x^4 + 1 + 2x^2 - x^2 = 0$ $[\because (\text{a} + b)^2 = a^2 + b^2 + 2ab]$ $(^1/_2)$
$x^4 + x^2 + 1 = 0$
Let, $x^2 = y$
$(x^2)^2 + x^2 + 1 = 0$
$y^2 + y + 1 = 0$
On comparing with $ay^2 + by + c = 0$,
we get $a = 1$, $b = 1$ and $c = 1$
Discriminant, $D = b^2 - 4ac$
$= (1)^2 - 4\ (1)\ (1) = 1 - 4 = -3$
Since, $D < 0$
$y^2 + y + 1 = 0$
i.e., $x^4 + x^2 + 1 = 0$
or $(x^2 + 1) - x^2 = 0$ has no real roots. $(^1/_2)$

Section - B

21) Let the first term be a, common difference be d, nth term be a_n and sum of n term be S_n.
Now $S_n = 3n^2 + 5m$ $(^1/_2)$
$S_{n-1} = 3(n - 1)^2 + 5\ (n - 1)$
$= 3\ (n^2 + 1 - 2n) + 5n - 5$
$= 3n^2 + 3 - 6n + 5n - 5$
$= 3n^2 - n - 2$
$a_n = S_n - S_{n-1}$ $(^1/_2)$
$= 3n^2 + 5n - (3n^2 - n - 2)$
$= 6n + 2$
Thus A.P. is 8, 14, 20, ...
Now $a_{15} = a + 14\ d = 8 + 14(6) = 92$ (1)

22) As per question we draw figure shown below.
We have $AC = 8$ cm, $AB = 10$ cm and $BC = 12$ cm
Let AF be x. Since length of tangents from an external point to a circle are equal



At A $AF = AD = x$ ------ (i)
At B $BE = BD = AB - AD = 10 - x$ ------ (ii)
At C $CE = CF = AC - AF = 8 - x$ ------ (iii) $(^1/_2)$
Now $BC = BE + EC$
$12 = 10 - x + 8 - x$ $(^1/_2)$

$2x = 18 - 12 = 6$ $(^1/_2)$

or $x = 3$

Now $AD = 3$ cm,

$BE = 10 - 3 = 7$ cm

and $CF = 8 - 3 = 5$ $(^1/_2)$

23) Since G is the mid-point of PQ we have

$PG = GQ$

$\frac{PG}{GQ} = 1$ $(^1/_2)$

According to the question $GH \parallel QR$, thus

$\frac{PG}{GQ} = \frac{PH}{HR}$ (By BPT) $(^1/_2)$

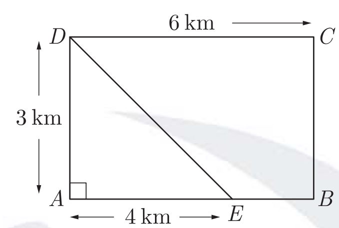
$1 = \frac{PH}{HR}$ $(^1/_2)$

$PH = HR$

Hence, H is the mid-points of PR. $(^1/_2)$

OR

As per given condition we have drawn the figure as shown :

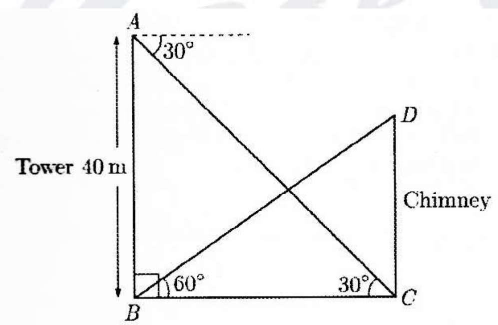


We have $AE = \frac{2}{3}AB = \frac{2}{3} \times 6 = 4$ km (1)

In right triangle ADE, $DE^2 = (3)^2 + (4)^2 = 25$

Thus, $DE = 5$ km (1)

24) Given $AB = 40$ m be the height of the tower and CD be the height of smoking chimney.



In right $\triangle ABC$, $\tan 30° = \frac{AB}{BC} = \frac{1}{\sqrt{3}} = \frac{40}{BC}$ $(^1/_2)$

$BC = 40\sqrt{3}$ $(^1/_2)$

Again In right $\triangle DCB$, $\tan 60° = \frac{DC}{BC}$ $(^1/_2)$

$\sqrt{3} = \frac{DC}{40\sqrt{3}}$

$DC = 120$ m $(^1/_2)$

The height of chimney is 100 m, Which is greater than the ideal height 100 m of a small emitting chimney.

25) After removing king, queen and jack of clubs from a deck of 52 playing cards there are 49 cards left in the deck. Out of these 49 cards one card can be chosen in 49 ways.

$\therefore$ Total number of elementary events = 49

(a) There are 13 heart cards in the deck containing 49 cards out of which one heart card can be chose in 13 ways.

$\therefore$ Favourable number of elementary events = 13

Hence, P(Getting a heart) $= \frac{13}{49}$ $(^1/_2)$

(b) There are 3 kings in the deck containing 49 cards. Out of these three kings one king can be chosen in 3 ways.

$\therefore$ Favourable number of elementary events = 3

Hence, P(Getting a king) $= \frac{3}{49}$ $(^1/_2)$

(c) After removing king, queen and jack of clubs only 10 club cards are left in the deck. Out of these 10 club cards one club card is chosen in 10 ways.

∴ Favourable number of elementary events = 10

Hence, P(Getting a club) $= \frac{10}{49}$ ($^1/_2$)

(d) There is only one '10' of hearts.

∴ Favourable number of elementary events = 1

Hence, P(Getting the '10' to hearts) $= \frac{1}{49}$ ($^1/_2$)

26) Diameter of hemisphere = Side of cubical block

$2r = 7$

or, $r = \frac{7}{2}$ ($^1/_2$)

Surface area of solid

= Surface area of the cube - Area of base of hemisphere + curved surface area of hemisphere

$= 6l^2 - \pi r^2 + 2\pi r^2$

$= 6 \times 49 - 11 \times \frac{7}{2} + 77 = 332.5 \text{ cm}^2$ ($^1/_2$)

Section - C

27) Finding prime factor of given number we have,

$92 = 2^2 \times 23$ (1)

$510 = 30 \text{ x } 17 = 2 \times 3 \times 5 \times 17$

HCF (510, 92) = 2

LCM (510, 92) = $2^2 \times 22 \times 3 \times 5 \times 14 = 23460$ (1)

HCF (510, 92) × LCM (510, 92)

$= 2 \times 23460 = 46920$

Product of two numbers = $510 \times 92 = 46920$ (1)

Hence, HCF × LCM = Product of two numbers

OR

Let a be any positive integer, then by Euclid's division algorithm a can be written as

$a = bq + r$ (1)

Take $b = 6$, then $0 \leq r < 6$ because $0 \leq r < b$,

Thus $a = 6q, 6q + 1, 6q + 2, 6q + 3, 6q + 4, 6q + 5$ (1)

Here $6q$, $6q + 2$ and $6q + 4$ are divisible by 2 and so $6q$, $6q + 2$ and $6q + 4$ are even positive integers.

But $6q + 1$, $6q + 3$, $6q + 5$ are odd, as they are not divisible by 2.

Thus any positive odd integer is of the form $6q + 1$, $6q + 3$ or $6q + 5$. (1)

28) Let the first term be a, common difference be d and nth term be a_n.

We have $a_7 = \frac{1}{9} \Rightarrow a + 6d = \frac{1}{9}$ ------ (i) $a_9 = \frac{1}{7} \Rightarrow a + 8d = \frac{1}{7}$ ------ (ii) (1)

Subtracting equation (i) and (ii) we get

$2d = \frac{1}{7} - \frac{1}{9} = \frac{2}{63} = \frac{1}{63}$ ($^1/_2$)

Substituting the value of d in (ii) we get

$a + 8 \times \frac{1}{63} = \frac{1}{7}$ ($^1/_2$)

$a = \frac{1}{7} - \frac{8}{63} = \frac{9-8}{63} = \frac{1}{63}$ ($^1/_2$)

Now, $a_{63} = a + (63 - 1)\, d$

$a_{63} = \frac{1}{63} + 62 \times \frac{1}{63} = \frac{1+62}{63} = \frac{63}{63} = 1$

Hence, $a_{63} = 1$ ($^1/_2$)

29) Let the digits of number be x and y , then number will $10x + y$

According to the question, we have

$$8(x + y) - 5 = 10x + y$$

$$2x - 7y + 5 = 0 \qquad \text{---- (i)} \qquad (^1/_2)$$

Also

$$16(x - y) + 3 = 10x + y$$

$$6x - 17y + 3 = 0 \qquad \text{---- (ii)} \qquad (^1/_2)$$

Comparing the equation with $ax + by + c = 0$ we get

$$a_1 = 2,\ b_1 = -1,\ c_1 = 5$$

$$a_2 = 6,\ b_2 = -17,\ c_2 = 3$$

Now

$$\frac{x}{b_2c_1 - b_1c_2} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{c_1b_2 - a_2b_1} \qquad (^1/_2)$$

$$\frac{x}{(-7)(3) - (-17)(5)} = \frac{y}{(5)(6) - (2)(3)}$$

$$= \frac{1}{(2)(-17) - (6)(-7)}$$

$$\frac{x}{-21+85} = \frac{y}{30-6} = \frac{1}{-34+42} \qquad (^1/_2)$$

$$\frac{x}{64} = \frac{y}{24} = \frac{1}{8}$$

$$\frac{x}{8} = \frac{y}{3} = 1$$

Hence, $x = 8,\ y = 3$ $(^1/_2)$

So required number = 10 x 8 + 3 = 83 $(^1/_2)$

30) We have

$$\alpha + \beta = 24 \qquad \text{------ (i)} \qquad (^1/_2)$$

$$\alpha - \beta = 8 \qquad \text{------ (ii)} \qquad (^1/_2)$$

Adding equations (i) and (ii) we have

$$2\alpha = 32 \Rightarrow \alpha = 16 \qquad (^1/_2)$$

Subtracting (i) from (ii) we have

$$2\beta = 24 \Rightarrow \beta = 12 \qquad (^1/_2)$$

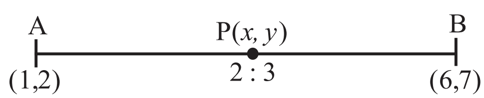
Hence, the quadratic polynomial

$$p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$$

$$= x^2 - (16 + 8)x + (16)(8)$$

$$= x^2 - 24x + 128 \qquad (1)$$

31) As per question, line diagram is shown below.



$(^1/_2)$

We have $AP = \frac{2}{5}AB \Rightarrow AP : PB = 2 : 3$ $(^1/_2)$

By using section formula,

$$x = \frac{mx_2 + nx_1}{m+n} \text{ and } y = \frac{my_2 + ny_1}{m+n} \qquad (1)$$

Applying section formula we get

$$x = \frac{2\times6 + 3\times1}{2+3} = \frac{12+3}{5} = 3 \qquad (^1/_2)$$

and

$$y = \frac{2\times7 + 3\times2}{2+3} = \frac{14+6}{5} = 4$$

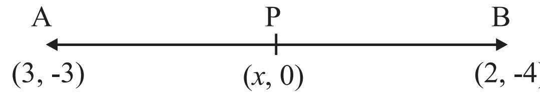
Thus $P(x, y) = (3, 4)$ $(^1/_2)$

OR

y co-ordinate of any point on the x will be zero. Let $(x, 0)$ be point on x axis which cut the line. As per question, line diagram is shown below.

Let the ratio be $k : 1$.

Using section formula for y coordinate we have



$$y = \frac{1(-3) + k(7)}{1+k} \Rightarrow k = \frac{3}{7} \qquad (1)$$

Using section formula for x coordinate we have

$$x = \frac{1(3) + k(-2)}{1+k} = \frac{3 - 2 \times \frac{3}{7}}{1 + \frac{3}{7}} = \frac{3}{2} \qquad (1)$$

Thus, co-ordinates of point are $\left(\frac{3}{2}, 0\right)$ (1)

32) We have $\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$

(a) $\tan 75^{o} = \tan(45^{o} + 30^{o})$

$$= \frac{\tan 45° + \tan 30°}{1 - \tan 45° . \tan 30°} \qquad (^1/_2)$$

$$= \frac{1 + \frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}} = \frac{\sqrt{3}+1}{\sqrt{3}-1} \qquad (^1/_2)$$

$$= \frac{(\sqrt{3}+1)(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$= \frac{3 + 2\sqrt{3} + 1}{(\sqrt{3})^2 (1)^2} = \frac{4 + 2\sqrt{3}}{2} \qquad (^1/_2)$$

Hence $\tan 75^{o} = 2 + \sqrt{3}$ $(^1/_2)$

(b) $\tan 90^{o} = \tan(60^{o} + 30^{o})$

$$= \frac{\tan 60° + \tan 30°}{1 - \tan 60° . \tan 30°} \qquad (^1/_2)$$

$$= \frac{\sqrt{3} + \frac{1}{\sqrt{3}}}{1 - \sqrt{3} \times \frac{1}{\sqrt{3}}} = \frac{\frac{3+1}{\sqrt{3}}}{0}$$

Hence $\tan 90^{o} = \infty$ $(^1/_2)$

33) Here AP is tangent at point A on circle.

Thus $\angle OAP = 90^{o}$ $(^1/_2)$

Now $\cos\theta = \dfrac{OA}{OP} = \dfrac{5}{10} = \dfrac{1}{2}$

or, $\theta = 60^{o}$ $(^1/_2)$

Reflex $\angle AOB = 360^{o} - 60^{o} - 60^{o} = 240^{o}$

Now $arc(ADB) = \dfrac{2 \times 3.14 \times 5 \times 120}{360} = 20.93$ $(^1/_2)$

Hence Length of elastic in contact = 20.93 cm

Now, $AP = 5\sqrt{3}\text{cm}$ $(^1/_2)$

Area, $(\Delta OAP + \Delta OBP) = 25\sqrt{3} = 43.25\ \text{cm}^2$

Area of sector, $OACB = \dfrac{25 \times 3.14 \times 120}{360} = 26.16\ \text{cm}^2$ $(^1/_2)$

Shaded Area $= 43.25 - 26.16$
$= 17.09\ \text{cm}^2$ $(^1/_2)$

34) Modal class is 30 - 35. $l = 30, f_1 = 25, f_0 = 10, f_2 = 7, h = 5$. (1)

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \qquad (1)$$

$$\Rightarrow \quad \text{Mode} = 30 + \frac{25-10}{50-10-7} \times 5$$

Mode = 30 + 2.27 or 32.27 approx. (1)

OR

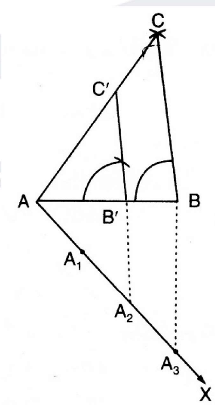
Frequency distribution table :-

Class interval	Frequency
0 - 50	8
50 - 100	15
100 -150	32
150 - 200	26
200 - 250	12
250 -300	7
Total	**100**

(3)

Section - D

35) **Steps of construction :- (3 mark = Construction & 1 mark = Diagram**



(a) Draw a line segment AB = 4 cm.
(b) With A as centre and radius = AC = 6 cm, draw an arc.
(c) With B as centre and radius = BC = 5 cm, draw another arc, intersecting the arc drawn in step (b) at C.
(d) Join AC and BC to obtain $\triangle ABC$.
(e) Below AB, make an acute angle $\angle BAX$.
(f) Along AX, mark off three points (greater of 2 and 3 in $\frac{2}{3}$) A_1, A_2, A_3 such that $AA_1 = A_1A_2 = A_2A_3$.
(g) Join A_3B.
(h) Since we have to construct a triangle each of whose sides is two-third of the corresponding sides of $\triangle ABC$. So, take two parts out of three equal parts on AX i.e. from point A_2 draw $A_2B' \parallel A_3B$, meeting AB at B'.
(i) From B', draw $B'C' \parallel BC$, meeting AC at C.

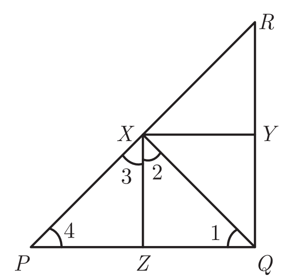
$AB'C'$ is the required triangle, each of the whose sides is two-third of the corresponding sides of $\triangle ABC$.

36) We have redrawn the given figure as shown :-

It may be easily seen that $RQ \perp PQ$ and $XZ \perp PQ$ or $XZ \parallel YQ$. $(^1/_2)$

Similary $XY \parallel ZQ$ $(^1/_2)$

Thus $XYQZ$ is rectangle. (1 mark = diagram)



In $\triangle XZQ$, $\angle 1 + \angle 2 = 90^\circ$ ---- (i)

and in $\triangle PZX$, $\angle 3 + \angle 4 = 90^\circ$ ---- (ii)

$XQ \perp PR$ or, $\angle 2 + \angle 3 = 90^\circ$ ---- (iii) $(^1/_2)$

From eq. (1) and (3) $\angle 1 = \angle 3$

From eq. (2) and (3) $\angle 2 = \angle 4$ $(^1/_2)$

Due to AA similarity

$\triangle PZX \sim \triangle XZQ$

$$\frac{PZ}{XY} = \frac{XZ}{ZQ} \qquad (^1/_2)$$

$XZ^2 = PZ \times ZQ$ Hence proved. $(^1/_2)$

OR

As per given condition we have drawn the figure below :

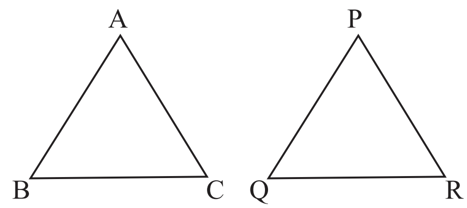
We have $\triangle ABC \sim \triangle PQR$ $(^1/_2)$

and $ar(\triangle ABC) = ar(\triangle PQR)$ $(^1/_2)$

Since $\triangle ABC \sim \triangle PQR$, we have

$$\frac{ar(\Delta ABC)}{ar(\Delta PQR)} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2} \quad \text{---- (i)} \qquad (^1/_2)$$

Since $ar(\triangle ABC) = ar(\triangle PQR)$ we have



$$\frac{ar(\Delta ABC)}{ar(\Delta PQR)} = 1 \qquad (^1/_2)$$

From eq. (1) we get $\dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{CA^2}{RP^2} = 1$ $(^1/_2)$

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP} = 1 \qquad (^1/_2)$$

$AB = PQ,\ BC = QR,\ CA = RP$ $(^1/_2)$

By SSS similarity we have $\Delta ABC \cong \Delta PQR$ $(^1/_2)$

37) We have $\dfrac{x+1}{x-1} + \dfrac{x-2}{x+2} = 4 - \dfrac{2x+3}{x-2}$

$$\frac{x^2+3x+2+x^2-3x+2}{x^2+x-2} = \frac{4x-8-2x-3}{x-2} \qquad (1)$$

$$\frac{2x^2+4}{x^2+x-2} = \frac{2x-11}{x-2} \qquad (1)$$

$(2x^2 + 4)(x - 2) = (2x - 11)(x^2 + x - 2)$ (1)

$5x^2 + 19x - 30 = 0$

$(5x - 6)(x + 5) = 0$

$$x = -5, \frac{6}{5} \qquad (1)$$

38) Volume of bowl $= \dfrac{2}{3}\pi r^3$ $(^1/_2)$

Volume of liquid in bowl $= \dfrac{2}{3}\pi (18)^3 \text{cm}^3$ $(^1/_2)$

Volume of one after wastage $= \dfrac{2}{3}\pi (18)^3 \times \dfrac{90}{100} \text{cm}^3$ $(^1/_2)$

Volume of one bottle $= \pi r^2 h$ $(^1/_2)$

Volume of liquid in 72 bottles $= \pi \times (3)^2 \times h \times 72 \text{ cm}^2$ $(^1/_2)$

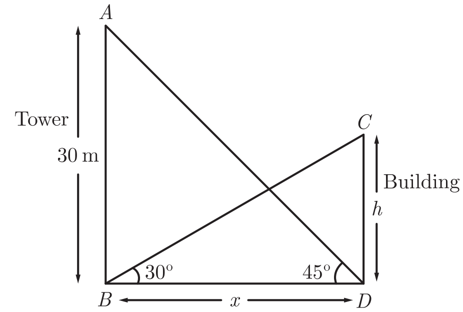
Volume of bottles = volume in liquid after wastage $\Rightarrow \pi \times (3)^2 \times h \times 72 = \dfrac{2}{3}\pi (18)^3 \times \dfrac{90}{100}$ $(^1/_2)$

$$\Rightarrow \quad h = \frac{\frac{2}{3}\pi (18)^3 \times \frac{90}{100}}{\pi \times (3)^2 \times 72} \Rightarrow \text{Hence, the height of bottle} = 5.4 \text{ cm.} \qquad (1)$$

39) Let the height of the building be $AB = h$ m. and distant between tower and building be, $BD = x$ m. As per given in question we have drawn figure below. (1 mark for diagram)

In $\triangle ABD$, $\tan 45° = \dfrac{AB}{BD} \Rightarrow 1 = \dfrac{30}{x}$ (1/2)

$x = 30.$ ----- (i) (1/2)



Now, In $\triangle BDC$, $\tan 30° = \dfrac{CD}{BD} \Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{x}$ (1/2)

$\sqrt{3}h = x \Rightarrow h = \dfrac{x}{\sqrt{3}}$ ----- (ii) (1/2)

From (i) and (ii) we get $h = \dfrac{30}{\sqrt{3}} = 10\sqrt{3}$ m (1/2)

Therefore height of the building is $10\sqrt{3}$ m. (1/2)

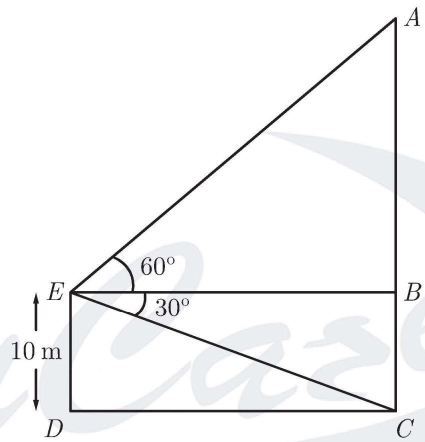
OR

As per given in question we have drawn figure below. Here AC is height of hill and man is at E . $ED = 10$ is height of ship from water level. As per given in question we have drawn figure below.

In $\triangle BCE$, $BC = 10$ m and $\angle BEC = 30°$ (1/2)

Now, $\tan 30° = \dfrac{BC}{BE} \Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{10}{BE}$ (1/2)

$BE = 10\sqrt{3}$ (1 mark = diagram)



Since $BE = CD$ distance of hill from ship

$CD = 10\sqrt{3}\text{ m} = 10 \times 1.732\text{ m} = 17.32\text{ m}$ (1/2)

Now in $\triangle$ABE, $\angle AEB = 60°$

Where $AB = h$, $BE = 10\sqrt{3}$ m

and $\angle AEB = 60°$

Thus, $\tan 60° = \dfrac{AB}{BE} \Rightarrow \sqrt{3} = \dfrac{AB}{10\sqrt{3}}$ (1/2)

$AB = 10\sqrt{3} \times \sqrt{3} = 30\text{ m}$ (1/2)

Thus, height of hill $AB + 10 = 40$ m. (1/2)

40) By formula method :-

Classes	f	$c.f.$
0 - 20	6	6
20 - 40	8	14
40 - 60	10	24
60 - 80	12	36
80 - 100	6	42
100 - 120	5	47
120 - 140	3	50

(1/2)

Median $= \dfrac{N}{2}$th term

Median $= \dfrac{50}{2} = 25$th term (1/2)

Median class = 60 - 80

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h$$

Median $= 60 + \dfrac{1}{12} \times 20$ (1/2)

Median $= 60 + \dfrac{5}{3}$

Median $= \dfrac{185}{3} = 61.67$ (1/2)

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