Section - D

30) (choice 1) Frequency distribution:

4

Class	Frequency	x_i	$f_i x_i$
11-13	3	12	$3 \times 12 = 36$
13-15	6	14	$6 \times 14 = 84$
15-17	9	16	$9 \times 16 = 144$
17-19	13	18	$13 \times 18 = 234$
19-21	f	20	$f \times 20 = 20f$
21-23	5	22	$5 \times 22 = 110$
23-25	4	24	$4 \times 24 = 96.$
Total: →	$40+f$		$704+20f$

Given, mean = 18. To find, value of f.

We know.

$$\text{mean } (\bar{x}) = \frac{\sum f_i x_i}{\sum f_i}$$

$$\Rightarrow 18 = \frac{704+20f}{40+f}$$

$$720 + 18f = 704 + 20f.$$

$$720 - 704 = 20f - 18f$$

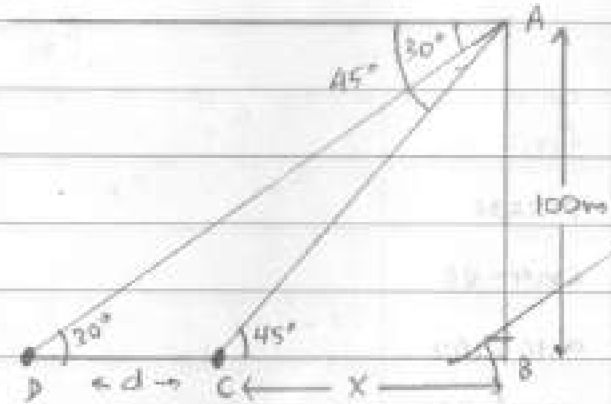
$$16 = 2f$$

$$\Rightarrow f = 8.$$

$\boxed{\text{The value of } f \text{ is } 8}$

29) Diagram:

4



AB → lighthouse = 100m high

C → boat 1

D → boat 2.

To find: $\overline{CD}$ or d.

(distance b/w ships)

We know,

$\tan\angle ACB = \frac{\text{opp.}}{\text{adj.}} = \frac{AB}{BC}$.

$\rightarrow \tan 45° = \frac{100}{x}$

$1 = \frac{100}{x}$

$\Rightarrow x = 100\,m$.

$\tan\angle ADB = \frac{\text{opp.}}{\text{adj.}} = \frac{AB}{BD}$.

$\rightarrow \tan 30 = \frac{100}{x+d}$

$\frac{1}{\sqrt{3}} = \frac{100}{d+100}$ [x=100]

$100+d = 100\sqrt{3}$.

$\rightarrow d = 100\sqrt{3} - 100. = 100(\sqrt{3}-1)$

Given, $\sqrt{3} = 1.732$,

$\Rightarrow d = 100(1.732-1)$

$= 100 \times 0.732 = 73.2m$.

→ The distance between the boats is 73.2m.

27) To prove: $\dfrac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A.$

4

Simplifying LHS:

$$\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A}$$

$$= \frac{\sin A\,(1 - 2\sin^2 A)}{\cos A\,(2\cos^2 A - 1)}$$

$$= \frac{\sin A}{\cos A}\left[\frac{1 - (2\sin^2 A)}{2\cos^2 A - 1}\right]$$

$$= \frac{\sin A}{\cos A}\left[\frac{\sin^2 A + \cos^2 A - 2\sin^2 A}{2\cos^2 A - (\sin^2 A + \cos^2 A)}\right] \qquad \left[\because \sin^2 A + \cos^2 A = 1\right]$$

$$= \frac{\sin A}{\cos A}\left[\frac{\cos^2 A - \sin^2 A}{\cos^2 A - \sin^2 A}\right]$$

$$= \frac{\sin A}{\cos A} \times 1$$

$$= \tan A. \qquad \left[\because \frac{\sin A}{\cos A} = \tan A\right]$$

LHS = RHS

hence proved.

28) i) Given, metal bucket shaped like frustum of cone.

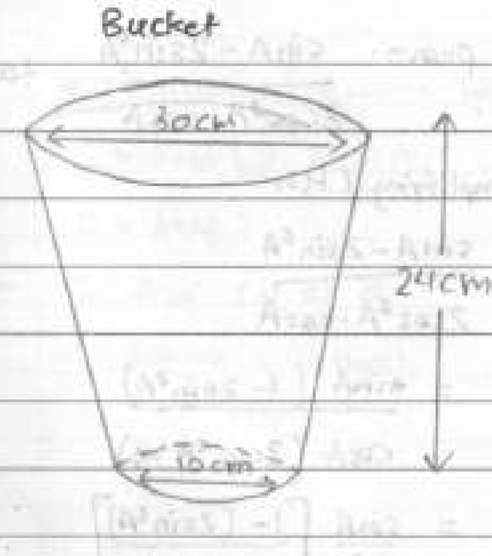
Dimensions: height = 24 cm. (h)

lower diameter = 10 cm → radius = $\frac{10}{2}$ = 5 cm (r_1)

upper diameter = 30 cm → radius = $\frac{30}{2}$ = 15 cm (r_2)

To find: Metal sheet needed to make bucket.

→ Area of metal sheet = Curved surface area + Area of base.



We know,

Curved surface area of frustum = $\pi \times (R+r) \times l$ sq. units.

where $l = \sqrt{h^2 + (R-r)^2}$ units.

To find l: $l = \sqrt{h^2 + (R-r)^2}$ units.

$= \sqrt{24^2 + (15-5)^2}$ cm

$= \sqrt{576 + 10^2}$

$= \sqrt{676}$

$l = 26$ cm.

⇒ CSA = $\pi (R+r) l$ sq. units

$= 3.14 \times (15+5) \times 26$ sq. cm

$= 3.14 \times 20 \times 26$

CSA = 1632.8 cm^2

We know, Area of circular base = πr^2 sq. units.

$\rightarrow$ Area = $3.14 \times 5 \times 5$ sq.cm

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

$= \frac{314}{4}$

Area $= 78.5$ cm^2.

Total area of sheet = Curved area + Circular base area

$= 1632.8 + 78.5$ cm^2

Area $= 1711.3$ cm^2

$\boxed{\text{The area of sheet needed is } 1711.3 \ cm^2.}$

(ii) Plastic buckets are less preferable to metal buckets because plastic buckets are more harmful to the environment. They may also leak harmful chemicals into the water being stored.

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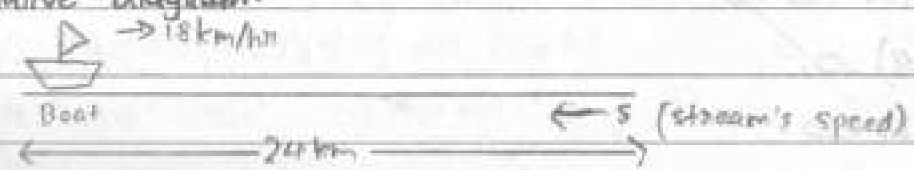
23) Representative diagram:

(Choice 1)



4

Given that:

Speed of boat = 18 km/hr in still water.

Speed of stream = s (variable, must find)

Distance upstream + back = 24 km

Time upstream = 1 hr more than time downstream.

We know, speed = $\frac{\text{Distance}}{\text{Time}} \rightarrow$ Time = $\frac{\text{Distance}}{\text{Speed}}$

Time upstream = $\frac{24}{18-s}$, Time downstream = $\frac{24}{18+s}$.

$$\rightarrow \frac{24}{18-s} = 1 + \frac{24}{18+s}.$$

$$\frac{24}{18-s} = \frac{18+s+24}{18+s}.$$ (cross-multiplying)

$$24(18+s) = (42+s)(18-s)$$

$$432+24s = 756+18s-42s-s^2$$

$$\rightarrow s^2+24s+24s+432-756=0.$$

$$s^2+48s+(-324)=0.$$

$$s^2+54s-6s-324=0.$$

$$s(s+54)-6(s+54)=0.$$

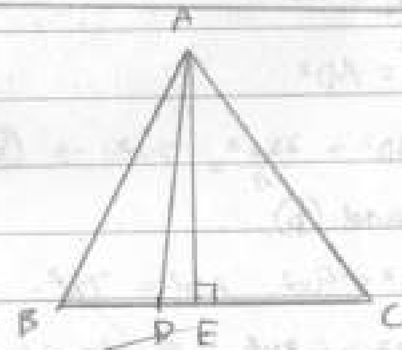
$$(s-6)(s+54)=0.$$

Now, either $s-6=0$ or $s+54=0$.
$\rightarrow s=6$ $\rightarrow s=-54$.

So speed = 6 or −54 km/hr.

But speed cannot be negative.

$\Rightarrow$ $\boxed{\text{Speed of the stream is 6 km/hr.}}$



25) Given: $\triangle ABC$ is equilateral.

4

$\rightarrow AB=BC=CA$, $\angle A=\angle B=\angle C=60°$

D is a point on BC such that $BD=\frac{1}{3}BC$.

To prove: $9(AD)^2=7(AB)^2$.

Construction: Draw $AE \perp BC$.

Proof: Let $BD=x$.

$\Rightarrow BC=3x=AB=AC$ [$\because \triangle ABC$ is equilateral] [Given $BD=\frac{1}{3}BC$].

Also, we know that $BE=\frac{1}{2}BC$ [Altitude in equilateral $\triangle$ bisects base].

As $\angle AEB=90°$,

In ~~Triangle~~ $\triangle ABE$, by Pythagoras Theorem,

$BE^2+AE^2=AB^2$ $\rightarrow AB^2=9x^2$. $\rightarrow$ ②.

$\left(\frac{3x}{2}\right)^2+AE^2=(3x)^2$.

$\frac{9x^2}{4}+AE^2=9x^2$ $\rightarrow AE^2=\frac{3\times 9x^2}{4}$ $\rightarrow$ ①

Now, in $\triangle ADE$, $\angle E = 90°$.

$DE = BE - BD$

$= \frac{3x}{2} - x$.

By Pythagoras Theorem,

$DE^2 + AE^2 = AD^2$

$\left(\frac{3x}{2} - x\right)^2 + \frac{27x^2}{4} = AD^2$ [From ①].

$\left(\frac{x}{2}\right)^2 + \frac{27x^2}{4} = AD^2$.

$\frac{x^2 + 27x^2}{4} = AD^2$

$\Rightarrow AD^2 = \frac{28x^2}{4} = 7x^2 \rightarrow$ (b).

From (a) and (b),

$AB^2 = 9x^2$, $AD^2 = 7x^2$.

$7AB^2 = 63x^2$, $9AD^2 = 63x^2$.

$\Rightarrow 7AB^2 = 9AD^2$.

hence proved.

24) Given, sum of 4 consecutive no. in AP is 32.

(1) Also, ratio of $t_1 \times t_n$ (first × last) and two middle terms product = 7:15.

Let no. of terms be n. nth term = $t_n = a + (n-1)d$.

$\rightarrow t_1 = a + (1-1)d$.

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

As there are two middle terms, n is even.

$\Rightarrow$ middle term 1 $= a + \left(\frac{n+2}{2} - 1\right) d$. Let this be α.

middle term 2 $= a + \left(\frac{n}{2} - 1\right) d$. Let this be β.

Given, $\frac{t_1 \cdot t_n}{\alpha \cdot \beta} = \frac{7}{15}$.

$$\frac{a \times [a + (n-1)d]}{\left(a + \frac{n}{2}d\right)\left[a + \left(\frac{n}{2} - 1\right)d\right]} = \frac{7}{15}.$$

$$\rightarrow \frac{a^2 + a(n-1)d}{a^2 + \frac{n}{2}d \cdot \left(\frac{n}{2} - 1\right)d + a\left[\frac{n}{2}d + \left(\frac{n}{2} - 1\right)d\right]} = \frac{7}{15}.$$

$$\frac{a^2 + a(n-1)d}{a^2 + \frac{n^2}{4}d^2 - \frac{n}{2}d^2 + a(n-1)d} = \frac{7}{15}.$$

Cross-multiplying,

$$15a^2 + 15a(n-1)d = 7a^2 + \left(\frac{7n^2}{4} - \frac{7n}{2}\right)d^2 + 7a(n-1)d.$$

$$8a^2 + 8a(n-1)d = \left(\frac{7n^2}{4} - \frac{7n}{2}\right)d^2.$$

Assuming we take only 4 terms, then n will be 4.

Substituting ~~x is~~ n=4 in above equation,

$8a^2 + 8a(4-1)d = \left(\frac{7\cdot 4^2}{4} - \frac{7\times 4}{2}\right)d^2$

$8a^2 + 24ad = (28-14)d^2$

$8a^2 + 24ad = 14d^2 \to (1)$.

Sum = 32. $\to S_n = \frac{n}{2}[2a+(n-1)d]$.

$32 = \frac{4}{2}[2a+3d]$.

$2a+3d = 16 \to (2)$.

Squaring (2), $4a^2 + 9d^2 + 12ad = 256 \to (2.1)$

Substituting (3) in (2.1),

$-15d^2 + 9d^2 = 256$

$-6d^2 = 256$

$d^2 = -\frac{256}{6}$

Substituting (3) in (2.1), $7d^2 + 9d^2 = 256$.

$16d^2 = 256 \to d^2 = 16,\ d = 4$.

Now, $2a + 3(4) = 16$.

$2a = 4$

$a = 2$. $\to$ Terms = 2, 6, 10, 14.

a and a+2d a+3d.

$\boxed{\text{The numbers are 2, 6, 10 and 14.}}$

when n=4,

terms $a+d,\ a,\ a+2d,\ a+3d$.

$7a(a+3d) = (a+d)(a+2d)\times 15$.

$7(a^2+3ad) = (a^2+ad+2d^2+2ad)15$

∴ $\cancel{2d^2=0}$.

$\cancel{d=0}$.

$7a^2 + 21ad = 15a^2 + 45ad + 30d^2$

$-30d^2 = 8a^2 + 24ad$

$-15d^2 = 4a^2 + 12ad \to (3)$.

terms $a+d,\ a,\ a+2d,\ a+3d$.

$\frac{a(a+3d)}{(a+2d)(a+d)} = \frac{7}{15}$ (Given)

$15a^2 + 45ad = 7[a^2+3ad+2d^2]$

$15a^2 + 45ad = 7a^2 + 21ad + 14d^2$.

$8a^2 - 14d^2 + 24ad = 0$.

$14d^2 = 8a^2 + 24ad$.

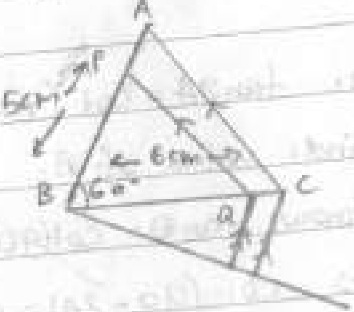
$7d^2 = 4a^2 + 12ad \to (3)$.

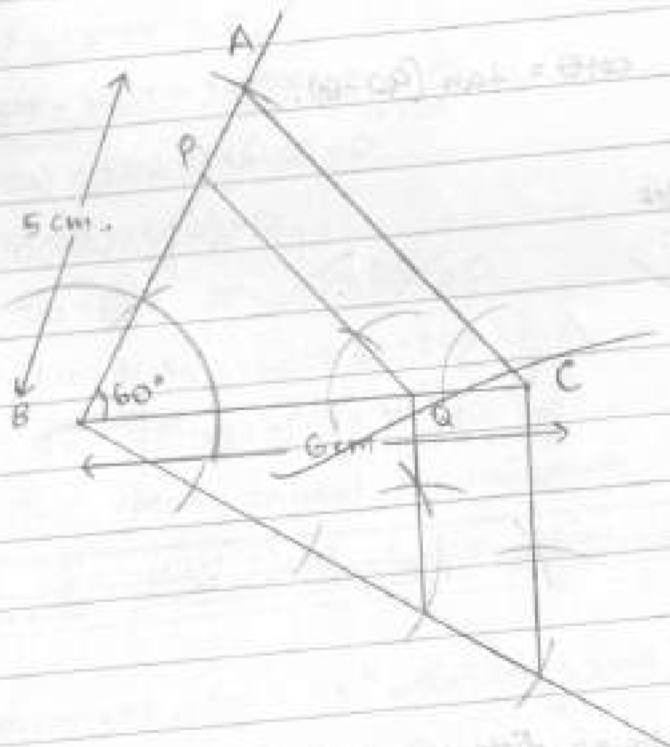
26) Given: $\triangle ABC$, $BC = 6cm$, $AB = 5cm$, $\angle ABC = 60°$.

To draw: $\triangle$ w/ $\frac{3}{4}$ sides of $\triangle ABC$.

4

Rough Diagram:





AB = 5cm

BC = 6cm

$\angle ABC = 60°$

$\triangle PBQ$ is required triangle.

PB = ~~5~~ 3.75 cm.

BQ = 4.5 cm.

PQ = 4.25 cm.

Section-c

15) Given: $\tan 2A = \cot(A-18)$, $0 \leq 2A < 90°$. (2A is acute)

(Choice 2) To find: value of A.

3

We know, $\tan\theta = \cot(90-\theta)$ and $\cot\theta = \tan(90-\theta)$.

$\rightarrow \cot(90-2A) = \cot(A-18)$

Applying $\cot^{-1}$, on both sides

$90 - 2A = A - 18.$

$108 = 3A.$

$\rightarrow A = 36°.$

$\boxed{\text{The value of A is } 36°.}$

---

16) Given: distance is 1500 km.

Usual speed = s.

3

We know, speed = $\frac{\text{distance}}{\text{time}}$ $\rightarrow$ ~~dist~~ time = $\frac{\text{distance}}{\text{speed}}$.

$\rightarrow$ From question, $\frac{1500}{100+s} + \frac{1}{2} = \frac{1500}{s}$. [half an hour late].
(30 mins = 0.5 hr).

$\frac{1500}{100+s} = \frac{1500}{s} - \frac{1}{2}.$

$\frac{1500}{100+s} = \frac{3000-s}{2s}$. Cross multiplying,

$3000s = 300000 - 100s + \cancel{3000s} - s^2$.

$s^2 + 100s - 300000 = 0$.

$s^2 + 600s - 500s - 300000 = 0$.

$s(s+600) - 500(s+600) = 0$

$(s-500)(s+600) = 0$.

$\Rightarrow s-500 = 0$ or $s+600 = 0$.

$\rightarrow s = 500$ km/h $\rightarrow s = -600$ km/h.

$\Rightarrow s = 500$ or -600 km/hr.

But speed cannot be negative.

$\Rightarrow$ $\boxed{\text{The usual speed of the plane is 500 km/hr.}}$

---

(4) Given, polynomial $p(x) = 2x^4 - 9x^3 + 5x^2 + 3x - 1$.

3

Two zeroes $\rightarrow 2+\sqrt{3}$ and $2-\sqrt{3}$.

$\Rightarrow$ Product of two zeroes is also a zero.

$\Rightarrow (2+\sqrt{3})(2-\sqrt{3}) = 4-3 = 1$ $[(a+b)(a-b) = a^2-b^2]$.

As 1 is a zero, $\Rightarrow x-1$ is a factor.

Dividing,

$$
\begin{array}{r|l}
x-1 & 2x^4-9x^3+5x^2+3x-1\ (2x^3-7x^2-2x+1 \\
 & \underline{2x^4-2x^3} \\
 & \quad -7x^3+5x^2 \\
 & \quad \underline{-7x^3+7x^2} \\
 & \qquad -2x^2+3x \\
 & \qquad \underline{-2x^2+2x} \\
 & \qquad\quad x-1 \\
 & \qquad\quad \underline{x-1} \\
 & \qquad\qquad 0
\end{array}
$$

⇒ By division algorithm,

$$p(x) = (x-1)\underbrace{(2x^3-7x^2-2x+1)}_{g(x)}.$$

Now, in a cubic polynomial, we know:

$$\text{sum of roots} = \frac{-\text{coeff. of } x^2}{\text{coeff. of } x^3}.$$

The roots of $g(x)$ are $2+\sqrt{3}$, $2-\sqrt{3}$ and α.

$$\rightarrow \alpha + 2+\sqrt{3}+2-\sqrt{3} = \frac{-(-7)}{2}$$

$$\alpha + 4 = \frac{7}{2}$$

$$\alpha = -\frac{1}{2}.$$ which is hence a zero of $p(x)$

⇒ $\boxed{\text{All zeroes are } -\frac{1}{2},\ 1,\ 2+\sqrt{3} \text{ and } 2-\sqrt{3}.}$

Bhaligram
68787026

(3) Numbers: 404, 96. To find: HCF and LCM.

3

$$\begin{array}{r|l} 2 & 404,\ 96 \\ \hline 2 & 202,\ 48 \\ \hline & 101,\ 24 \end{array}$$

$\Rightarrow$ Their HCF is 4.

404 = 2 × 202; 202 = 2 × 101; 101 = 7 × 13

96 = 2 × 48; 48 = 2 × 24; 24 = 2 × 12; 12 = 2 × 6; 6 = 2 × 3.

$404 = 2^2 \times 7 \times 13$

$96 = 2^5 \times 3$

$\boxed{\text{HCF} = \text{greatest common factor} = 2^2 = 4.}$

LCM = all factors (least power) = ~~2~~ $2^5 \times 3 \times 7 \times 13$

$= 96 \times 101$

$= \boxed{9696}$

Product of two numbers = 96 × 404

= 38784

Product of HCF + LCM = 9696 × 4

= 38784.

Hence, HCF × LCM = product of two numbers.

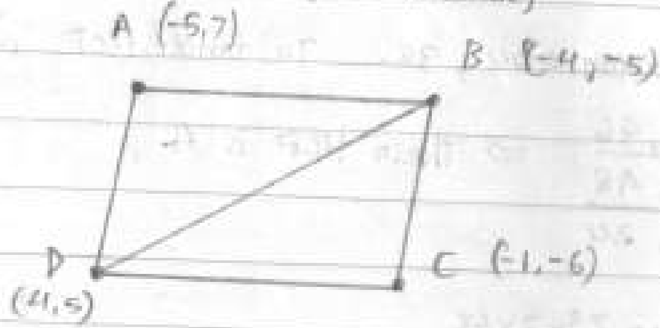
15) Vertices of quadrilateral ABCD:

(choice 2) $A(-5,7)$, $B(-4,-5)$, $C(-1,-6)$, $D(4,5)$

3

Area of quad ABCD.

= area $\triangle ABD$ + area $\triangle BCD$.



area $\triangle ABD \rightarrow$

$$= \frac{1}{2}\left[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)\right] \text{ sq. units.}$$

$$= \frac{1}{2}\left[-5(-5-5) + (-4)(5-7) + 4(7+5)\right]$$

$$= \frac{1}{2}\left[50 + 8 + 48\right]$$

$$= \frac{1}{2}\left[58+48\right].$$

$$= \frac{1}{2} \times 106 = 53 \text{ sq. units}^2.$$

area $\triangle BCD = \frac{1}{2}\left[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)\right]$.

$$= \frac{1}{2}\left[-4(-6-5) + (-1)(5+5) + (4)(-5+6)\right].$$

$$= \frac{1}{2}\left[44-10+4\right]$$

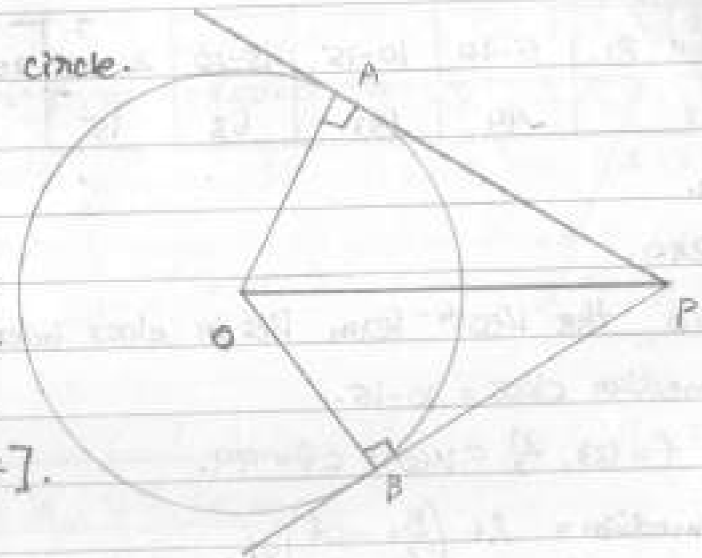
$$= \frac{1}{2} \times 38 = 19 \text{ sq. units}^2.$$

$\Rightarrow$ Area of quadrilateral = Area of two triangles = $53+19 = 72$ sq. units.

$\boxed{\text{Area of quadrilateral ABCD is 72 sq. units}}$

18) Given: Circle (O, r). AP and PB are tangents drawn to the circle.

3



To prove: PA = PB.

Construction: Join OA, OB and OP.

Proof: OA = OB [radius]. (side).

$\angle OAP = \angle OBP = 90°$ (right angle).

[$\because$ radius is perpendicular to tangent at point of contact].

OP = OP (hypotenuse).

So in $\triangle OAP$ and $\triangle OBP$,

by RHS congruency,

$\rightarrow \triangle OAP \cong \triangle OBP$.

by CPCT,

$\Rightarrow$ AP = BP.

hence proved.

22) Distribution of frequencies:

Salary in thousand Rs.	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of persons	49	133	63	15	6	7	4	2	1

3

To find: median.

no. of people = 280.

$\Rightarrow \frac{n}{2} = 140$, the 140^{th} term lies in class interval 10-15.

$\Rightarrow$ median class = 10-15.

$l = 10$, $h = 5$, $f = 133$, $\frac{n}{2} = 140$, $cf = 49$.

We know, median $= l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$.

$$\Rightarrow \text{median} = 10 + \frac{140 - 49}{133} \times 5.$$

$$= 10 + \frac{\cancel{91}^{13}}{\cancel{133}_{19}} \times 5.$$

$$= 10 + \frac{65}{19}$$

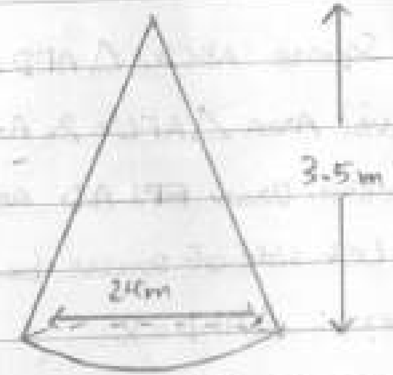
$$= 10 + 3.421$$

$$= 13.421.$$

The median salary is 13.421 thousand rupees.

21) Conical heap of rice:

(choice 2) Dimensions: diameter = 24m, height 3.5 m. → radius = 12m.



Volume of cone = $\frac{1}{3} \times \pi r^2 h$ cu. units.

$= \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5$ cu. m.

3

$= 132 \times 4$

$= 528$ cu. m.

The volume of the rice heap is 528 cu. m.

Area of cloth required = Curved surface area.

CSA of cone = $\pi r l$ sq. units where $l = \sqrt{h^2 + r^2}$ units.

Finding l: $l = \sqrt{h^2 + r^2}$ units

$= \sqrt{3.5^2 + 12^2}$ m

$= \sqrt{12.25 + 144}$

$= \sqrt{156.25}$

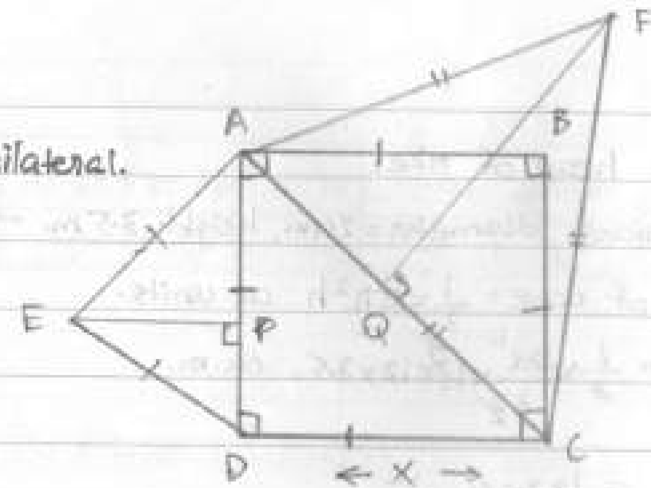
$= 12.5$ m.

$\Rightarrow$ CSA = $\pi r l$ sq. units

$= \frac{22}{7} \times 12.5 \times 12$

$= \frac{22 \times 150}{7} = \frac{3300}{7} = 471.\overline{428571}$ m².

The area of canvas cloth required is $471.\overline{428571}$ m².



17) Given: Square ABCD. $\triangle AED$ and $\triangle AFC$ are equilateral.

(choice 1) To prove: Area $\triangle AFC = 2 \times$ Area $\triangle AED$.

Construction: Draw $EP \perp AD$ and $FQ \perp AC$.

Proof: Let side of square be x.

$\Rightarrow$ sides of $\triangle AED = x$.

In $\triangle ABC$, $\angle B = 90°$.

$\Rightarrow$ By Pythagoras Theorem,

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

$x^2 + x^2 = AC^2 \Rightarrow AC = \sqrt{2}x. \Rightarrow$ sides of $\triangle AFC = \sqrt{2}x$.

We know, altitude of equilateral $\triangle$ bisects the base.

$\rightarrow PD = \frac{x}{2}$, $AQ = \frac{x}{\sqrt{2}}$.

In $\triangle AEP$, $\angle P = 90°$.

By Pythagoras theorem, $AE^2 = EP^2 + AP^2$.

$$x^2 = EP^2 + \left(\frac{x}{2}\right)^2.$$

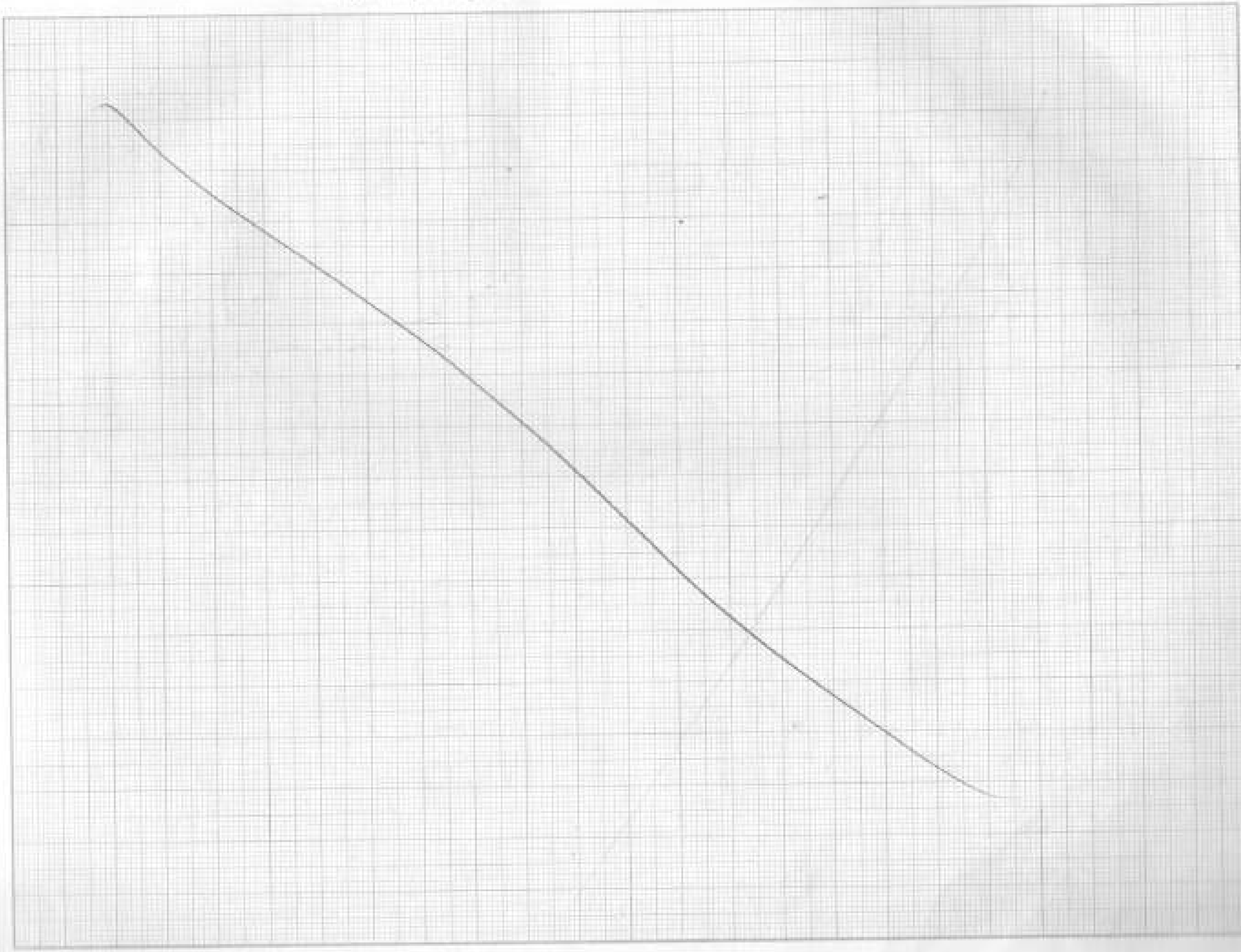
$$EP^2 = \frac{3x^2}{4} \rightarrow EP = \frac{\sqrt{3}}{2}x^2.$$

In $\triangle AFQ$, $\angle Q = 90°$.

By Pythagoras theorem, $AF^2 = FQ^2 + AQ^2$

$$2x^2 = FQ^2 + \frac{x^2}{2}.$$

$$FQ^2 = \frac{3x^2}{2} \rightarrow FQ = \frac{\sqrt{3}x}{\sqrt{2}}.$$



We know, Area of triangle = $\frac{1}{2} \times$ Base $\times$ height sq. units.

$\Rightarrow$ Area of $\triangle AFC = \frac{1}{2} \times \sqrt{2}x \times FQ$

$= \frac{1}{2} \cdot \sqrt{2}x \cdot \frac{\sqrt{3}}{\sqrt{2}}x$

$= \frac{\sqrt{3}}{2}x^2$.

Area of $\triangle AED = \frac{1}{2} \times x \times EP$.

$= \frac{1}{2} \cdot x \cdot \frac{\sqrt{3}}{2}x$

$= \frac{\sqrt{3}}{4}x^2$.

$\therefore$ Area of $\triangle AED = \frac{\sqrt{3}}{2}x^2 =$ Area of $\triangle AFC$.

hence proved.

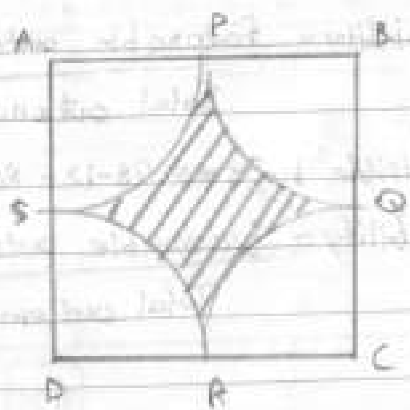
---

20) Given: side of square ABCD = 12 cm.

3

To find: shaded area.

Shaded area + Area of 4 quadrants = Area of square.



Area of square = s^2 sq. units

$= 12^2 = 144 \text{ cm}^2$.

Area of quadrant = $\frac{1}{4} \times \pi r^2$ sq. units

$= \frac{1}{4} \times 3.14 \times \frac{12}{2} \times \frac{12}{2}$

$= 9 \times 3.14 = \cancel{28.26}$ 28.26 cm^2.

$\Rightarrow$ shaded area = Area of square − 4×(Area of quadrant) sq.units

$= 144 - 4(28.26)$ sq.cm

$= 144 - 113.04$

$= 30.96\ cm^2$.

$\boxed{\text{The area of the shaded region is } 30.96\ cm^2.}$

Section-B

2) Integers, 1 to 100. (between)

$\Rightarrow$ total = 98 possible outcomes.

i) divisible by 8 → 12 numbers. (8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96).

$\Rightarrow$ Probability = $\frac{\text{Favorable outcome}}{\text{Total outcome}} = \frac{12}{98} = \boxed{\frac{6}{49}}$

ii) not divisible by 8 → 98 − 12 = 86 numbers.

$\Rightarrow$ Probability = $\frac{\text{Favorable outcome}}{\text{Total outcome}} = \frac{86}{98} = \boxed{\frac{43}{49}}$

$\Rightarrow$ ~~Shaded area = Area of square − 4 (Area of quadrant) sq. units~~

~~$= 144 - 4(28.26)$ sq. cm~~

~~$= 144 -$~~

11) Two dice tossed together.

2

$\Rightarrow$ Total outcome = 36.

i) doublet: (1,1), (2,2), (3,3), (4,4), (5,5), (6,6) → 6 possibilities.

Probability = $\frac{\text{Favorable outcome}}{\text{Total outcome}} = \frac{6}{36} = \boxed{\frac{1}{6}}$

ii) Sum of 10: (4,6), (6,4), (5,5) → 3 possibilities.

Probability = $\frac{\text{Favorable outcome}}{\text{Total outcome}} = \frac{3}{36} = \boxed{\frac{1}{12}}$

9) Sum of first 8 multiples of 3:

2

Forms an AP, $a = 3$, $d = 3$, $n = 8$.

Sum = $S_n = \frac{n}{2}[2a + (n-1)d]$

$S_8 = \frac{8}{2}[2\times3 + (8-1)3] = 4[6+21] = 4\times27 = 108.$

$\boxed{\text{The sum of the first 8 multiples of 3 is } 108}$

8) Given, rectangle ABCD.

2

$\Rightarrow$ opposite sides are equal.

hence, $x+y=30 \rightarrow (1)$

$x-y=14 \rightarrow (2)$.

$(1)+(2)$, $2x=44$

$x=22$.

Substituting in (1), $22+y=30$

$y=8$.

$\Rightarrow \boxed{x=22,\ y=8}$

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7) Given, $\sqrt{2}$ is irrational

2

To prove: $5+3\sqrt{2}$ is irrational.

Proof: Let us assume $5+3\sqrt{2}$ is rational. So it is in form $\frac{a}{b}$. ~~$[a,b \in R, b \neq 0]$~~ $[a,b \in Z, b \neq 0, HCF(a,b)=1]$

$\Rightarrow 5+3\sqrt{2}=\frac{a}{b}$

$3\sqrt{2}=\frac{a}{b}-5$.

$3\sqrt{2}=\frac{a-5b}{b}$

$\sqrt{2}=\frac{a-5b}{3b}$.

This shows that $\sqrt{2}$ is ~~irrational~~ rational (a-5b and 3b are integers).

But we know that $\sqrt{2}$ is irrational.

This contradicts our assumption that $5+\sqrt{2}\times 3$ is rational.

$\Rightarrow 5+3\sqrt{2}$ is irrational, hence proved.

Q\8) Points A(2,3), B(6,-3) divided by P(4,m).

Let the ratio be k:1.

2 By seg. section formula,

$$P(4,m) = \left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$$

$$(4,m) = \left(\frac{6k+2}{k+1}, \frac{-3k+3}{k+1}\right)$$

$$\Rightarrow \frac{6k+2}{k+1} = 4$$

$$6k+2 = 4k+4$$

$$2k = 2$$

$$k = 1.$$ → The ratio is 1:1.

now, $m = \frac{-3k+3}{k+1}$

$$m = \frac{-3+3}{1+1}$$

$m = 0.$ → $\boxed{\text{Value of } m \text{ is } 0, \text{ the point is } P(4,0).}$

Section - A.

6) $\frac{AB}{PQ} = \frac{1}{3}$. $\frac{ar\Delta ABC}{ar\Delta PQR} = \frac{AB^2}{PQ^2} = \frac{1}{3^2} = \frac{1}{9}$.

$\boxed{\text{Ratio of areas is } \frac{1}{9}.}$

5) $\cos^2 67° - \sin^2 23°$

$\cancel{= \cos^2 67° - \cos^2 67°}$

$(\cos 67 + \sin 23)(\cos 67 - \sin 23)$

$= (\cos 67 + \cos 67)(\cos 67 - \cos 67)$ $[\cos\theta = \sin(90-\theta)]$.

$= 0$.

$\boxed{\text{The value is } 0}$.

4) $d = -4$, $a_7 = 4$. $\boxed{\text{The first term is } 28.}$

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

$t_7 = a + (7-1)(-4)$

$4 = a + 6 \times (-4)$

$a = 24 + 4$

$a = 28$.

3) Distance between (x, y) and $(0,0)$.

$$\Rightarrow \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$$

$$=\sqrt{(x-0)^2+(y-0)^2}$$

$$=\sqrt{x^2+y^2}.$$

$\boxed{\text{The distance is } \sqrt{x^2+y^2}.}$

2) smallest prime $= 2$

smallest composite $= 4$

HCF $(2,4) = 2$.

$\boxed{\text{The HCF of the smallest prime and smallest composite is 2.}}$

1) $x^2-2kx-6=0$. let α be other root.

Product $= \frac{c}{a} = \frac{-6}{1} = -6$.

$3 \times \alpha = -6$

$\alpha = -2$.

Sum $= \frac{-b}{a} = -\frac{(-2k)}{1} = 2k$.

$\Rightarrow 3+(-2) = 2k$

$1 = 2k$, $k = \frac{1}{2}$.

$\boxed{\text{Value of } k \text{ is } \tfrac{1}{2}}$