# ICSE Board <br> Class IX Mathematics <br> Paper 2 - Solution 

## SECTION - A (40 Marks)

Q. 1.
(a) $\frac{\sin 30^{\circ}-\sin 90^{\circ}+2 \cos 0^{\circ}}{\tan 30^{\circ} \times \tan 60^{\circ}}=\frac{\frac{1}{2}-1+2}{\frac{1}{\sqrt{3}} \times \sqrt{3}}=\frac{1}{2}+1=\frac{3}{2}=1 \frac{1}{2}$
(b) $\frac{3 \times 27^{n+1}+9 \times 3^{n-1}}{8 \times 3^{3 n}-5 \times 27^{n}}=\frac{3 \times 3^{3 n+3}+9 \times 3^{3 n-1}}{8 \times 3^{3 n}-5 \times 3^{3 n}}$

$$
\begin{aligned}
& =\frac{3^{3 n}\left(3 \times 3^{3}+9 \times 3^{-1}\right)}{3^{3 n}(8-5)} \\
& =\frac{3 \times 27+9 \times \frac{1}{3}}{3} \\
& =\frac{81+3}{3} \\
& =\frac{84}{3} \\
& =28
\end{aligned}
$$

(c) Given, $\frac{2+\sqrt{3}}{2-\sqrt{3}}=x+y \sqrt{3}$

Rationalize the denominator

$$
\begin{aligned}
& \frac{(2+\sqrt{3})(2+\sqrt{3})}{(2-\sqrt{3})(2+\sqrt{3})}=x+y \sqrt{3} \\
& \Rightarrow \frac{4+3+4 \sqrt{3}}{4-3}=x+y \sqrt{3} \\
& \Rightarrow 7+4 \sqrt{3}=x+y \sqrt{3}
\end{aligned}
$$

Comparing the real and irrational parts on both sides, we get $x=7, y=4$
Q. 2.
(a)

Given that,
$\operatorname{arc} \mathrm{AXB}=\frac{1}{2} \operatorname{arc} \mathrm{BYC}$
$\Rightarrow \angle \mathrm{AOB}=\frac{1}{2} \angle \mathrm{BOC}$
Since $A O C$ is a straight line,
$\angle \mathrm{AOB}+\angle \mathrm{BOC}=180^{\circ}$
$\therefore \frac{1}{2} \angle \mathrm{BOC}+\angle \mathrm{BOC}=180^{\circ}$
$\therefore \frac{3}{2} \angle \mathrm{BOC}=180^{\circ}$
$\therefore \angle \mathrm{BOC}=180^{\circ} \times \frac{2}{3}=120^{\circ}$

(b) Given, $x+y=6$; $x-y=4$

We know that
$(x+y)^{2}=(x-y)^{2}+4 x y$
$(6)^{2}=(4)^{2}+4 x y$
$\Rightarrow 36-16=4 x y$
$\Rightarrow 20=4 x y$
$\Rightarrow \mathrm{xy}=5$
(c) Let, $\frac{\log a}{b-c}=\frac{\log b}{c-a}=\frac{\log c}{a-b}=k$
$\Rightarrow \log \mathrm{a}=\mathrm{k}(\mathrm{b}-\mathrm{c}), \log \mathrm{b}=\mathrm{k}(\mathrm{c}-\mathrm{a})$ and $\log \mathrm{c}=\mathrm{k}(\mathrm{a}-\mathrm{b})$
Now, $A=a^{a} \cdot b^{b} . c^{c}$
Taking log both sides
$\log A=a \log a+b \log b+c \log c$
$=a \cdot k(b-c)+b \cdot k(c-a)+c \cdot k(a-b)$
$=\mathrm{k}[\mathrm{ab}-\mathrm{ac}+\mathrm{bc}-\mathrm{ab}+\mathrm{ac}-\mathrm{bc}]$
$=\mathrm{k} \times 0=0$
$\Rightarrow \log \mathrm{A}=0$
$\Rightarrow \log A=\log 1 \Rightarrow A=1$
$\therefore a^{a} \cdot b^{b} . c^{c}=1$
Hence Proved.
Q. 3.
(a) In $\triangle \mathrm{ADC}$,
$\mathrm{x}+2 \mathrm{x}+90^{\circ}=180^{\circ}$ (sum of all angles in a $\Delta$ is $180^{\circ}$ )
$\Rightarrow 3 \mathrm{x}=90^{\circ}$
$\Rightarrow \mathrm{x}=30^{\circ}$
$\Rightarrow \mathrm{m} \angle \mathrm{D}=30^{\circ}$

$\therefore \mathrm{m} \angle \mathrm{B}=\mathrm{m} \angle \mathrm{D}=30^{\circ}$ [Opposite angles of \|gm are equal]
And $\mathrm{m} \angle \mathrm{A}=\mathrm{m} \angle \mathrm{C}=180^{\circ}-30^{\circ}$
[sum of co- interior angles $=180^{\circ}$ in a ||gm]
$\Rightarrow \mathrm{m} \angle \mathrm{A}=\mathrm{m} \angle \mathrm{C}=150^{\circ}$
Thus, the angles of a parallelogram are $150^{\circ}, 30^{\circ}, 150^{\circ}$ and $30^{\circ}$.
(b) Let $x=5.3 \overline{47}=5.34747 \ldots .$.

Multiplying (i) by 10, we get
$10 \mathrm{x}=53.4747 \ldots$....
Multiplying (ii) by 100 , we get
$1000 x=5347.47$.....
Subtracting (ii) from (iii), we get
$1000 x-10 x=5347.47 \ldots-53.47 \ldots$
$\Rightarrow 990 \mathrm{x}=5294$
$\Rightarrow \mathrm{x}=\frac{5294}{990}$
$\Rightarrow \mathrm{x}=\frac{2647}{495}$
$\therefore 5.3 \overline{47}=\frac{2647}{495}$
(c) While drawing frequency polygon, we represent each class by its mid-value.

| Classes <br> Rain (mm) | Class Marks | Days |
| :---: | :---: | :---: |
| $0-10$ | 5 | 0 |
| $10-20$ | 15 | 8 |
| $20-30$ | 25 | 10 |
| $30-40$ | 35 | 14 |
| $40-50$ | 45 | 20 |
| $50-60$ | 55 | 15 |
| $60-70$ | 65 | 8 |
| $70-80$ | 75 | 7 |
| $80-90$ | 85 | 6 |
| $90-100$ | 95 | 4 |
| $100-110$ | 105 | 0 |

The frequency polygon is as follows:

(d)

## Q. 4.

(a) Each exterior angle of first polygon $=\frac{360^{\circ}}{n-1}$

Each exterior angle of second polygon $=\frac{360^{\circ}}{n+2}$
$\frac{360^{\circ}}{n-1}-\frac{360^{\circ}}{n+2}=6$
$\Rightarrow \frac{1}{\mathrm{n}-1}-\frac{1}{\mathrm{n}+2}=\frac{1}{60}$
$\Rightarrow \frac{\mathrm{n}+2-\mathrm{n}+1}{(\mathrm{n}-1)(\mathrm{n}+2)}=\frac{1}{60}$
$\Rightarrow \frac{3}{\mathrm{n}^{2}+2 \mathrm{n}-\mathrm{n}-2}=\frac{1}{60}$
$\Rightarrow \mathrm{n}^{2}+\mathrm{n}-2=180$
$\Rightarrow \mathrm{n}^{2}+\mathrm{n}-182=0$
$\Rightarrow \mathrm{n}^{2}+14 \mathrm{n}-13 \mathrm{n}-182=0$
$\Rightarrow \mathrm{n}(\mathrm{n}+14)-13(\mathrm{n}+14)=0$
$\Rightarrow(\mathrm{n}+14)(\mathrm{n}-13)=0$
$\mathrm{n}=-14$ is not applicable
$\therefore \mathrm{n}-13=0$
$\therefore \mathrm{n}=13$
(b)

Given: $\mathrm{A} \| \mathrm{gm} \mathrm{ABCD}, \mathrm{E}$ and F are the midpoints of AB and $D C$. Line $P Q$ meets $A D, E F$ and $B C$ at $P, G$ and $Q$ respectively.
To prove: $\mathrm{PG}=\mathrm{GQ}$
Proof: $\mathrm{AE}=\frac{1}{2} \mathrm{AB}$ and $\mathrm{DF}=\frac{1}{2} \mathrm{DC}$
[ E and F are the mid-points]

$\Rightarrow \mathrm{AE}=\mathrm{DF}$
Also, AE || DF [As AB || DC]
AE and DF are the parts of AB and DC .
$\therefore$ AEFD is a parallelogram
[ $\because$ Opposite sides of parallelogram are equal and parallel]
$\therefore \mathrm{AD}\|\mathrm{EF}\| \mathrm{BC}$
$\therefore \mathrm{PG}=\mathrm{GQ}$
[By intercept theorem $\mathrm{AD}, \mathrm{EF}$ and BC are parallel, PQ cuts them] Hence proved.
(c) $\mathrm{P}=$ Rs. $5000, \mathrm{r}=12 \%, \mathrm{~T}=1$ year

Amount at the end of first year

$$
\begin{aligned}
& =5000+\left(\frac{5000 \times 12 \times 1}{100}\right) \\
& =\text { Rs. } 5000+600=\text { Rs. } 5600
\end{aligned}
$$

Amount at the end of first year after payment of Rs. 2000

$$
\text { = Rs. } 5600 \text { - Rs. } 2000 \text { = Rs. } 3600
$$

Amount at the end of second year

$$
\begin{aligned}
& =3600+\left(\frac{3600 \times 12 \times 1}{100}\right) \\
& =\text { Rs. } 3600+432=\text { Rs. } 4032
\end{aligned}
$$

Amount at the end of second year after payment of Rs. $2000=$ Rs. $4032-$ Rs. $2000=$ Rs. 2032
Amount at the end of third year

$$
\begin{aligned}
& =2032+\left(\frac{2032 \times 12 \times 1}{100}\right) \\
& =\text { Rs. } 2032+\text { Rs. } 243.84 \\
& =\text { Rs. } 2275.84
\end{aligned}
$$

## SECTION - B (40 Marks)

Q. 5.
(a) Area of a square formed $=484 \mathrm{~m}^{2}$
$\Rightarrow(\text { Side })^{2}=484$
$\Rightarrow$ Side $=22 \mathrm{~m}$
Thus, perimeter of a square $=4 \times$ Side $=4 \times 22=88 \mathrm{~m}$
Let $r$ be the radius of the circle formed.
Now,
Circumference of a circle $=$ Perimeter of a square
$\Rightarrow 2 \times \frac{22}{7} \times \mathrm{r}=88$
$\Rightarrow \mathrm{r}=\frac{88 \times 7}{2 \times 22}$
$\Rightarrow \mathrm{r}=14 \mathrm{~m}$
$\therefore$ Area of a circle $=\pi r^{2}=\frac{22}{7} \times 14 \times 14=616 \mathrm{~m}^{2}$
(b) $\sin \theta=\frac{\mathrm{p}}{\mathrm{q}}=\frac{\text { perpendicular }}{\text { hypotenuse }}=\frac{\mathrm{AB}}{\mathrm{AC}}$

By Pythagoras theorem,

$$
\mathrm{BC}^{2}=\mathrm{AC}^{2}-\mathrm{AB}^{2}=\mathrm{q}^{2}-\mathrm{p}^{2}
$$

$B C=\sqrt{q^{2}-p^{2}}$
$\cos \theta=\frac{B C}{A C}=\frac{\sqrt{q^{2}-p^{2}}}{q}$


Now,

$$
\sin \theta+\cos \theta=\frac{p}{q}+\frac{\sqrt{q^{2}-p^{2}}}{q}=\frac{\sqrt{q^{2}-p^{2}}+p}{q}
$$

(c) Points $(a, 0),(0, b)$ and $(1,1)$ are collinear. So, area of triangle formed by these points will be 0 .

$$
\begin{aligned}
& \Rightarrow \frac{1}{2}\left[x_{1}\left(y_{2}-y_{3}\right)+x_{2}\left(y_{3}-y_{1}\right)+x_{3}\left(y_{1}-y_{2}\right)\right]=0 \\
& \Rightarrow[a(b-1)+0(1-0)+1(0-b)]=0 \\
& \Rightarrow a b-a-b=0 \\
& \Rightarrow a b=a+b
\end{aligned}
$$

On dividing throughout by ab, we get

$$
1=\frac{1}{a}+\frac{1}{b}
$$

Q. 6.
(a)

$$
\begin{aligned}
& \left(x^{2}+y^{2}-z^{2}\right)^{2}-(2 x y)^{2} \\
& =\left(x^{2}+y^{2}-z^{2}+2 x y\right)\left(x^{2}+y^{2}-z^{2}-2 x y\right) \\
& =\left(x^{2}+y^{2}+2 x y-z^{2}\right)\left(x^{2}+y^{2}-2 x y-z^{2}\right) \\
& =\left\{(x+y)^{2}-(z)^{2}\right\}\left\{(x-y)^{2}-(z)^{2}\right\} \\
& =(x+y+z)(x+y-z)(x-y-z)(x-y+z)
\end{aligned}
$$

(b) Given: A parallelogram ABCD , such that $\mathrm{BD} \perp \mathrm{AC}$.

To prove: ABCD is a rhombus
Proof:
In $\triangle \mathrm{OAB}$ and $\triangle \mathrm{OBC}$
OA = OC [Diagonals of a ||gm bisect each]
$\angle \mathrm{AOB}=\angle \mathrm{BOC} \quad\left[\right.$ Each $90^{\circ}$ ]
$\mathrm{OB}=\mathrm{OB}$

$\therefore \triangle \mathrm{OAB} \cong \triangle \mathrm{OBC}$ [SAS axioms of congruency]

$$
\begin{aligned}
& \mathrm{AB}=\mathrm{BC} \quad[\mathrm{C} . \mathrm{P} . \mathrm{C} . \mathrm{T}] \\
& \mathrm{BC}=\mathrm{AD} \text { and } \mathrm{AB}=\mathrm{DC} \quad[\text { Given }] \\
& \Rightarrow \mathrm{AB}=\mathrm{DC}=\mathrm{BC}=\mathrm{AD}
\end{aligned}
$$

Hence $A B C D$ is a rhombus.
(c) $3 a=p\left(\frac{x}{2}-y\right)$
$\Rightarrow \frac{\mathrm{x}}{2}-\mathrm{y}=\frac{3 \mathrm{a}}{\mathrm{p}}$
$\Rightarrow \mathrm{y}=\left(\frac{\mathrm{x}}{2}-\frac{3 \mathrm{a}}{\mathrm{p}}\right)$
$\Rightarrow \mathrm{y}=\left(\frac{\mathrm{px}-6 \mathrm{a}}{2 \mathrm{p}}\right)$
Given $\mathrm{a}=32, \mathrm{x}=4, \mathrm{p}=5$
$\Rightarrow \mathrm{y}=\frac{5 \times 4-6 \times 32}{2 \times 5}$
$\Rightarrow \mathrm{y}=\frac{20-192}{10}$
$\Rightarrow \mathrm{y}=-17.2$

## Q. 7.

(a) $2 x-3 y=7 \Rightarrow 2 x=7+3 y$

$$
\Rightarrow x=\frac{7+3 y}{2}
$$

Taking convenient values of $y$, we get

| x | 3.5 | 5 | 8 |
| :---: | :---: | :---: | :---: |
| y | 0 | 1 | 3 |

And $x+6 y=11 \Rightarrow x=11-6 y$
Taking convenient values of $y$, we get

| x | 5 | -1 | -7 |
| :---: | :---: | :---: | :---: |
| y | 1 | 2 | 3 |

Now we plot these points on graph paper as follows:


The point of intersection of the two lines is $(5,1)$.
Hence the solution set is $\mathrm{x}=5, \mathrm{y}=1$.
(b) (i) Parallelograms BFED and AFEC are on the same base FE and between the same parallels AD || EF. Thus, they are equal in area.
$\therefore \operatorname{ar}(\| g m$ BFED $)=\operatorname{ar}(| | g m ~ A F E C)=140 \mathrm{~cm}^{2}$
(ii) $\triangle \mathrm{BFD}$ and ||gm BFED are on the same base BD and between the same parallels BD and FE.

$$
\therefore \mathrm{A}(\triangle \mathrm{BFD})=\frac{1}{2} \times \mathrm{A}(\| \mathrm{gm} \mathrm{BFED})=\frac{1}{2} \times 140=70 \mathrm{~cm}^{2}
$$

## Q. 8.

(a) Given: $P Q R S$ is a quadrilateral, and $P R$ and $Q S$ are its diagonals.

To Prove: $(P Q+Q R+R S+S P)>(P R+Q S)$
Proof:

1. In $\triangle P Q S, S P+P Q>Q S$
2. In $\triangle P Q R, P Q+Q R>P R$
3. In $\triangle Q R S,(Q R+R S)>Q S$
4. In $\Delta \mathrm{RSP},(\mathrm{RS}+\mathrm{SP})>\mathrm{PR}$

[Sum of the two sides of a $\Delta$ is greater than the third side]
Adding 1, 2, 3 and 4
$2(P Q+Q R+R S+S P)>2(P R+Q S)$
$\Rightarrow P Q+Q R+R S+S P>P R+Q S$
[Hence Proved]
(b) Let the two places $\mathrm{P}_{1}$ and $\mathrm{P}_{2}$ be 30 km apart and let A start from $\mathrm{P}_{1}$ and B fromP $\mathrm{P}_{2}$.

Let A's speed of walking be $x \mathrm{~km} / \mathrm{hr}$ and B's speed be $y \mathrm{~km} / \mathrm{hr}$.
According to the question, when they walk in the same direction
$10(x-y)=30$
When they walk in opposite directions
$2(x+y)=30$
On dividing (i) by (ii), we get
$\frac{5(x-y)}{x+y}=1 \Rightarrow 5 x-5 y=x+y$
$\Rightarrow 4 \mathrm{x}-6 \mathrm{y}=0$
On multiplying (ii) by 2 , we get
$4 x+4 y=60$
Subtracting (iii) from (iv), we get
$10 y=60 \Rightarrow y=6$
Substituting value of $y$ in (iv),
$4 \mathrm{x}+4(6)=60$
$\Rightarrow 4 \mathrm{x}+24=60 \Rightarrow 4 \mathrm{x}=36$
$\Rightarrow \mathrm{x}=\frac{36}{4}=9$
$\therefore$ A's speed $=9 \mathrm{~km} / \mathrm{hr}$ and B's speed $=6 \mathrm{~km} / \mathrm{hr}$

## Q. 9.

(a) Mean height of the 10 girls $=1.38 \mathrm{~m}$

Sum of heights of 10 girls $=1.38 \times 10=13.8 \mathrm{~m}$
Mean height of 40 boys $=1.44 \mathrm{~m}$
Sum of heights of 40 boys $=1.44 \times 40=57.6 \mathrm{~m}$
Sum of heights of 50 students ( 10 girls +40 boys) $=13.8+57.6=71.4 \mathrm{~m}$
$\therefore$ Mean height of 50 students $=\frac{71.4}{50}=1.428 \mathrm{~m}$
(b) Given: $\mathrm{m} \angle \mathrm{D}=90^{\circ}, \mathrm{AB}=8 \mathrm{~cm}, \mathrm{BC}=6 \mathrm{~cm}$ and $\mathrm{CA}=3 \mathrm{~cm}$

To find: length of $C D$
Let $C D=x \mathrm{~cm}$
In $\triangle \mathrm{ADC}$,
$\mathrm{AD}^{2}+\mathrm{CD}^{2}=\mathrm{AC}^{2} \quad[$ By Pythagoras theorem $]$
$\mathrm{AD}^{2}=\mathrm{AC}^{2}-\mathrm{DC}^{2}=3^{2}-\mathrm{x}^{2}$
$\mathrm{AD}^{2}=9-\mathrm{x}^{2}$
In $\triangle \mathrm{ADB}$,
$\mathrm{AD}^{2}+\mathrm{BD}^{2}=\mathrm{AB}^{2} \quad$ [By Pythagoras theorem]
$9-x^{2}+(6+x)^{2}=8^{2}\left[\because \mathrm{AD}^{2}=9-x^{2}\right.$ and $\left.B D=6+x\right]$
$\Rightarrow 9-x^{2}+36+x^{2}+12 x=64$
$\Rightarrow 12 \mathrm{x}=64-45=19$
$\therefore \mathrm{x}=\frac{19}{12}$
$\mathrm{CD}=\frac{19}{12} \mathrm{~cm}=1 \frac{7}{12}$
(c) Volume of rectangular tank $=80 \times 60 \times 60 \mathrm{~cm}^{3}=288000 \mathrm{~cm}^{3}$

One liter $=1000 \mathrm{~cm}^{3}$
Volume of water flowing in per sec
$=1.5 \mathrm{~cm}^{2} \times 3.2 \frac{\mathrm{~m}}{\mathrm{~s}}$
$=15 . \mathrm{cm}^{2} \times \frac{(3.2 \times 100) \mathrm{cm}}{\mathrm{s}}$
$=480 \frac{\mathrm{~cm}^{3}}{\mathrm{~s}}$
Volume of water flowing in $1 \mathrm{~min}=480 \times 60=28800 \mathrm{~cm}^{3}$
Hence,
$28800 \mathrm{~cm}^{3}$ of water can be filled in 1 min
$\Rightarrow$ Time required to fill $288000 \mathrm{~cm}^{3}$ of water $=\left(\frac{1}{28800} \times 288000\right) \min =10 \mathrm{~min}$
Q. 10.
(a) Using $\sec \left(90^{\circ}-\theta\right)=\operatorname{cosec} \theta, \tan \left(90^{\circ}-\theta\right)=\cot \theta$

And $\cos \left(90^{\circ}-\theta\right)=\sin \theta$
$\frac{\sec \left(90^{\circ}-\theta\right) \cdot \operatorname{cosec} \theta-\tan \left(90^{\circ}-\theta\right) \cot \theta+\cos ^{2} 25^{\circ}+\cos ^{2} 65^{\circ}}{3 \tan 27^{\circ} \tan 63^{\circ}}$
$=\frac{\operatorname{cosec} \theta \cdot \operatorname{cosec} \theta-\cot \theta \cdot \cot \theta+\cos ^{2}\left(90^{\circ}-65^{\circ}\right)+\cos ^{2} 65^{\circ}}{3 \tan \left(90^{\circ}-63^{\circ}\right) \tan 63^{\circ}}$
$=\frac{\operatorname{cosec}^{2} \theta-\cot ^{2} \theta+\sin ^{2} 65^{\circ}+\cos ^{2} 65^{0}}{3 \cot 63^{0} \tan 63^{0}}$
$=\frac{1+1}{3}$
$=\frac{2}{3}$
(b) Steps of construction:

1. We draw $\mathrm{AB}=4.5 \mathrm{~cm}$
2. Now we construct $\mathrm{m} \angle \mathrm{BAE}=60^{\circ}$
3. Then we cut off $\mathrm{AD}=4.5 \mathrm{~cm}$ from AE
4. We draw two arcs of radius 4.5 cm , one with centre at D and other at B .
5. Let them cut at C .
6. Join DC and BC.
$A B C D$ is the required rhombus.

(c) Construction: Draw $\mathrm{OM} \perp \mathrm{AB}$ and $\mathrm{ON} \perp \mathrm{CD}$. Join OB and OD .

$\mathrm{BM}=\frac{\mathrm{AB}}{2}=\frac{5}{2}$ and $\mathrm{ND}=\frac{\mathrm{CD}}{2}=\frac{11}{2}$ (Perpendicular from centre bisects the chord)
Let ON be x.
Then, $O M$ will be $6-x$.
In $\triangle \mathrm{MOB}$,
$\mathrm{OM}^{2}+\mathrm{MB}^{2}=\mathrm{OB}^{2}$
$\therefore(6-\mathrm{x})^{2}+\left(\frac{5}{2}\right)^{2}=\mathrm{OB}^{2}$
$\therefore 36+\mathrm{x}^{2}-12 \mathrm{x}+\frac{25}{4}=\mathrm{OB}^{2}$
In $\triangle \mathrm{NOD}, \mathrm{ON}^{2}+\mathrm{ND}^{2}=\mathrm{OD}^{2}$
$\therefore \mathrm{OD}^{2}=\mathrm{x}^{2}+\left(\frac{11}{2}\right)^{2}=\mathrm{x}^{2}+\frac{121}{4}$
We have $O B=O D \quad$....(radii of same circle)
$36+x^{2}-12 x+\frac{25}{4}=x^{2}+\frac{121}{4} \ldots .[$ [From (1) and (2)]
$\therefore 12 x=36+\frac{25}{4}-\frac{121}{4}=\frac{144+25-121}{4}=\frac{48}{4}=12$
$\therefore 12 \mathrm{x}=12$
$\Rightarrow \mathrm{x}=1$
From equation (2),
$\mathrm{OD}^{2}=(1)^{2}+\left(\frac{121}{4}\right)=1+\frac{121}{4}=\frac{125}{4}$
$\Rightarrow \mathrm{OD}=\frac{5}{2} \sqrt{5}$
Hence, the radius of the circle is $\frac{5}{2} \sqrt{5} \mathrm{~cm}$.
Q. 11.
(a) Given: $a+\frac{1}{a}=p$,

Cubing on both the sides, we get

$$
\begin{aligned}
& \left(a+\frac{1}{a}\right)^{3}=p^{3} \\
& \Rightarrow a^{3}+\frac{1}{a^{3}}+3\left(a+\frac{1}{a}\right)=p^{3} \\
& \Rightarrow a^{3}+\frac{1}{a^{3}}+3 p=p^{3} \\
& \Rightarrow a^{3}+\frac{1}{a^{3}}=p^{3}-3 p=p\left(p^{2}-3\right)
\end{aligned}
$$

Hence Proved.
(b) Let $\frac{1}{x+y}=a, \frac{1}{x-y}=b$

Then, we have
$5 a+3 b=4$
$2 \mathrm{a}+5 \mathrm{~b}=\frac{27}{5}$
Multiplying equation (i) by 2 and equation (ii) by 5 , we get
$10 \mathrm{a}+6 \mathrm{~b}=8$
$10 a+25 b=27$
Subtracting (iv) from (iii), we get $-19 b=-19$
$\mathrm{b}=\frac{-19}{-19}=1$
Substituting value of $b$ in equation (i), we get

$$
5 a+3(1)=4
$$

$$
\Rightarrow 5 a+3=4 \Rightarrow 5 \mathrm{a}=1 \Rightarrow \mathrm{a}=\frac{1}{5}
$$

Now $\frac{1}{x+y}=a, \frac{1}{x-y}=b$

$$
\begin{align*}
\therefore \frac{1}{x+y}=\frac{1}{5}, & \frac{1}{x-y}=1 \\
\Rightarrow x+y=5 & \ldots . .(v)  \tag{v}\\
x-y=1 & \ldots .(v i) \tag{vi}
\end{align*}
$$

Adding (v) and (vi), we get $2 \mathrm{y}=4 \Rightarrow \mathrm{y}=2$
Substituting the value of $y$ in equation (vi), we get $x-2=1 \Rightarrow x=3$
Hence, $x=3, y=2$.
(c)

| x | 25 | 35 | 45 | 55 | 65 | 75 | Total |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| f | 10 | 6 | 8 | 12 | 5 | 9 | 50 |
| fx | 250 | 210 | 360 | 660 | 325 | 675 | 2,480 |

Here, $\quad \sum \mathrm{f}=50, \sum \mathrm{fx}=2480$
$\therefore$ Mean $=\frac{\sum \mathrm{fx}}{\sum \mathrm{f}}=\frac{2480}{50}=49.6$

