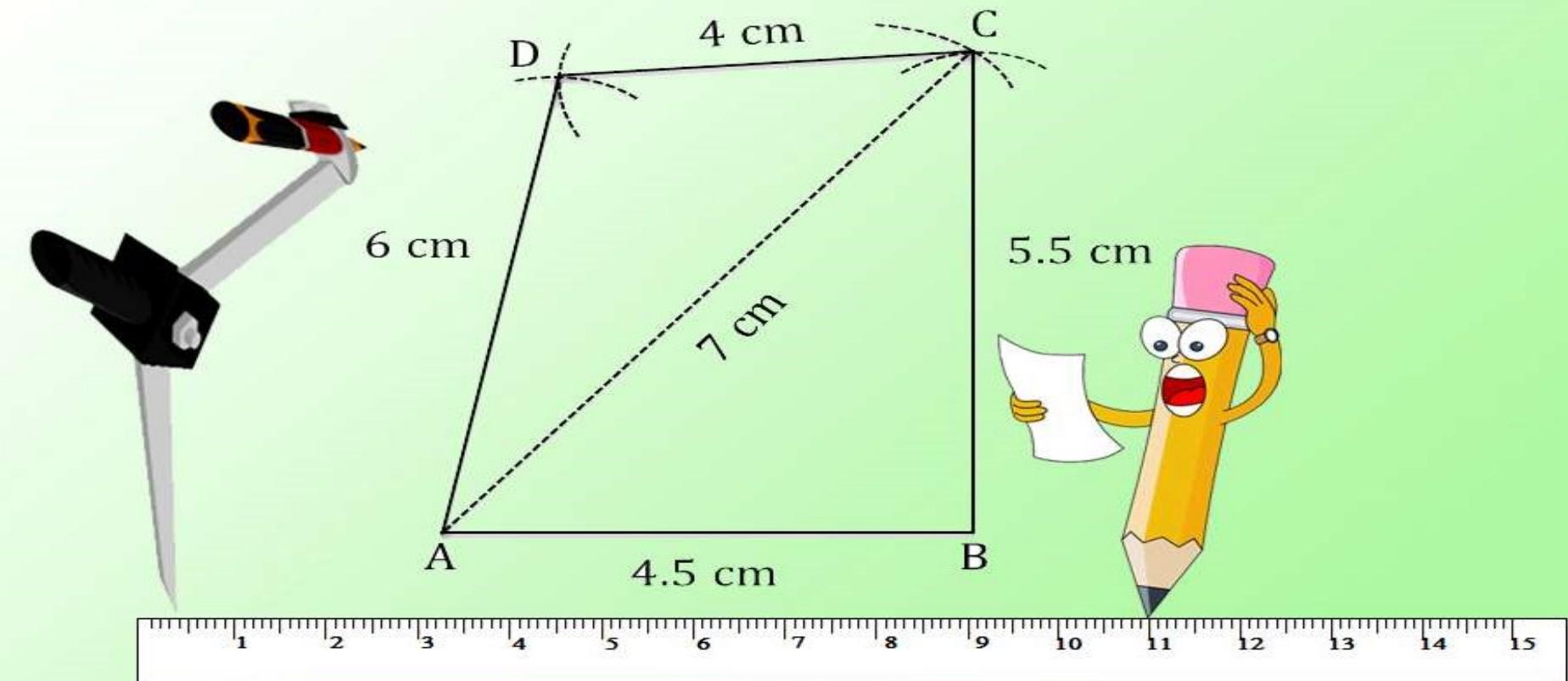


Practical Geometry



Lecture 1

1

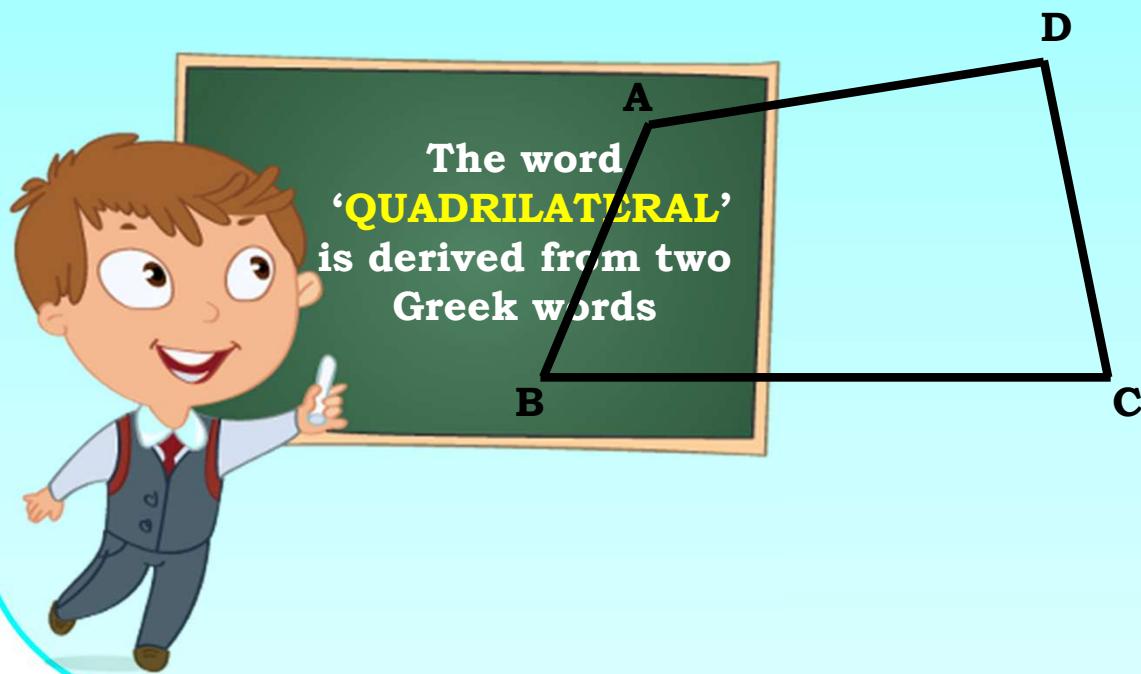
Module

QUADRILATERAL

⇒ **FOUR**

⇒ **SIDES**

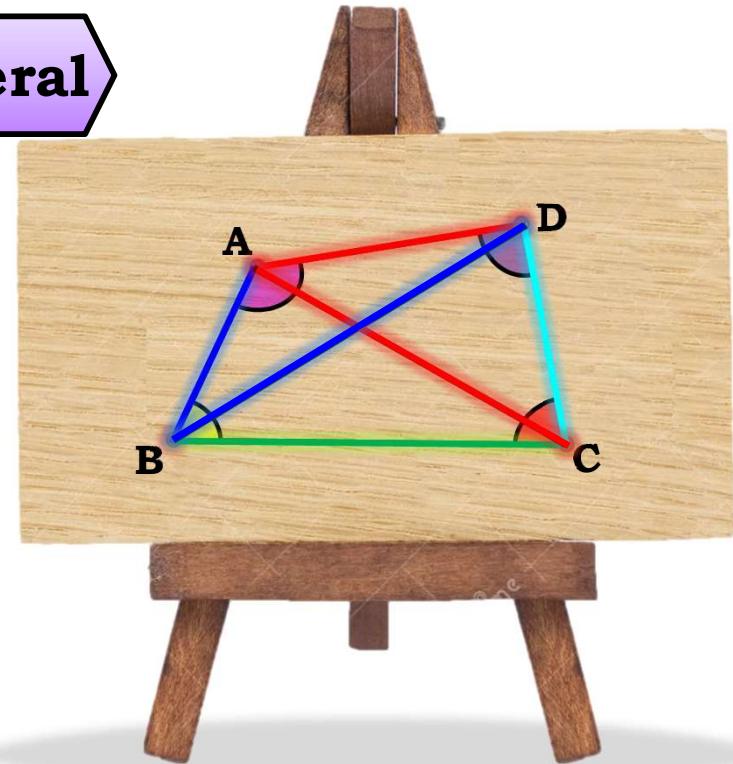
Definition : Any four sided closed figure is called a Quadrilateral.





Elements of a Quadrilateral

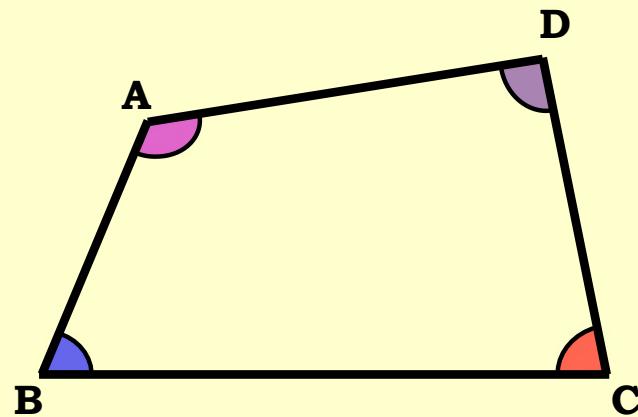
Elements	Numbers	Names
Vertices	4	A, B, C, D
Sides	4	AB, BC, CD, DA
Angles	4	$\angle A, \angle B, \angle C, \angle D$
Diagonals	2	AC, BD





Sum of all angles of a quadrilateral is 360° .

$$\angle A + \angle B + \angle C + \angle D = 360^\circ$$



Module 2

Constructing a quadrilateral

1

When the lengths of four sides and a diagonal are given.

2

When two adjacent sides and three angles are known.
We shall learn how to construct a unique quadrilateral using different measurements.

3

When two adjacent sides and three angles are known.

4

When three sides and two included angles are given.

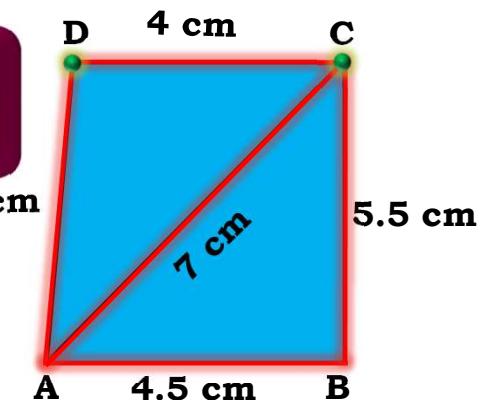
5

When four sides and one angle are given.

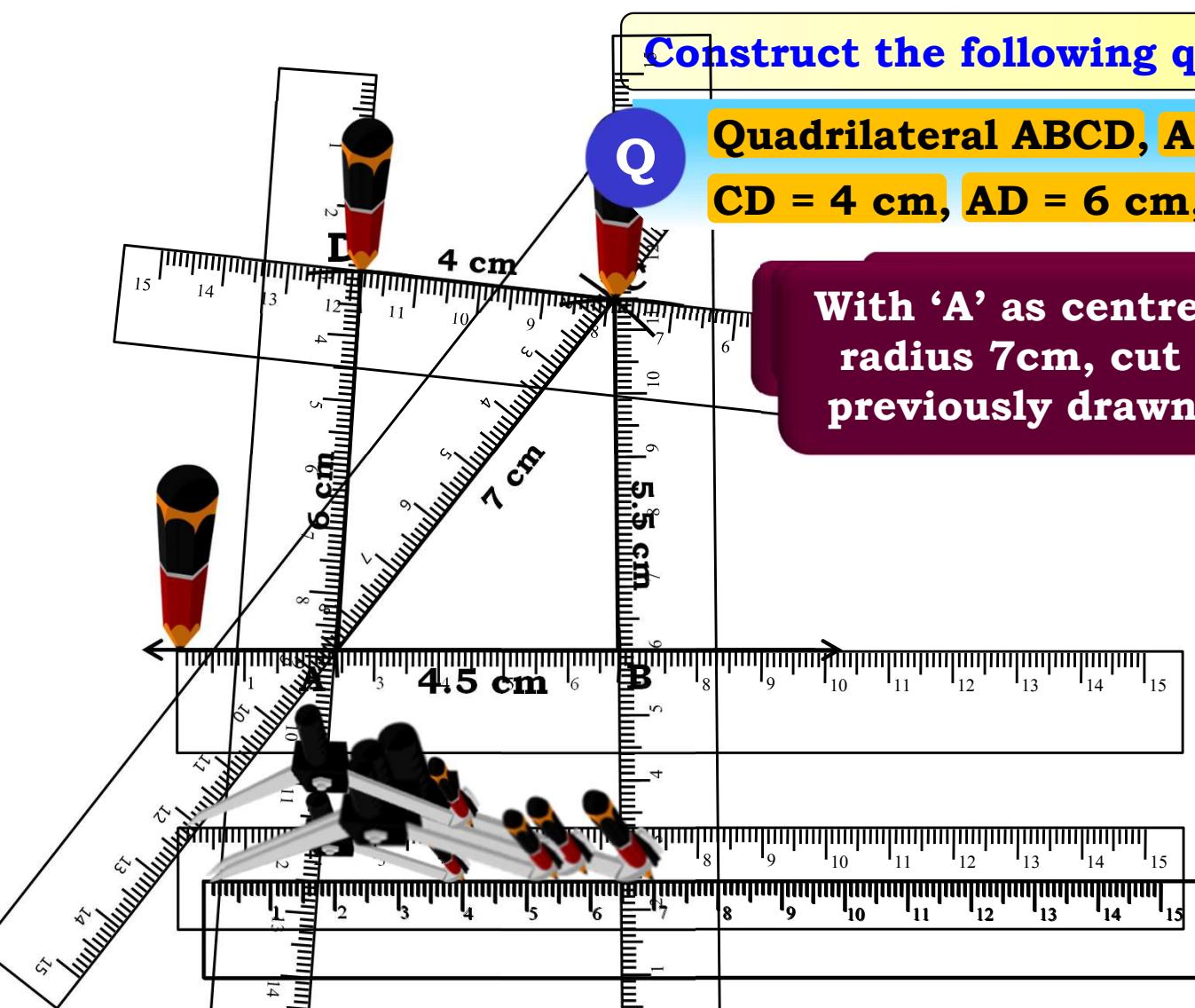
Construct the following quadrilaterals.

**Quadrilateral ABCD, AB = 4.5 cm, BC = 5.5 cm,
CD = 4 cm, AD = 6 cm, AC = 7 cm.**

**With 'A' as centre and
radius 7cm, cut the
previously drawn arc**



Rough figure

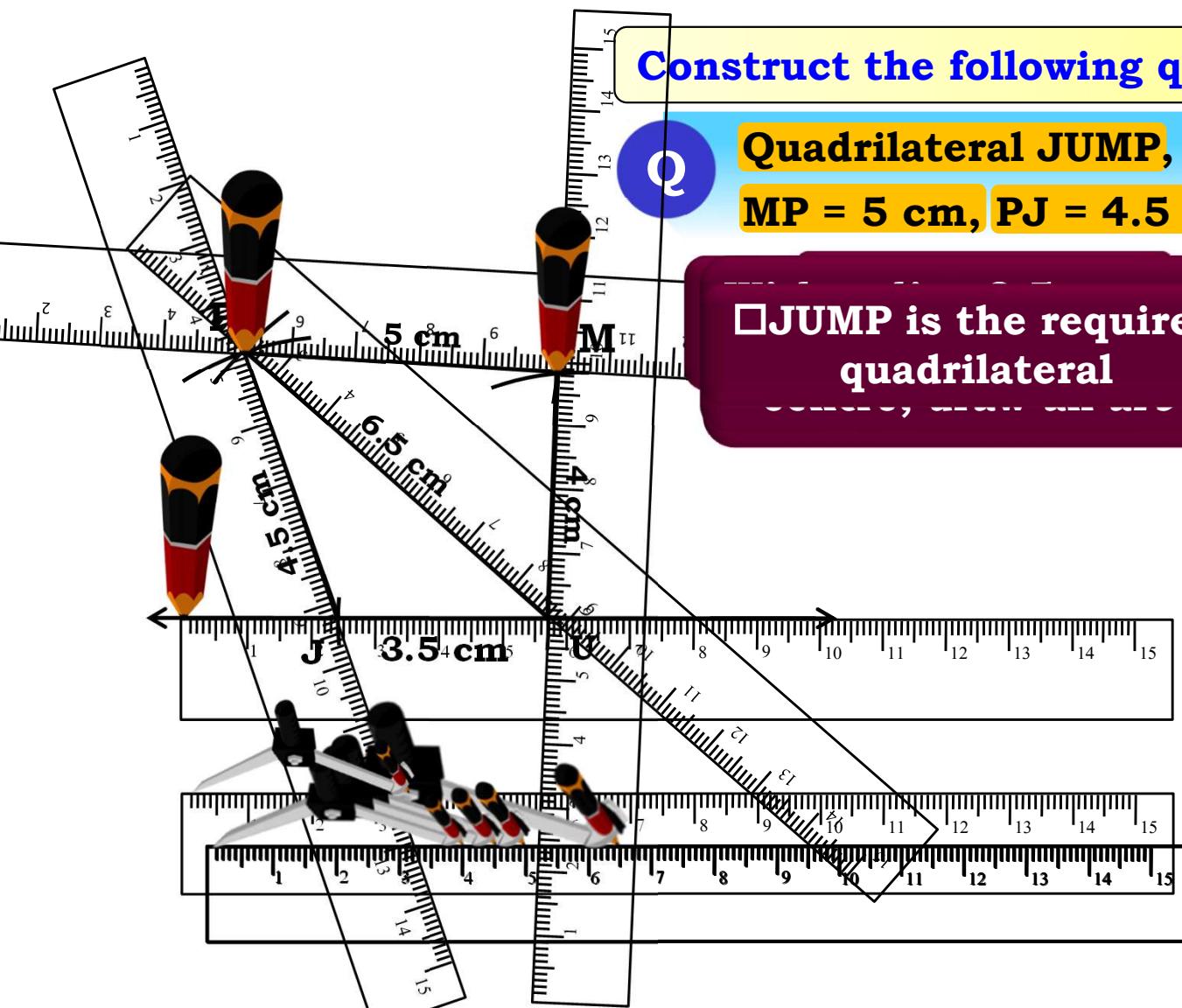
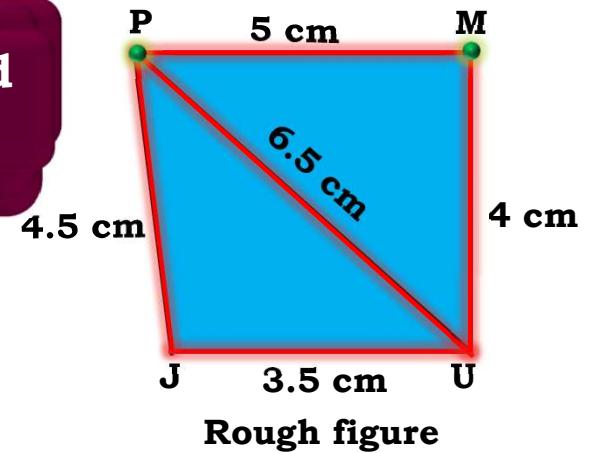


Module 3

Construct the following quadrilateral.

Q Quadrilateral JUMP, $JU = 3.5 \text{ cm}$, $UM = 4 \text{ cm}$,
 $MP = 5 \text{ cm}$, $PJ = 4.5 \text{ cm}$, $PU = 6.5 \text{ cm}$.

□JUMP is the required quadrilateral



Module 4

Constructing a quadrilateral

1

When the lengths of four sides and a diagonal are given.

2

When two diagonals and three sides are given.

3

When two adjacent sides and three angles are known.

4

When three sides and two included angles are given.

5

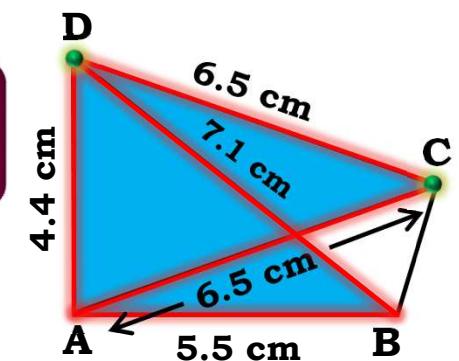
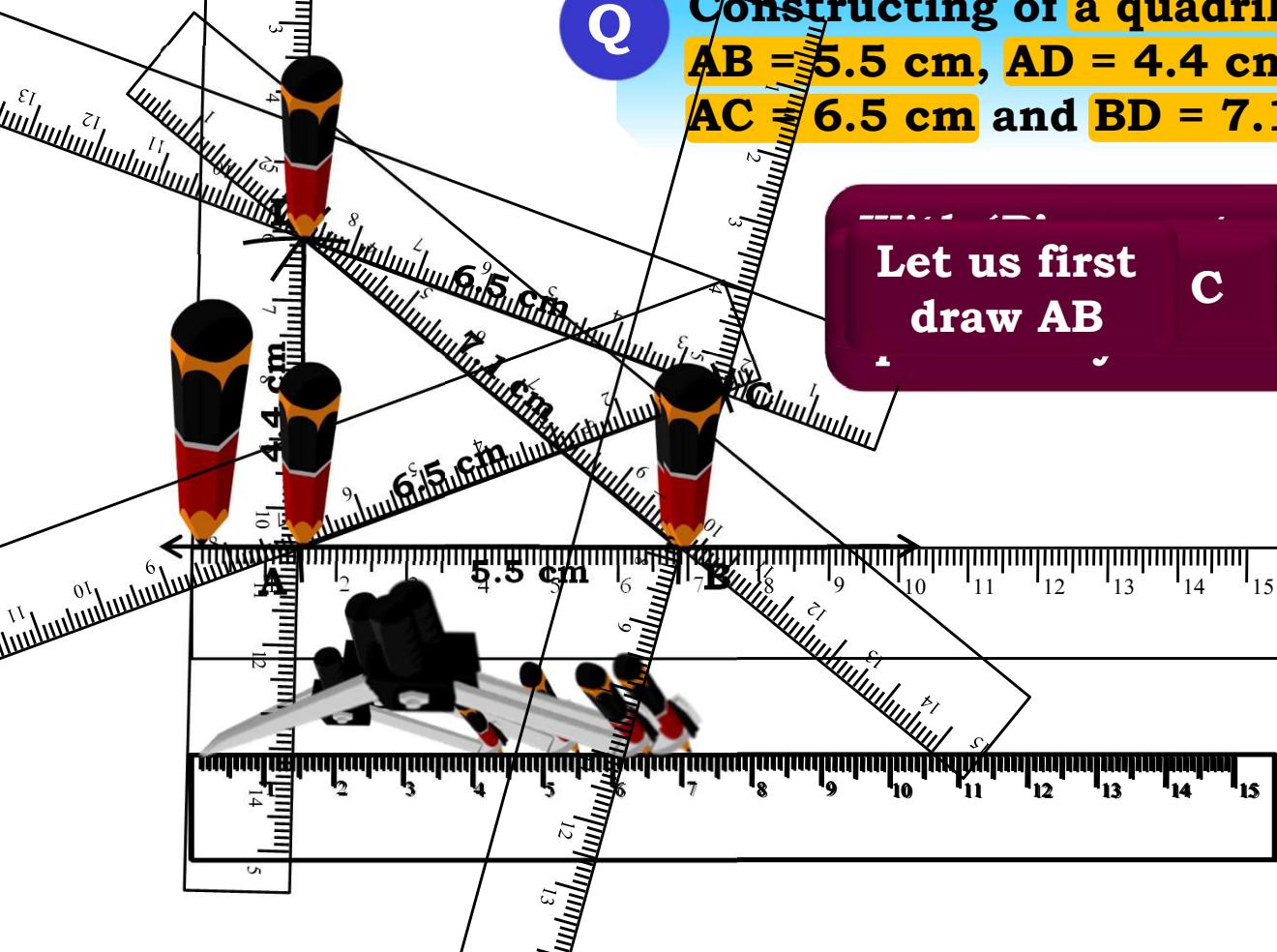
When four sides and one angle are given.

Construct the following quadrilaterals.

Q

**Constructing of a quadrilateral ABCD in which
 $AB = 5.5 \text{ cm}$, $AD = 4.4 \text{ cm}$, $CD = 6.5 \text{ cm}$,
 $AC = 6.5 \text{ cm}$ and $BD = 7.1 \text{ cm}$.**

**Let us first
draw AB**



Rough figure

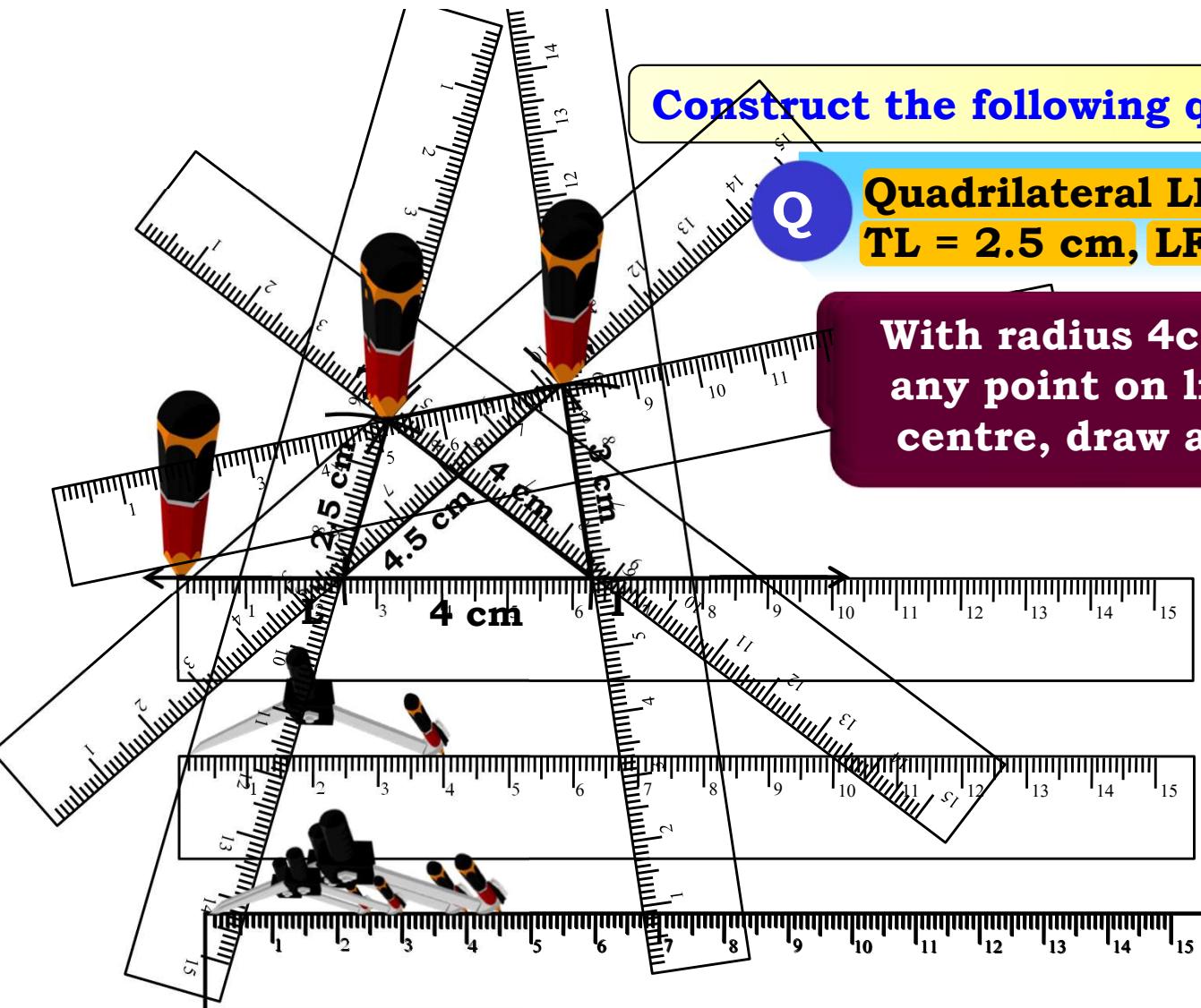
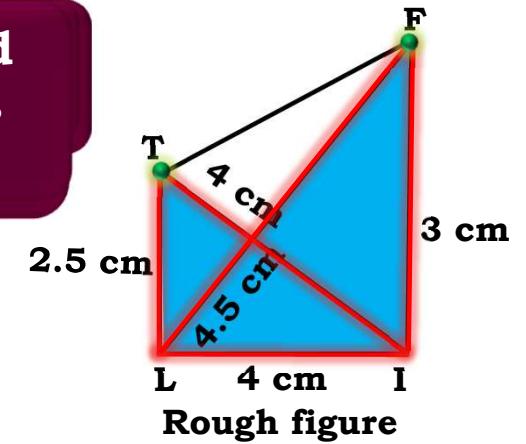
Module 5

Construct the following quadrilateral.

Q

**Quadrilateral LIFT, LI = 4 cm, IF = 3 cm,
TL = 2.5 cm, LF = 4.5 cm, IT = 4 cm**

**With radius 4cm and
any point on line as
centre, draw an arc**



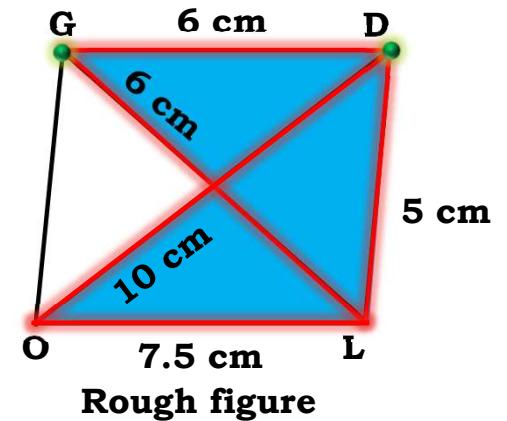
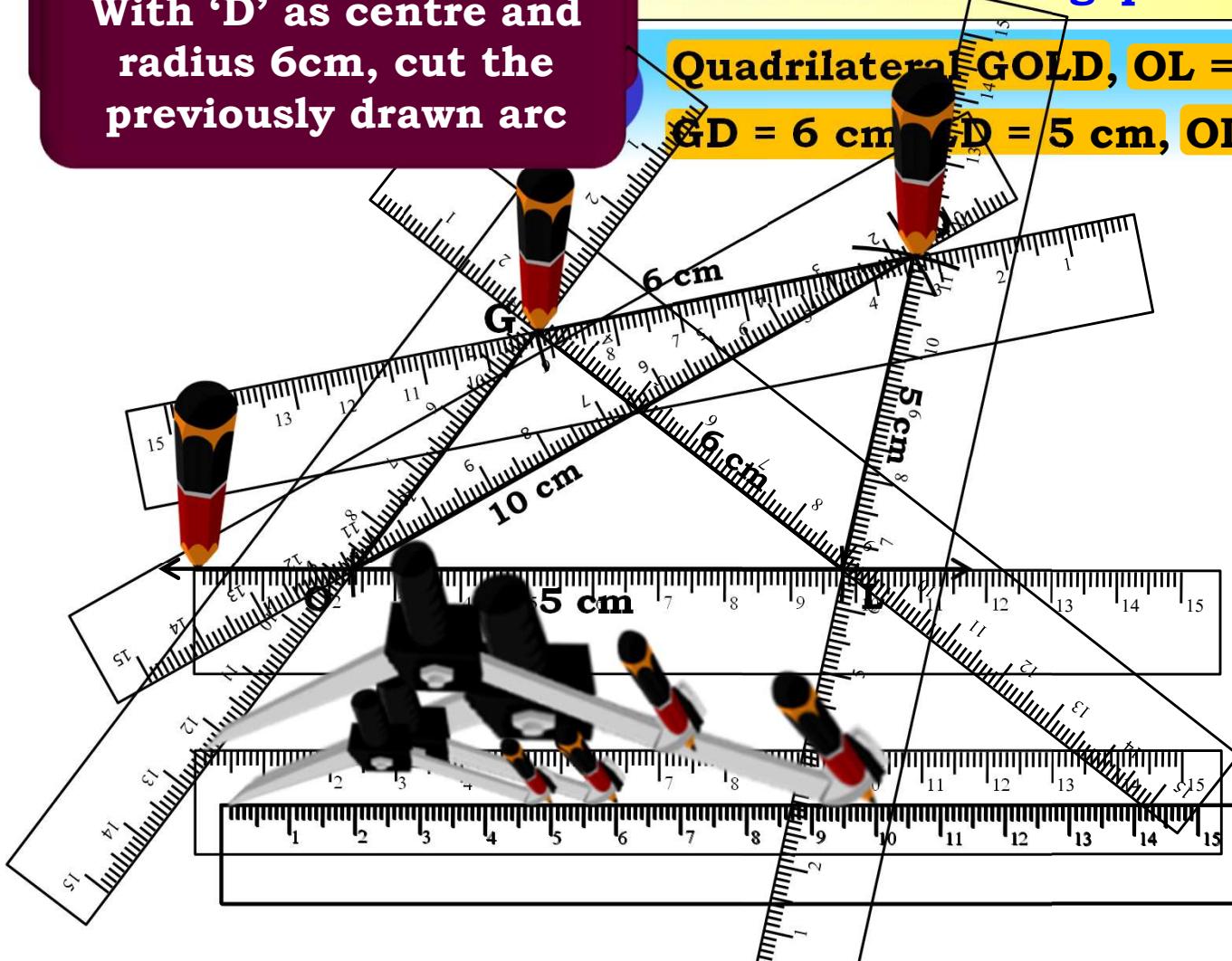
6

Module

With 'D' as centre and radius 6cm, cut the previously drawn arc

Construct the following quadrilateral.

Quadrilateral GOLD, $OL = 7.5 \text{ cm}$, $GL = 6 \text{ cm}$,
 $GD = 6 \text{ cm}$, $LD = 5 \text{ cm}$, $OD = 10 \text{ cm}$



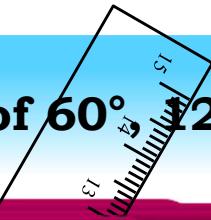
Lecture 2

7

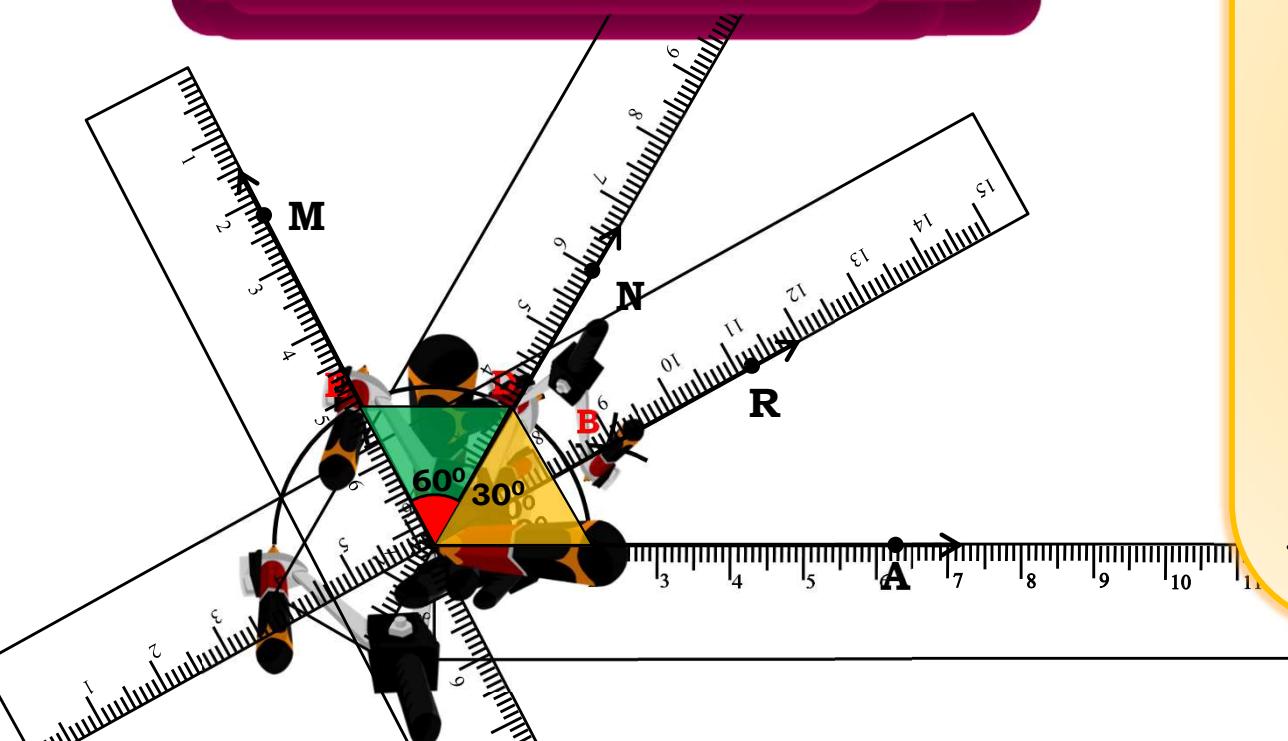
Module

Q

Construct an angle of 60° , 120° and 30° .



**With D as the centre and same
 $r = l(CD)$, draw an arc**



Justification

$\triangle DOC$ is an equilateral triangle.

$$\angle NOA = 60^\circ$$

$\triangle EOD$ is an equilateral triangle.

$$\angle MON = 60^\circ$$

$$\begin{aligned}\angle MOA &= \angle MON + \angle NOA \\ &= 60 + 60 \\ &= 120^\circ\end{aligned}$$

$$\angle NOA = 60^\circ$$

Ray OR bisect $\angle NOA$

$$\begin{aligned}\angle ROA &= \frac{1}{2} \angle NOA \\ &= \frac{1}{2} \times 60 \\ &= 30^\circ\end{aligned}$$

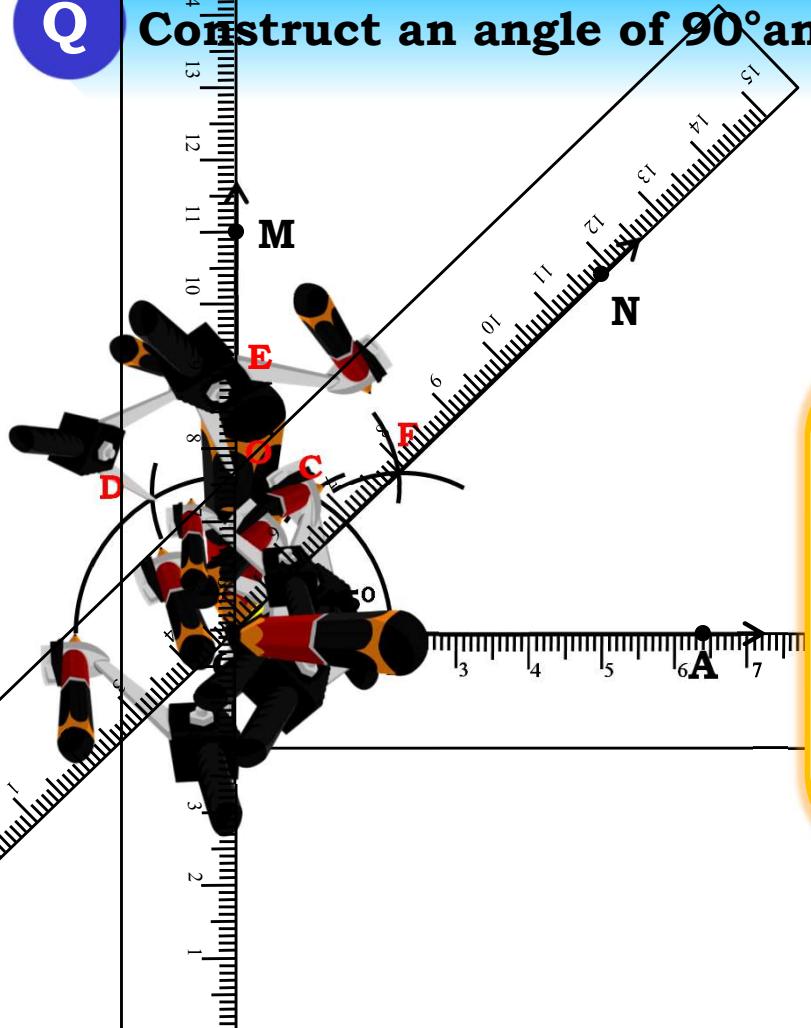
$$\therefore \angle ROA = 30^\circ$$

8

Module

Q

Construct an angle of 90° and 45° .



Draw OF

With O as the centre and same radius, draw intersecting arcs

Justification

$$\angle MOA = 90^\circ$$

Ray ON bisect $\angle MOA$

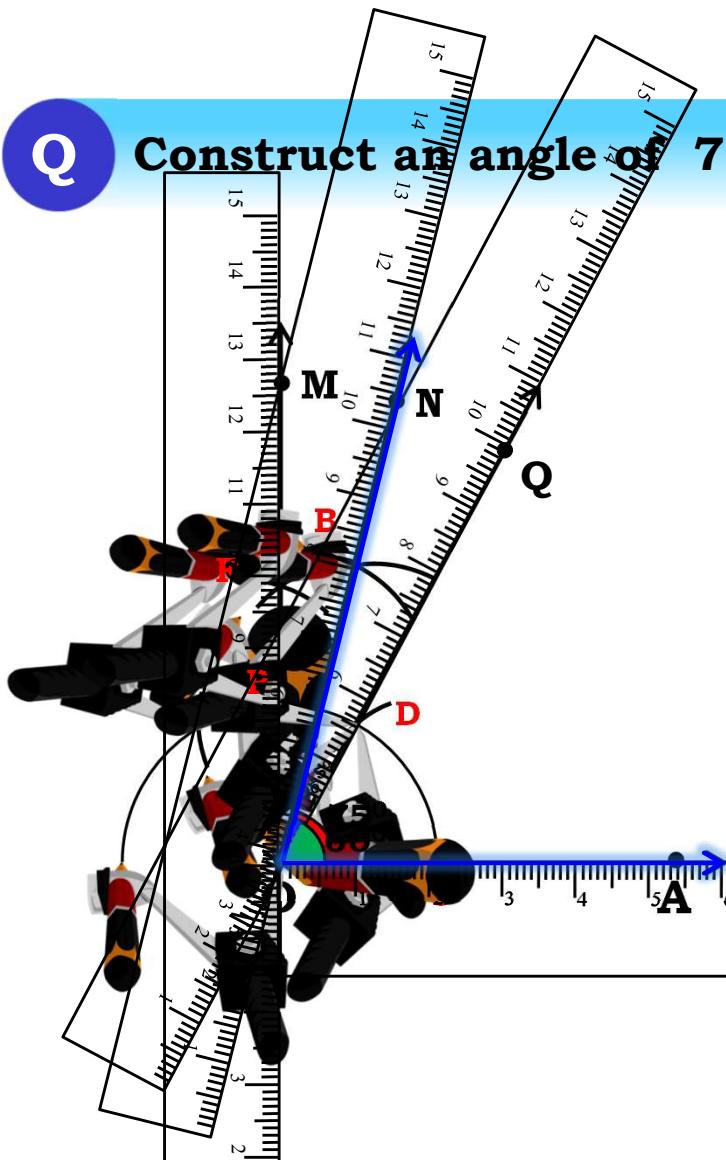
$$\begin{aligned}\angle NOA &= \frac{1}{2} \angle MOA \\ &= \frac{1}{2} \times 90\end{aligned}$$

$$\therefore \angle NOA = 45^\circ$$

Module 9

Q

Construct an angle of 75° .



With **Draw OB** centre and same radius, draw an intersecting arc

Justification

$$\angle MOA = 90^\circ$$

$$\angle QOA = 60^\circ$$

$$\angle MOQ + \angle QOA = \angle MOA$$

$$\therefore \angle MOQ + 60 = 90$$

$$\therefore \angle MOQ = 90 - 60$$

$$\therefore \angle MOQ = 30^\circ$$

Ray ON bisect $\angle MOQ$

$$\angle NOQ = \frac{1}{2} \angle MOQ$$

$$= \frac{1}{2} \times 30$$

$$\therefore \angle NOQ = 15^\circ$$

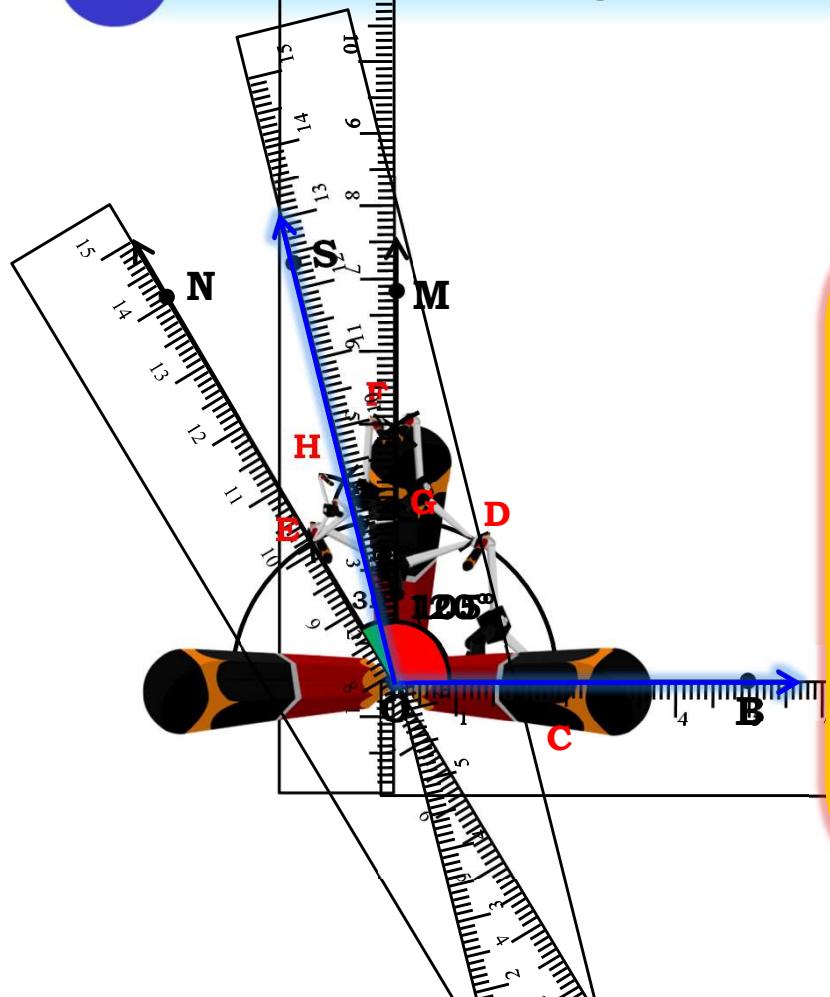
$$\begin{aligned}\angle NOA &= \angle NOQ + \angle QOA \\ &= 15 + 60\end{aligned}$$

$$\therefore \angle NOA = 75^\circ$$

Module 10

Q

Construct an angle of 105° .



1 With E as the centre
and same radius,
draw intersecting arcs

$$\angle MOB = 90^\circ$$

Justification

$$\angle NOB = 120^\circ$$

$$\begin{aligned}\angle MON &= \angle NOB - \angle MOB \\ &= 120 - 90 \\ &= 30^\circ\end{aligned}$$

OS is the bisector of $\angle MON$

$$\begin{aligned}\angle SOM &= \frac{1}{2} \angle MON \\ &= \frac{1}{2} \times 30^\circ\end{aligned}$$

$$\therefore \angle SOM = 15^\circ$$

$$\begin{aligned}\angle SOB &= \angle MOB + \angle SOM \\ &= 90 + 15 \\ &= 105^\circ\end{aligned}$$

Module

11

Constructing a quadrilateral

1

When the lengths of four sides and a diagonal are given.

2

When two diagonals and three sides are given.

3

When two adjacent sides and three angles are known.

4

When three sides and two included angles are given.

5

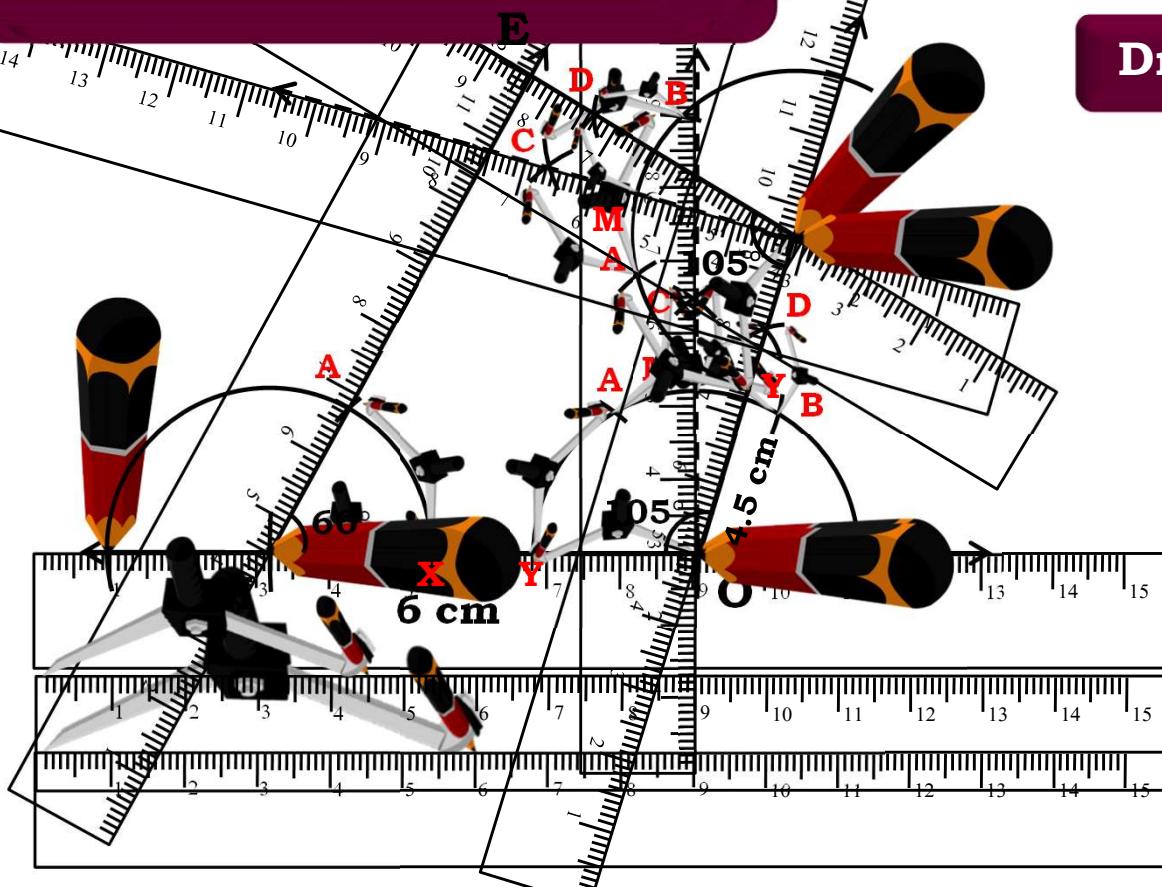
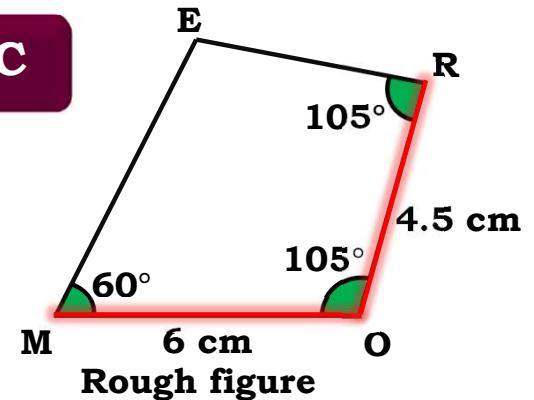
When four sides and one angle are given.

Now, A as centre and same radius draw another intersecting arc

Irregular polygon of following measures.

Irregular quadrilateral MORE, $MO = 6 \text{ cm}$, $OR = 4.5 \text{ cm}$, $\angle M = 60^\circ$, $\angle O = 105^\circ$, $\angle R = 105^\circ$.

Draw RC



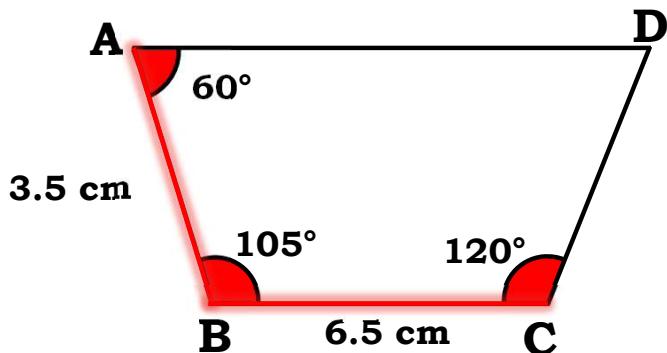
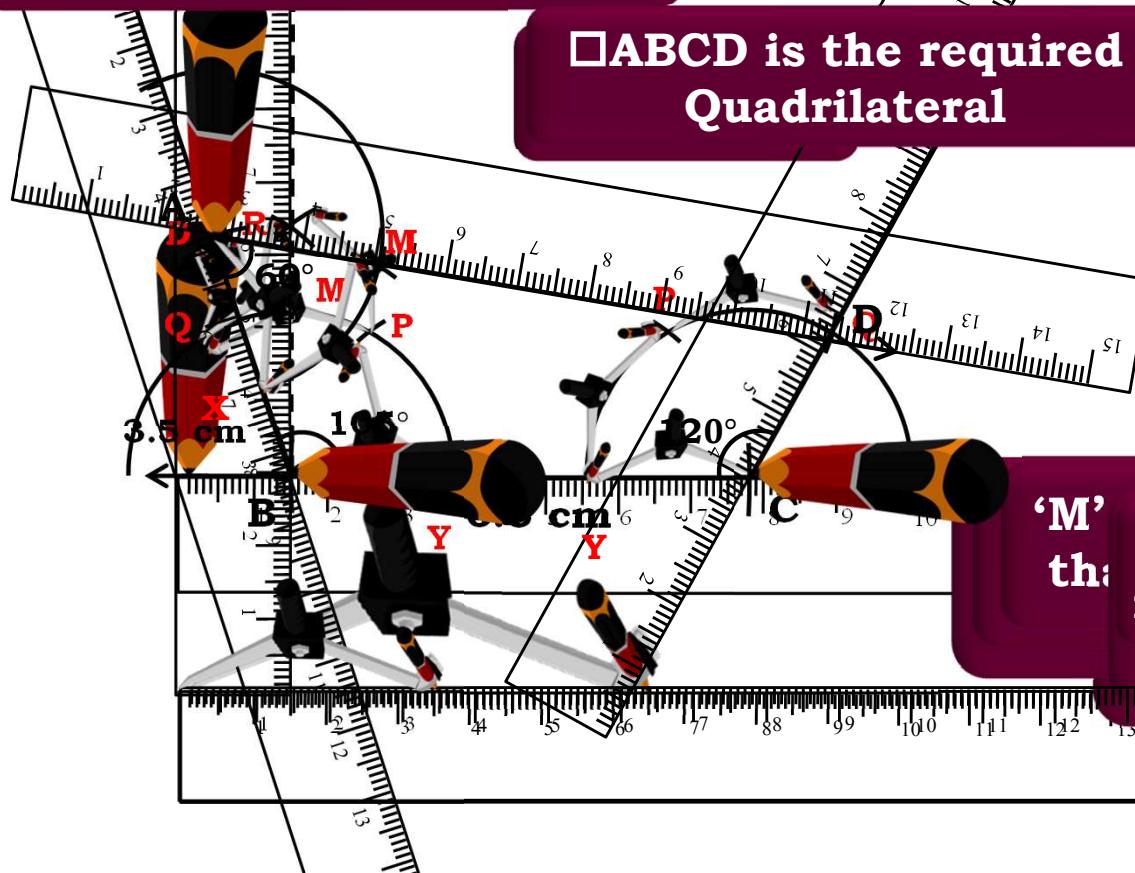
Module 12

Quadrilaterals.

Now, P as centre and same radius draw another intersecting arc

Quadrilateral ABCD where $AB = 3.5 \text{ cm}$, $\angle A = 60^\circ$, $\angle B = 105^\circ$ and $\angle C = 120^\circ$.

$\square ABCD$ is the required Quadrilateral



With 'C' as centre and any suitable radius draw an arc that intersects the previously drawn arc

3

Lecture

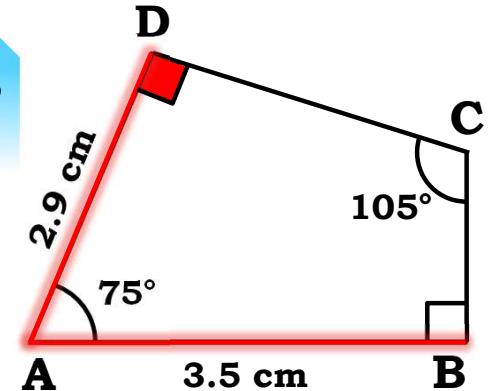
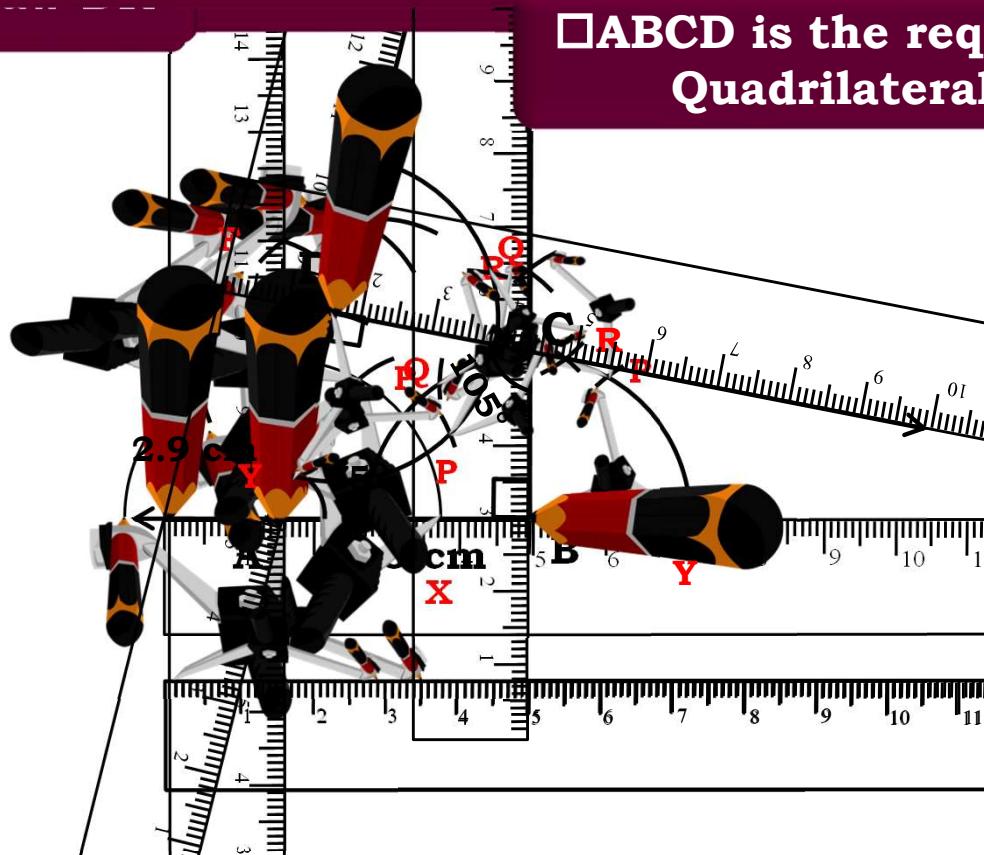
Module 13

With 'A' as centre and radius 2.9 cm draw an arc

Use materials.

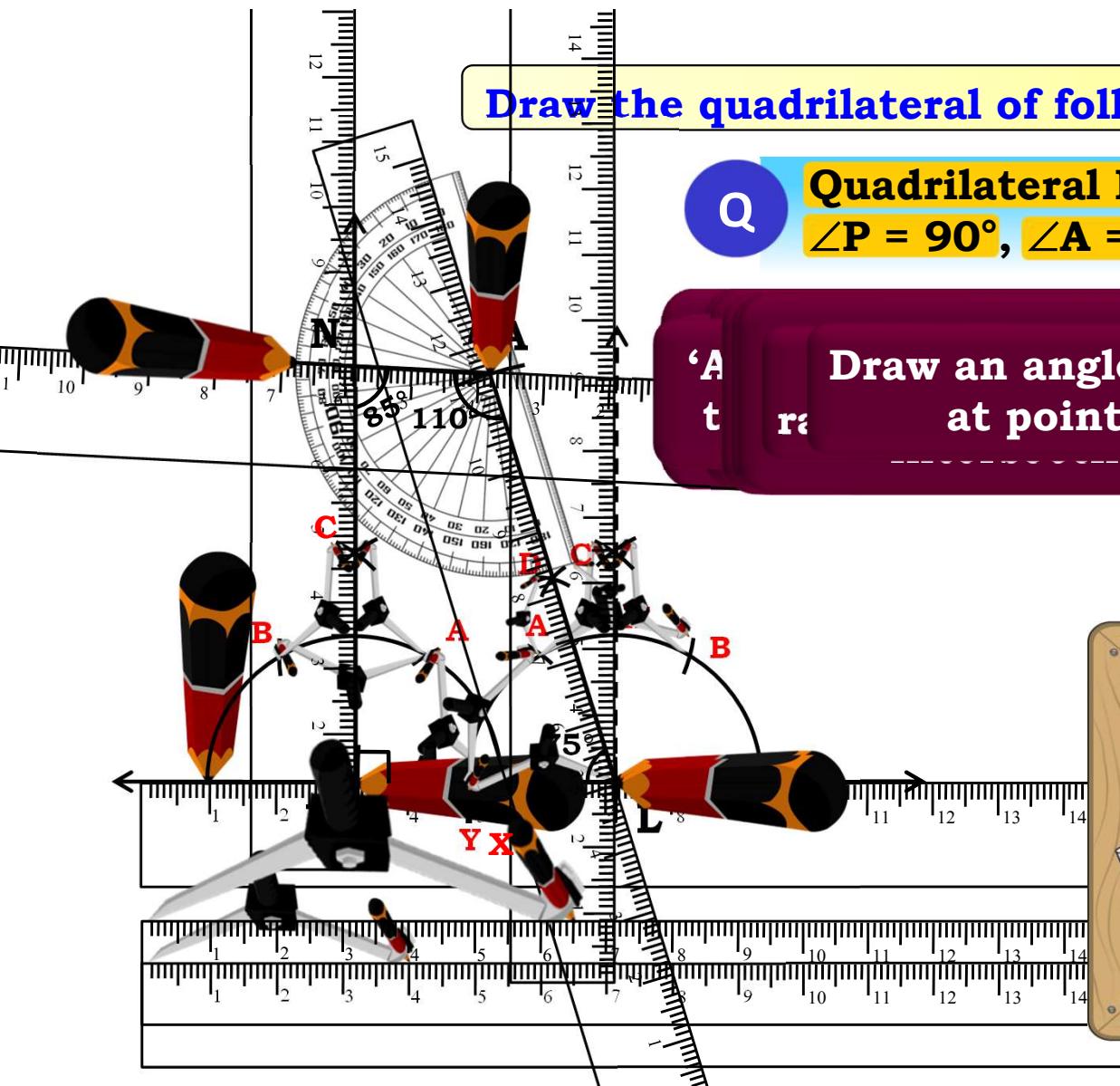
Given quadrilateral ABCD, AB = 3.5 cm,
 $\angle A = 90^\circ$, $\angle C = 105^\circ$

$\square ABCD$ is the required
Quadrilateral



Analysis : In $\square ABCD$,
 $\angle A + \angle B + \angle C + \angle D = 360^\circ$
 $\therefore 75 + 90 + 105 + \angle D = 360$
 $\angle D + 270 = 360$
 $\angle D = 360 - 270$
 $\angle D = 90^\circ$

Module 14



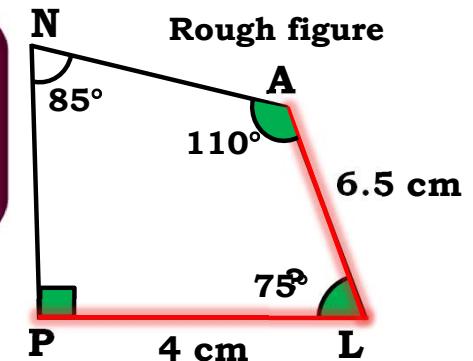
Draw the quadrilateral of following measures.

Q

**Quadrilateral PLAN, PL = 4 cm, LA = 6.5 cm,
 $\angle P = 90^\circ$, $\angle A = 110^\circ$, $\angle N = 85^\circ$**

**'A
t
r'**

**Draw an angle of 110°
at point 'A'**



Analysis : In \square PLAN,

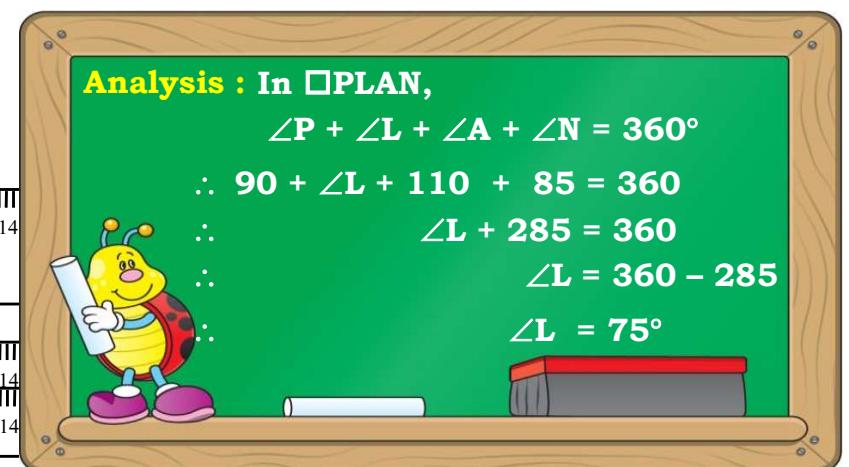
$$\angle P + \angle L + \angle A + \angle N = 360^\circ$$

$$\therefore 90 + \angle L + 110 + 85 = 360$$

$$\therefore \angle L + 285 = 360$$

$$\therefore \angle L = 360 - 285$$

$$\therefore \angle L = 75^\circ$$



Module 15

Constructing a quadrilateral

1

When the lengths of four sides and a diagonal are given.

2

When two diagonals and three sides are given.

3

When two adjacent sides and three angles are known.

4

When three sides and two included angles are given.

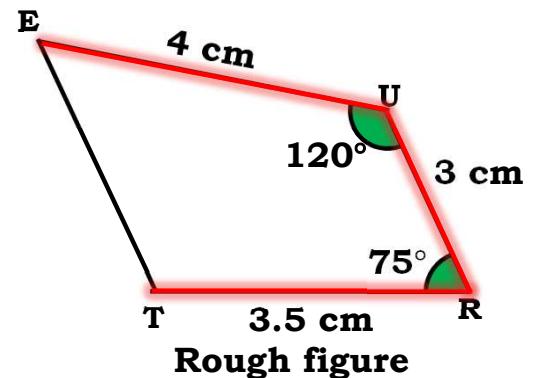
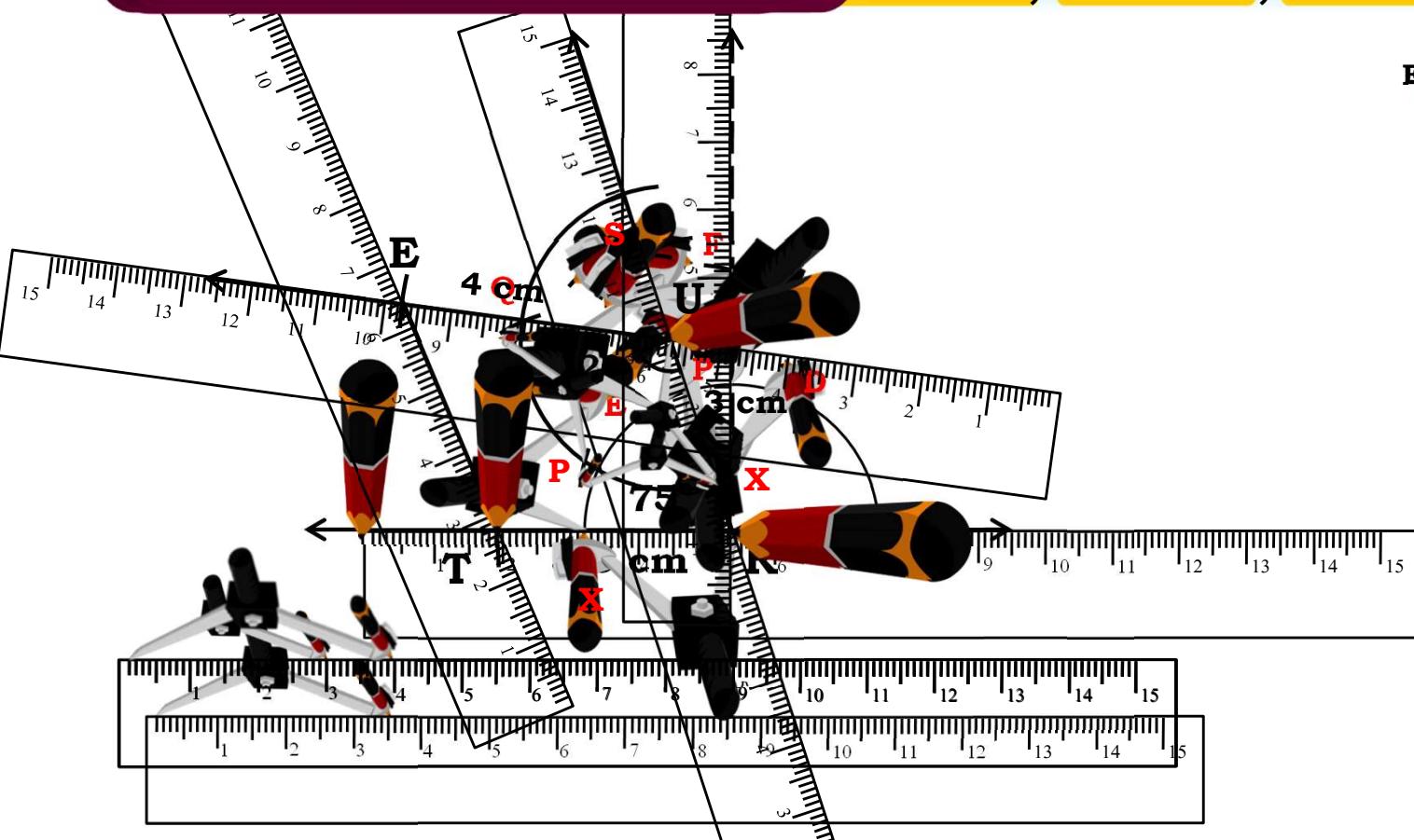
5

When four sides and one angle are given.

Now, P as centre and same radius draw another intersecting arc

Construct a quadrilateral of following measures.

Quadrilateral TRUE, $TR = 3.5 \text{ cm}$, $RU = 3 \text{ cm}$, $UE = 4 \text{ cm}$, $\angle R = 75^\circ$, $\angle U = 120^\circ$.



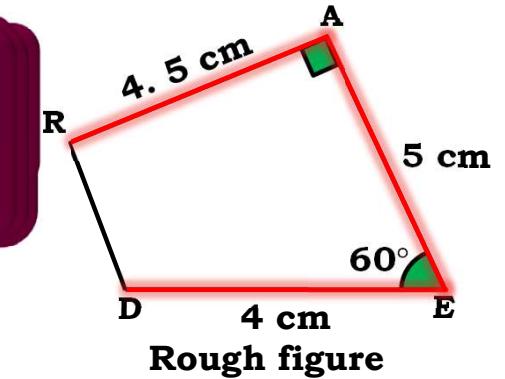
Module 16

Draw the quadrilateral of following measure.

Q

**Quadrilateral DEAR, $DE = 4 \text{ cm}$, $EA = 5 \text{ cm}$,
 $AR = 4.5 \text{ cm}$, $\angle E = 60^\circ$, $\angle A = 90^\circ$**

**□DEAR is the required
quadrilateral
intersecting arc**



Module 17

Constructing a quadrilateral

1

When the lengths of four sides and a diagonal are given.

2

When two diagonals and three sides are given.

3

When two adjacent sides and three angles are known.

4

When three sides and two included angles are given.

5

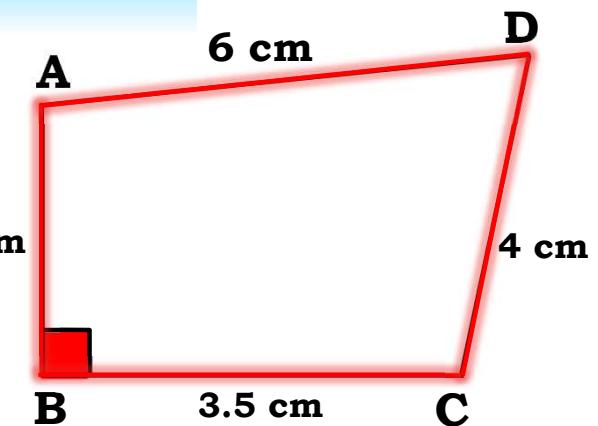
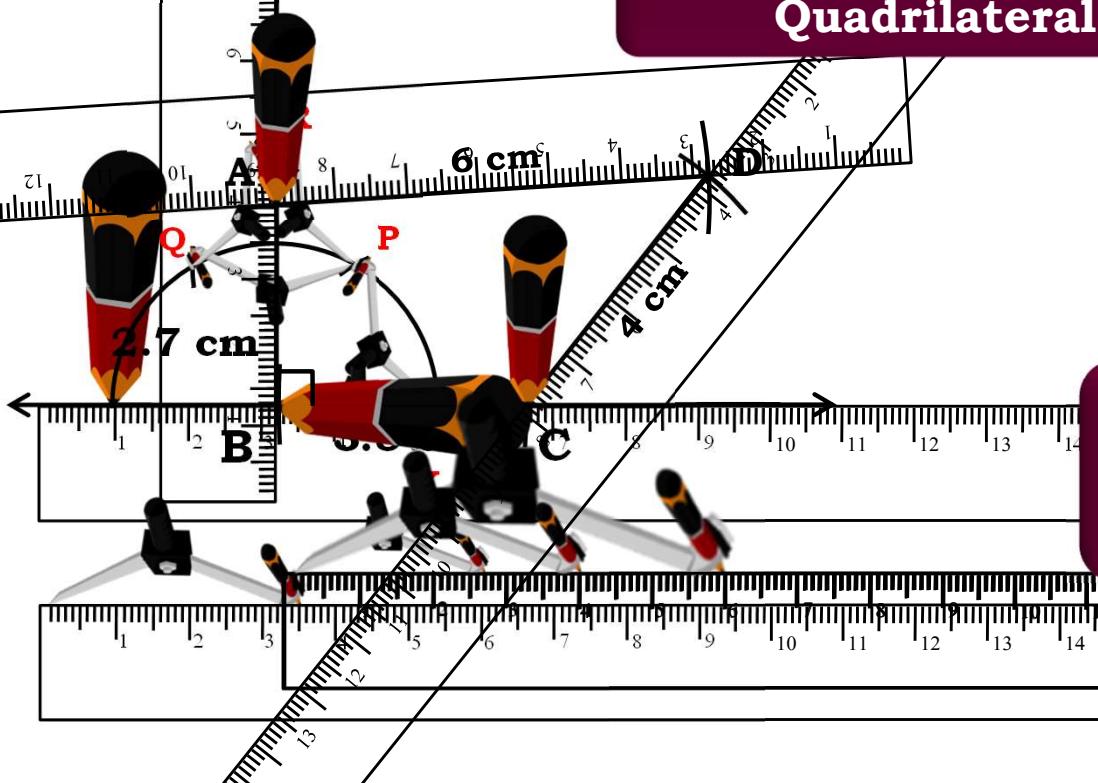
When four sides and one angle are given.

Construct the following quadrilaterals.

Q

Construct a quadrilateral ABCD in which $AB = 2.7 \text{ cm}$, $BC = 3.5 \text{ cm}$, $CD = 4 \text{ cm}$, $AD = 6 \text{ cm}$, $\angle B = 90^\circ$

□ABCD is the required Quadrilateral



Now 'X' as centre and with the same radius, cut previously drawn arc

Dra Draw BR

4

Lecture

Module 18

PARALLELOGRAM

RECTANGLE

RHOMBUS

SQUARE

KITE

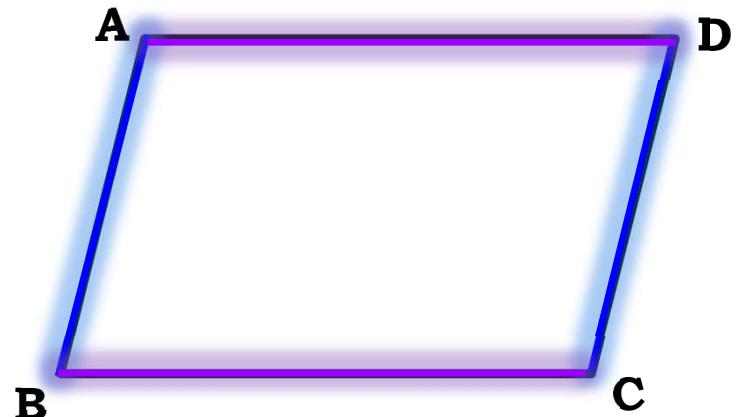
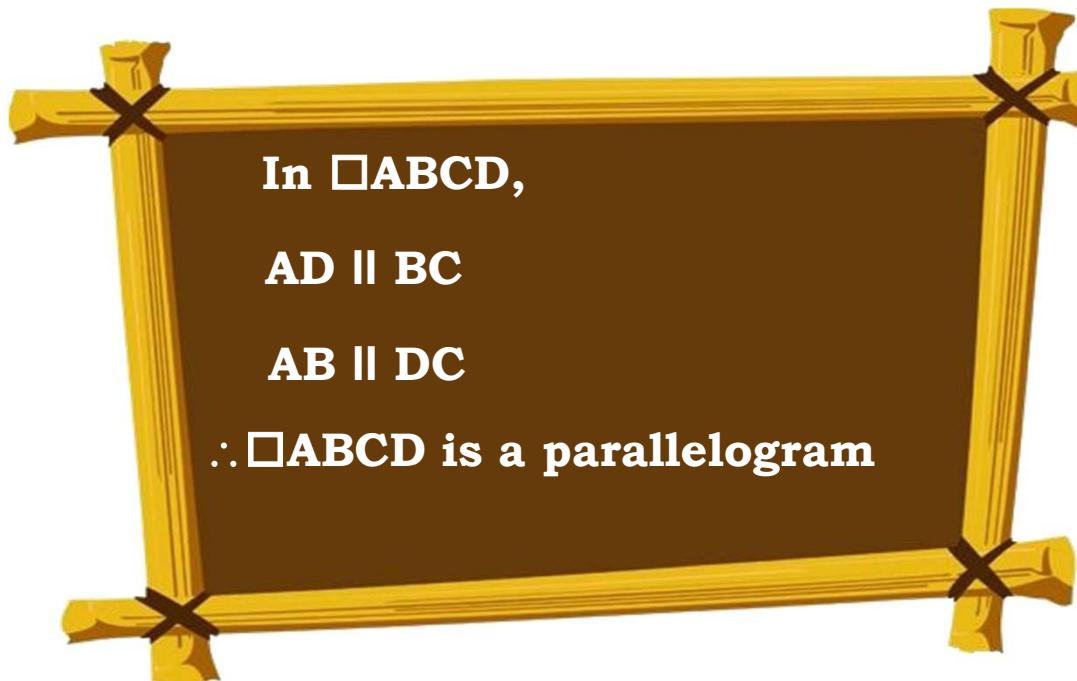
Let us understand
PARALLELOGRAM
and its properties



PARALLELOGRAM

Definition:

A quadrilateral with opposite sides parallel is called a parallelogram.



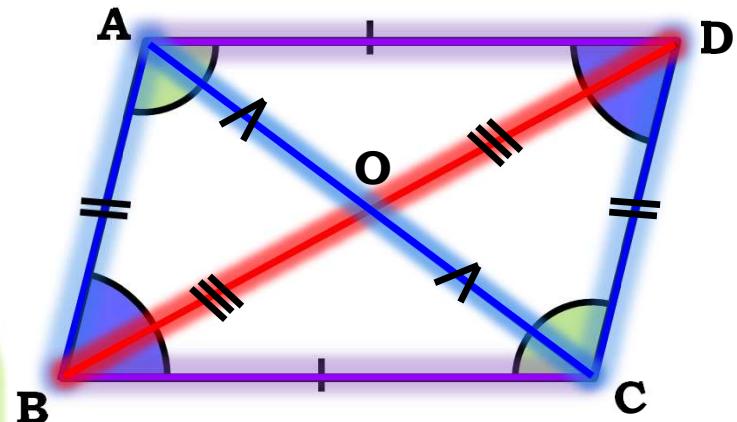
PARALLELOGRAM

Definition:

A quadrilateral with opposite sides parallel is called a parallelogram.

Properties of a Parallelogram:

- The opposite sides of a parallelogram are equal.
i.e. $AD = BC$, $AB = DC$
- The opposite angles of a parallelogram are equal.
i.e. $\angle A = \angle C$, $\angle B = \angle D$
- Dividing each other
in two equal parts
- The diagonals of a parallelogram bisect each other.
i.e. $BO = OD$, $AO = OC$
- The adjacent angles are supplementary.
i.e. $\angle A + \angle B = 180^\circ$



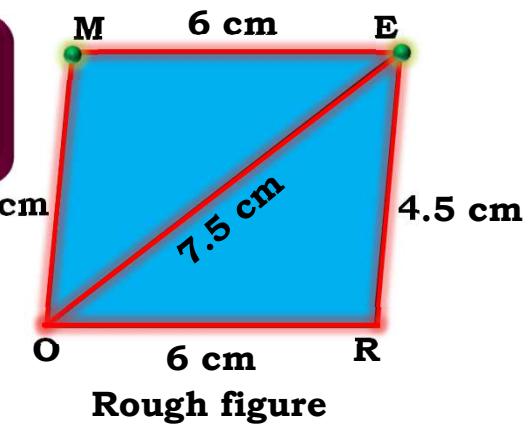
Module 19

Construct the following quadrilateral.

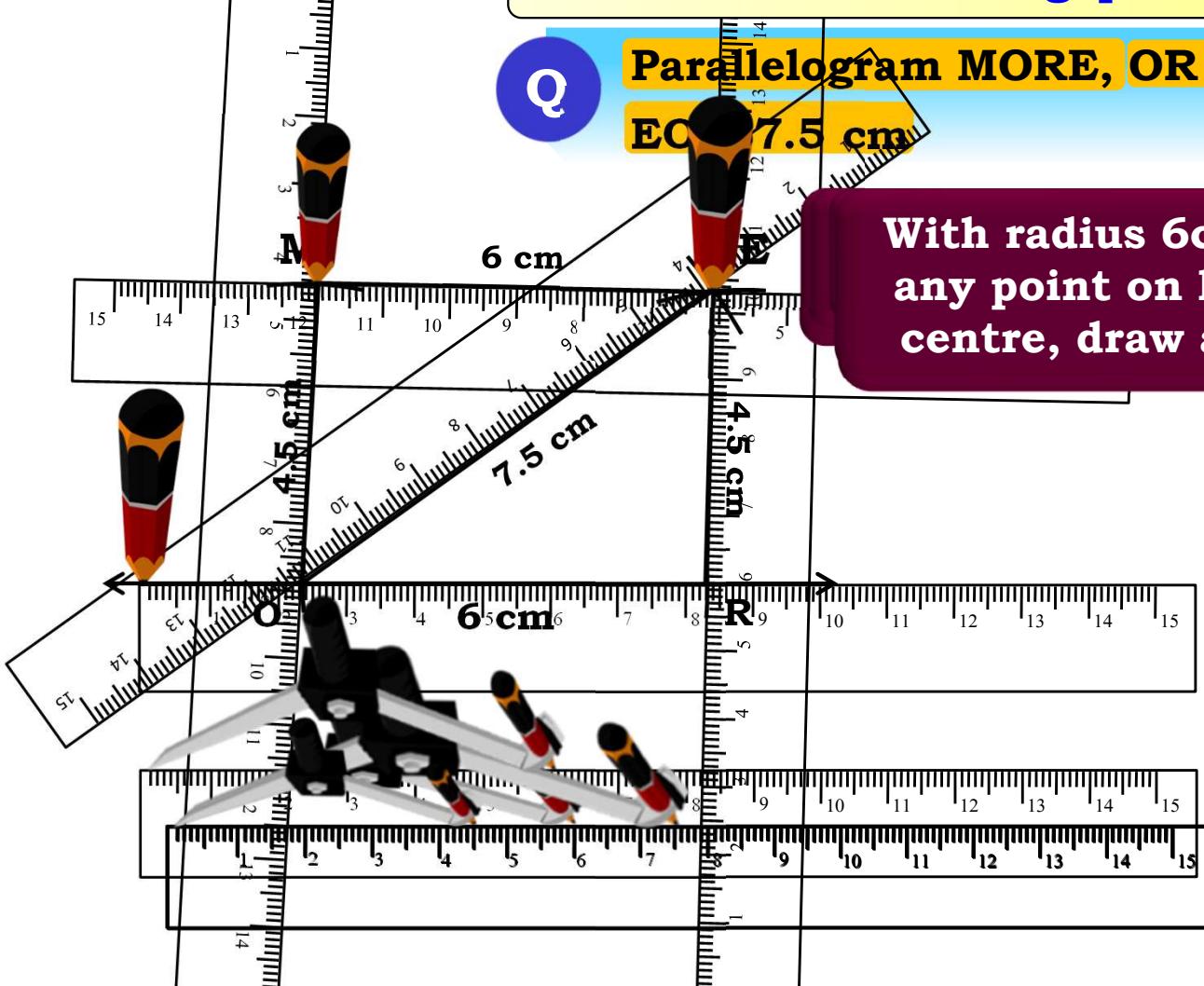
Q

**Parallelogram MORE, OR = 6 cm, RE = 4.5 cm,
EO = 7.5 cm**

**With radius 6cm and
any point on line as
centre, draw an arc**



Rough figure



Module 20

Draw the quadrilateral of following measures.

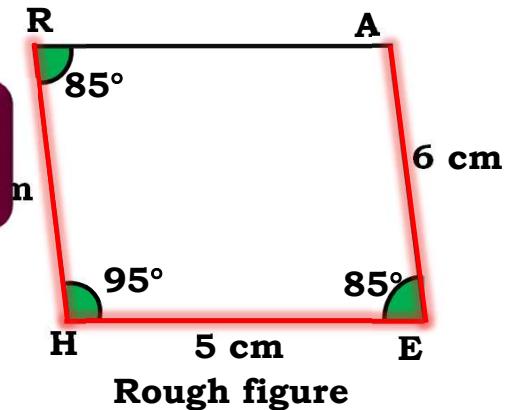
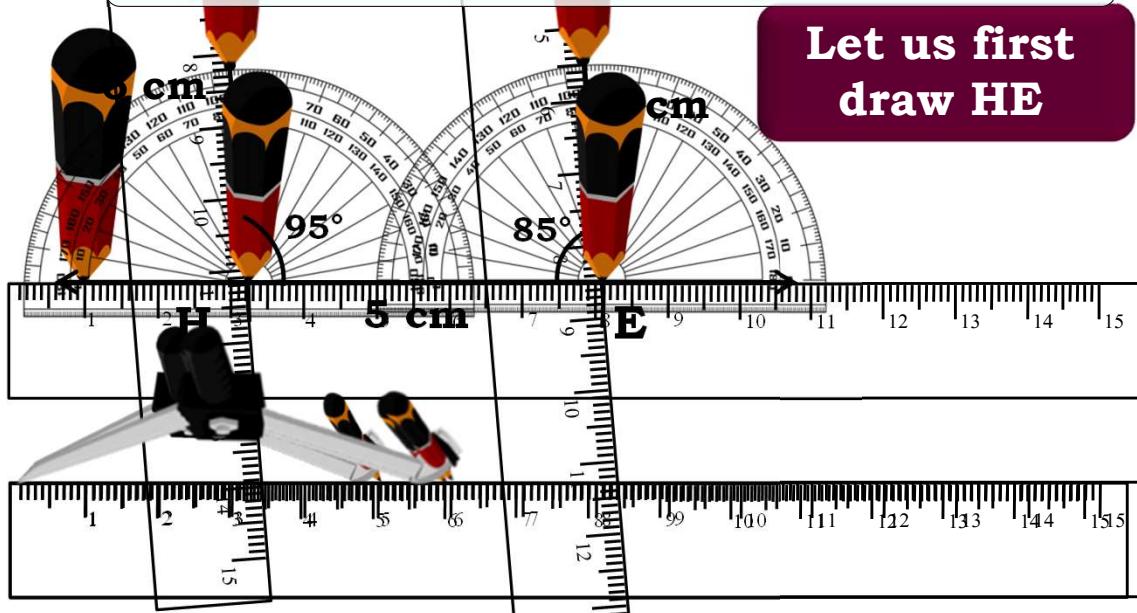
Q

Parallelogram HEAR $HE = 5 \text{ cm}$,
 $EA = 6 \text{ cm}$, $\angle R = 85^\circ$

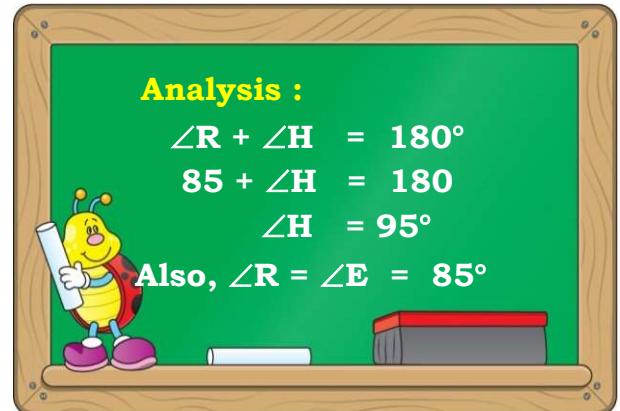
Adjacent angles of a Parallelogram are supplementary
parallelogram

Opposite angles of a Parallelogram are equal

**Let us first
draw HE**



Analysis :
 $\angle R + \angle H = 180^\circ$
 $85 + \angle H = 180$
 $\angle H = 95^\circ$
Also, $\angle R = \angle E = 85^\circ$



Module 21

PARALLELOGRAM

RECTANGLE

RHOMBUS

SQUARE

KITE

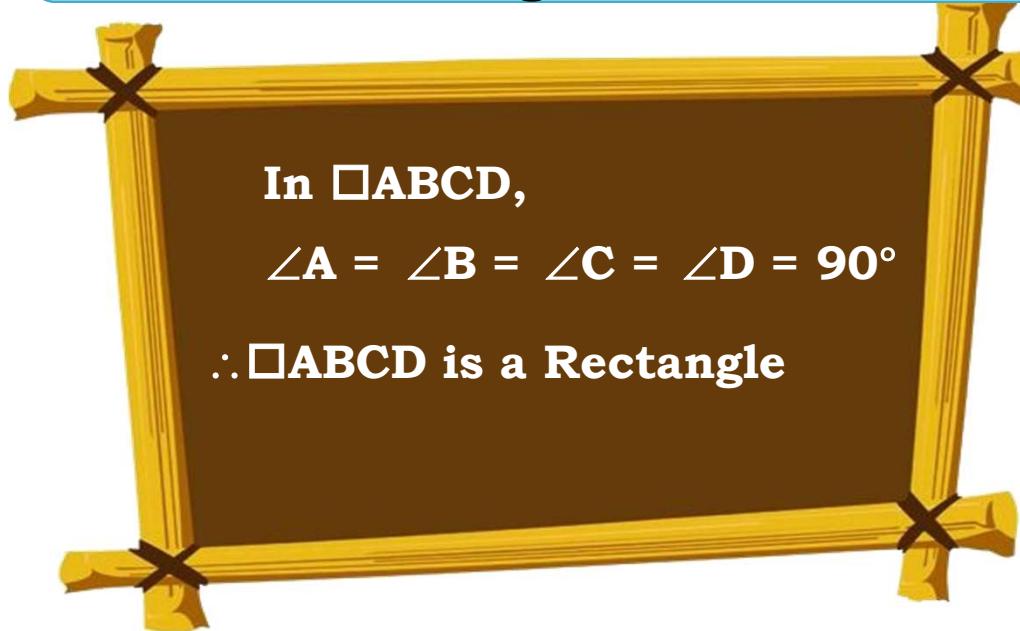
Let us understand
RECTANGLE
and its properties



RECTANGLE

Definition:

A quadrilateral with all angles right angles is called a rectangle.



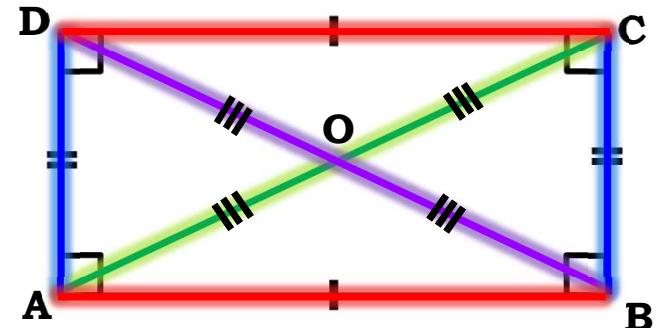
RECTANGLE

Definition:

A quadrilateral with all angles right angles is called a rectangle.

Properties of a Rectangle:

- The opposite sides of a rectangle are equal.
i.e. $AD = BC$, $AB = DC$
- The diagonals of a rectangle
i.e. $AC = BD$
Dividing each other in two equal parts
- The diagonals of a rectangle bisect each other.
i.e. $BO = OD$, $AO = OC$



Module 22

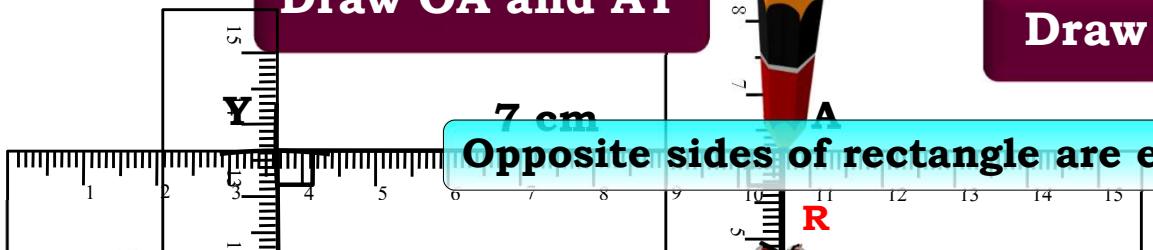
Multilateral of following measures.

With 'A' as centre and radius 7 cm, draw an arc

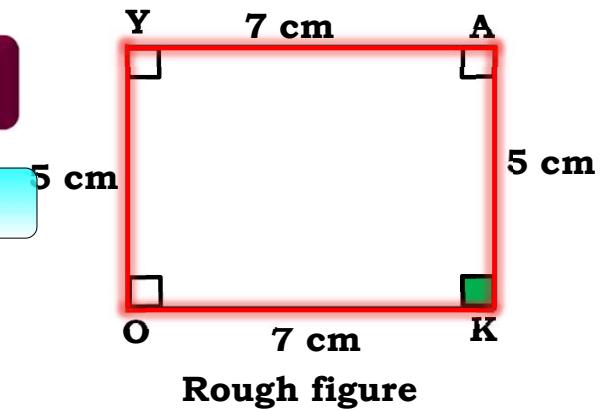
rectangle OKAY, $OK = 7 \text{ cm}$, $KA = 5 \text{ cm}$

Draw OA and AY

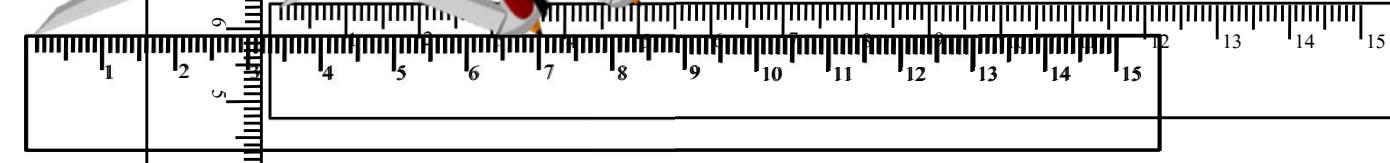
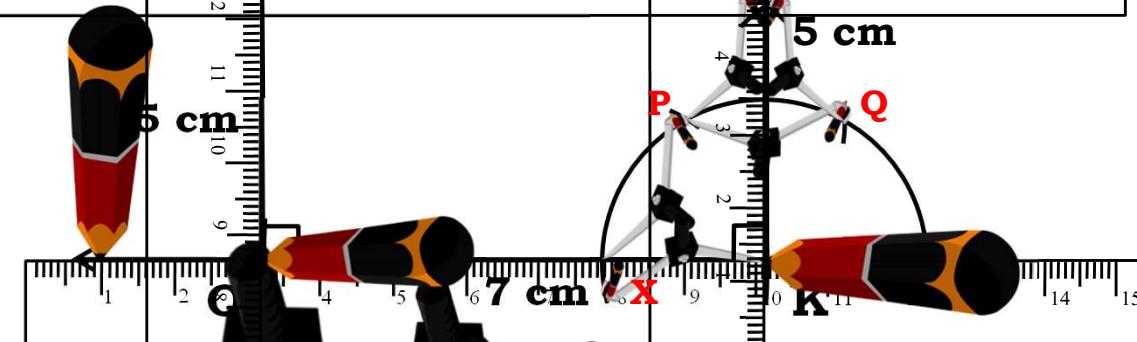
Draw KR



Opposite sides of rectangle are equal



Rough figure



Module 23

Draw the quadrilateral of following measures.

□PMNO is the required rectangle

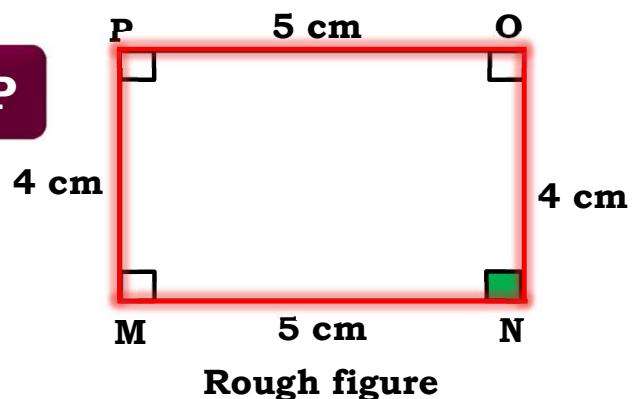
intersecting arc

rectangle with adjacent sides of length 5 cm

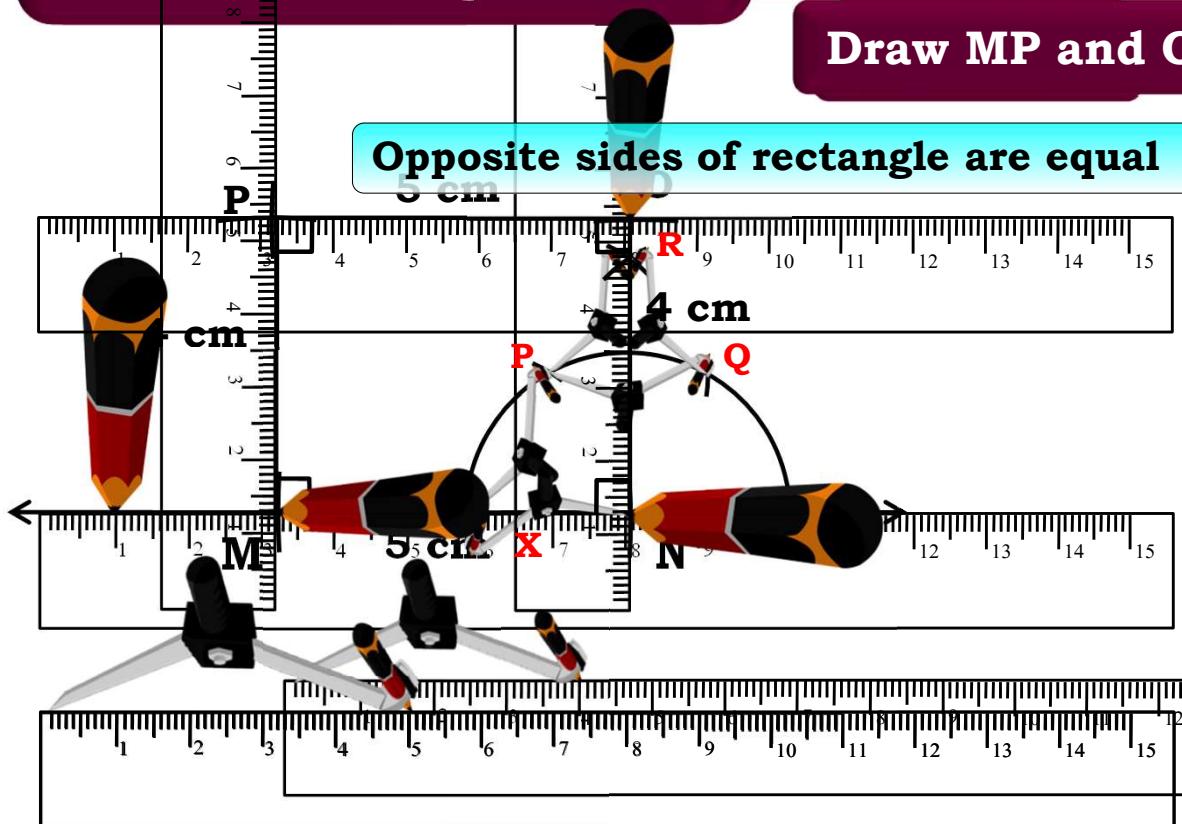
re
c

Draw MP and OP

Opposite sides of rectangle are equal



Rough figure



Module 24

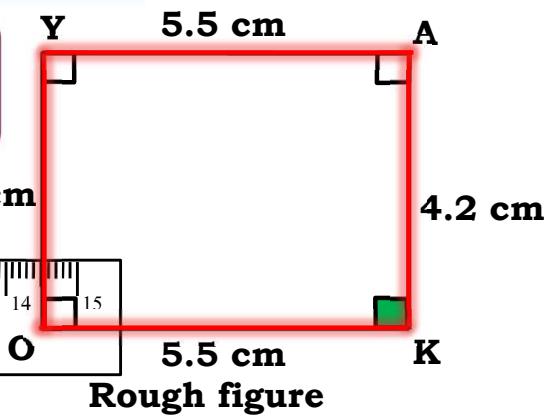
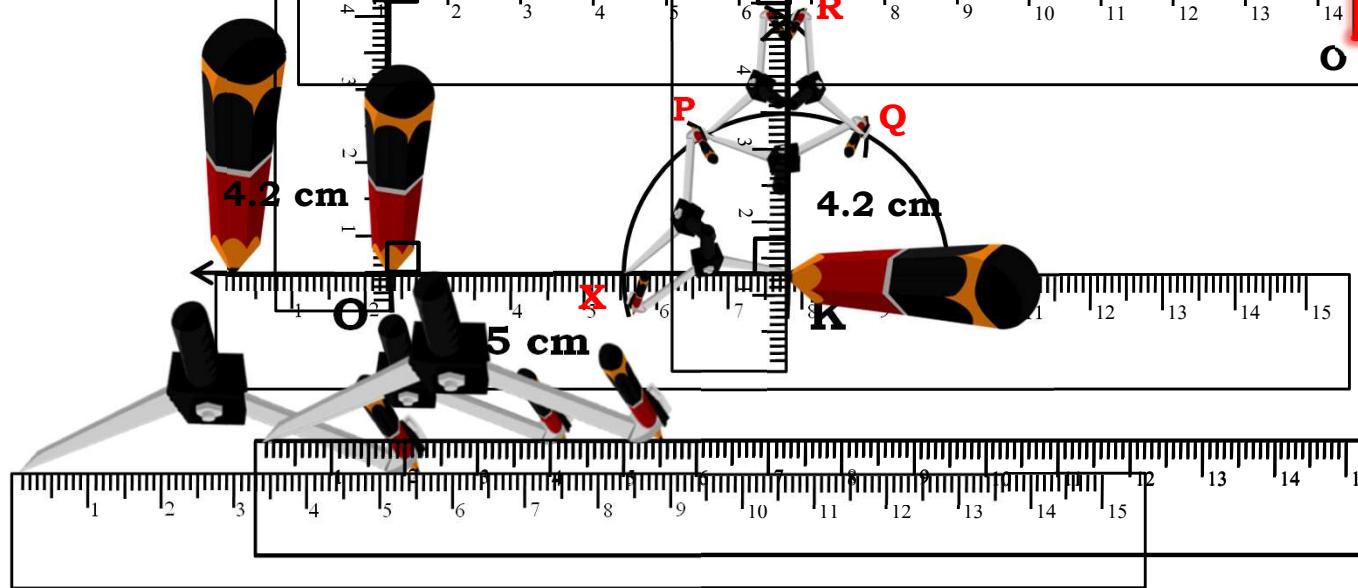
Now, P as centre and same radius draw another intersecting arc

Join OY and OK to get the rectangle of following measures.

Draw OY and AY

□OKAY is the required rectangle

Opposite sides of rectangle are equal

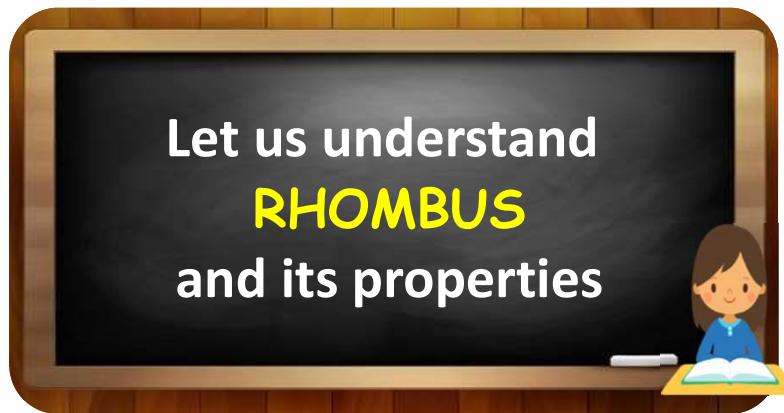
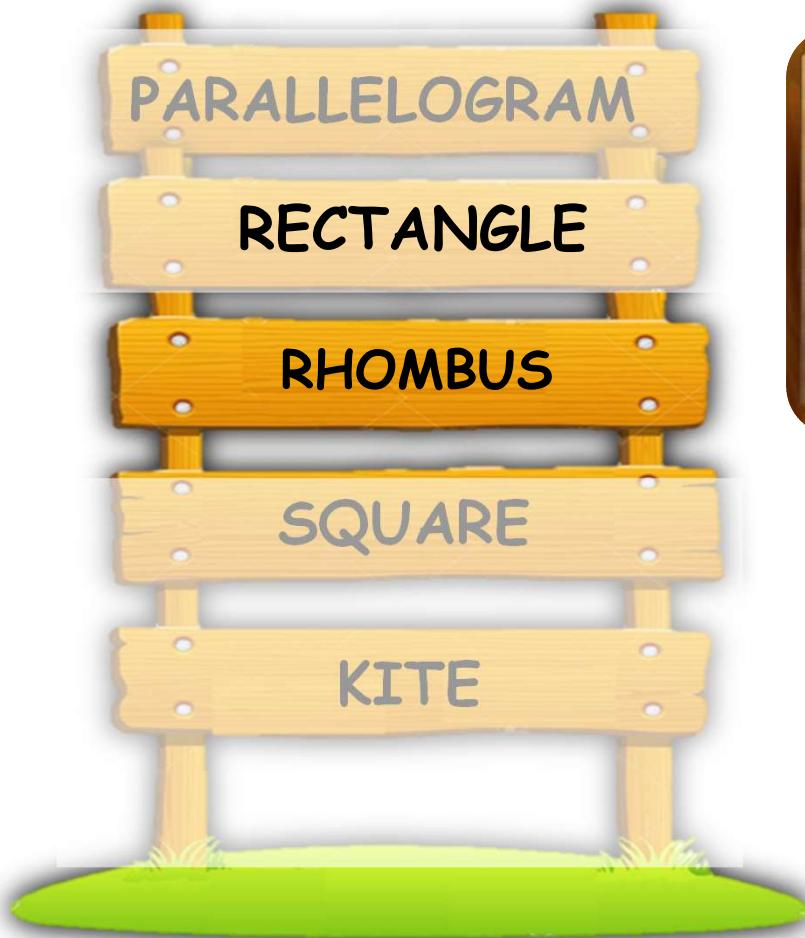


5

Lecture

Module

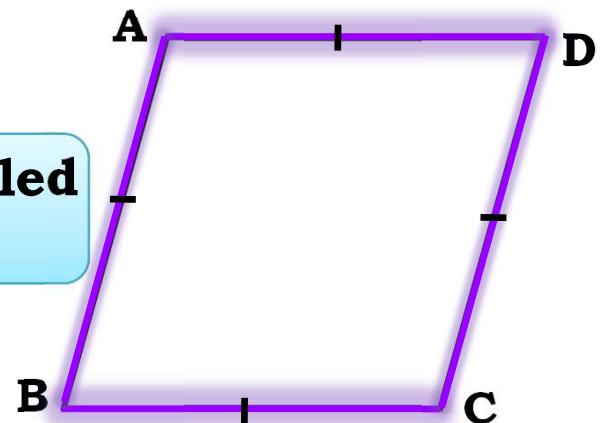
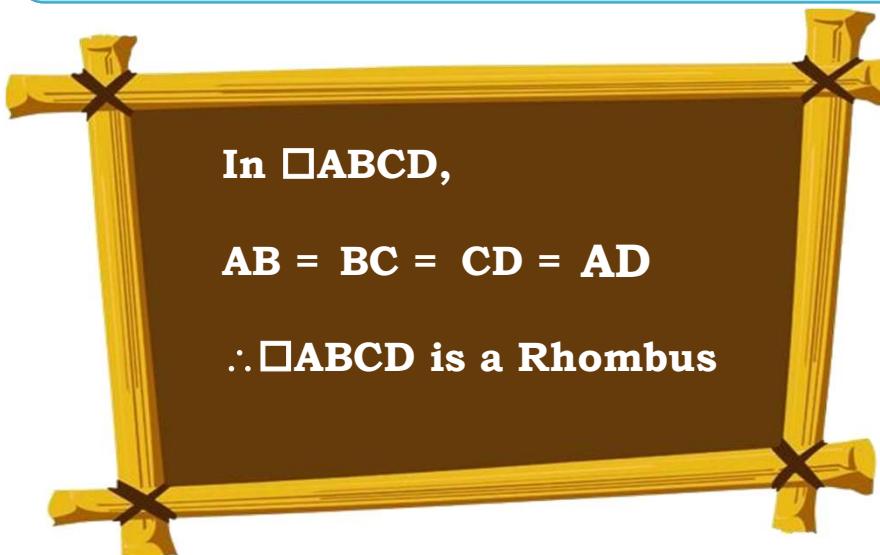
25



RHOMBUS

Definition:

A quadrilateral with all four sides equal is called a rhombus.



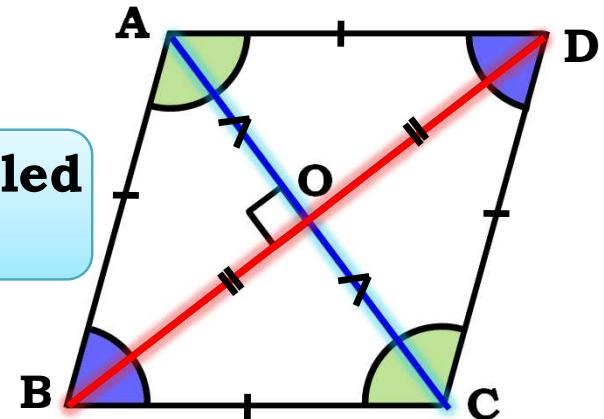
RHOMBUS

Definition:

A quadrilateral with all four sides equal is called a rhombus.

Properties of a Rhombus:

- The opposite angles of a rhombus are equal.
i.e. $\angle A = \angle C$, $\angle B = \angle D$
- Diagonals of rhombus are perpendicular bisectors of each other.
i.e. $\angle AOB = 90^\circ$
 $OB = OD$, $AO = OC$



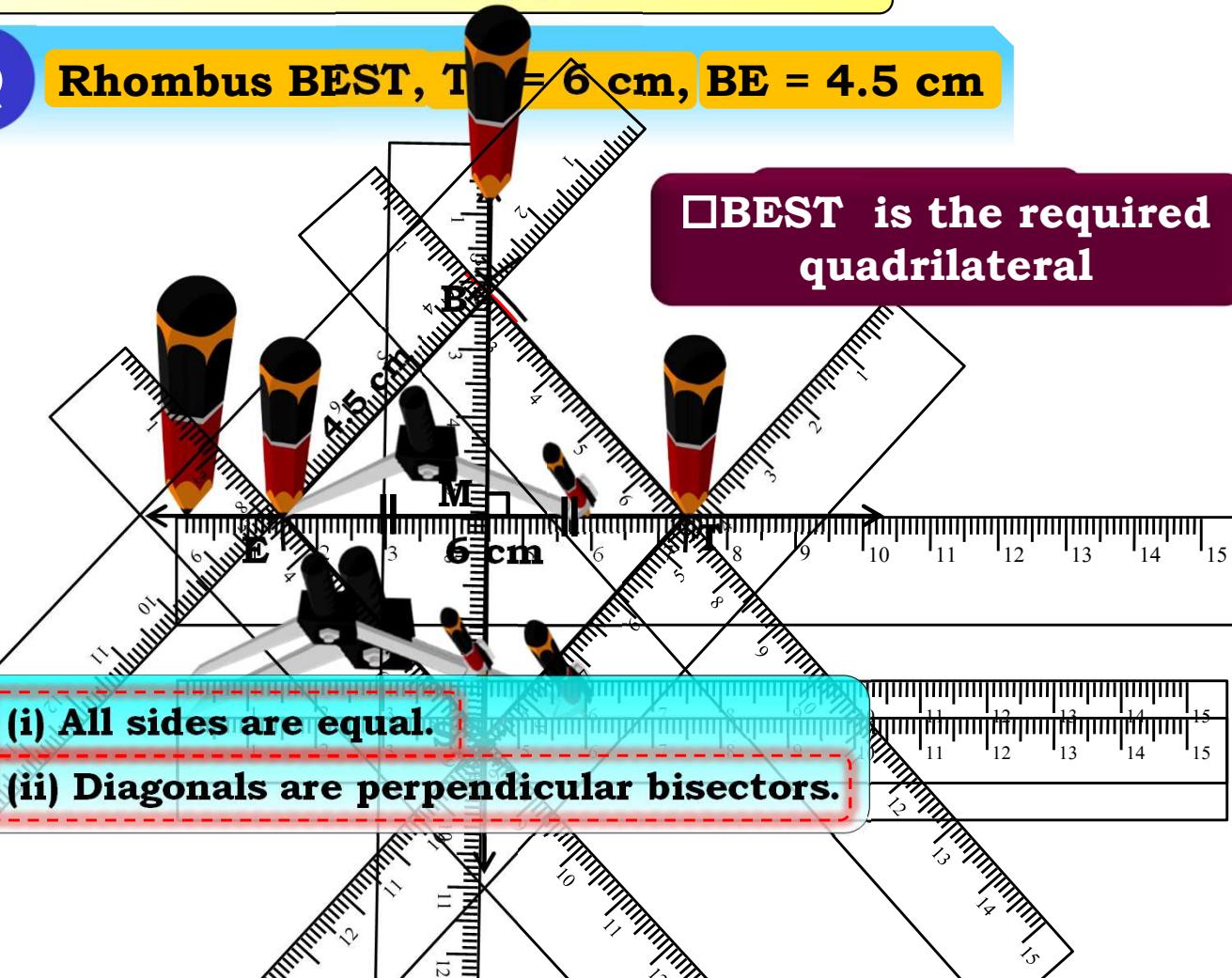
Module 26

Construct the following quadrilateral.

Q

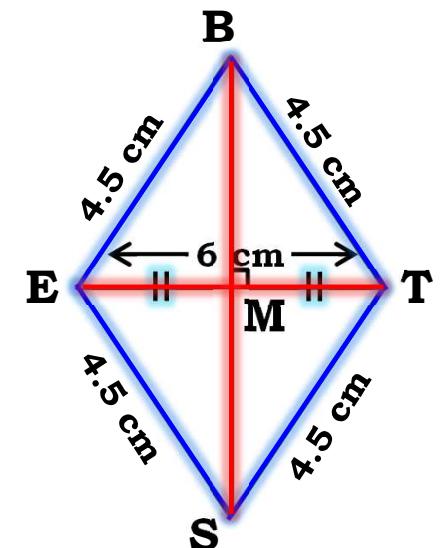
Rhombus BEST, $BT = 6 \text{ cm}$, $BE = 4.5 \text{ cm}$

□BEST is the required quadrilateral



(i) All sides are equal.

(ii) Diagonals are perpendicular bisectors.



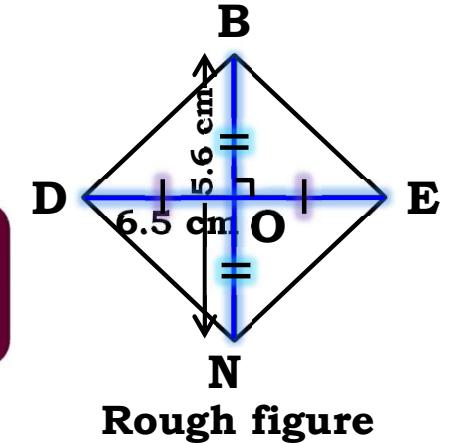
Module 27

Construct the following quadrilateral.

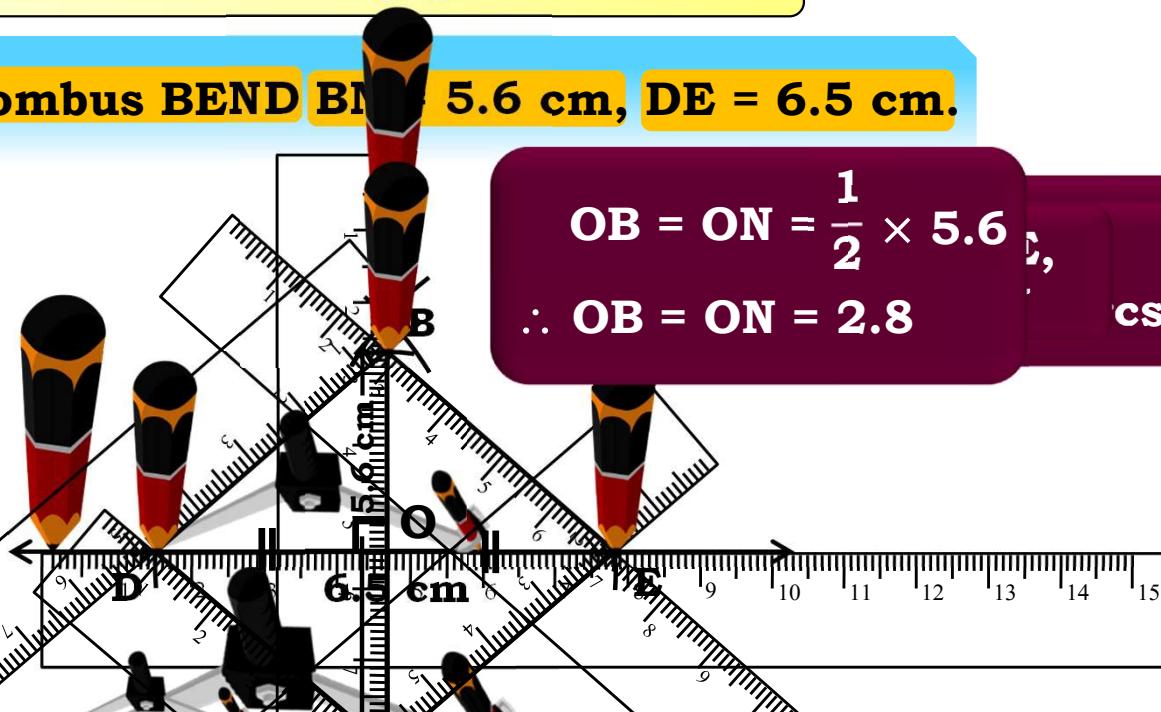
Q

Rhombus BEND $BN = 5.6 \text{ cm}$, $DE = 6.5 \text{ cm}$.

$$OB = ON = \frac{1}{2} \times 5.6 \text{ cm}, \\ \therefore OB = ON = 2.8 \text{ cm}$$



Rough figure



Diagonals are perpendicular bisectors.

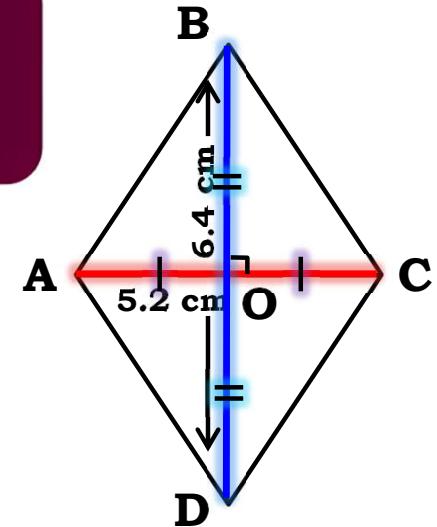
Module 28

Construct the following quadrilaterals.

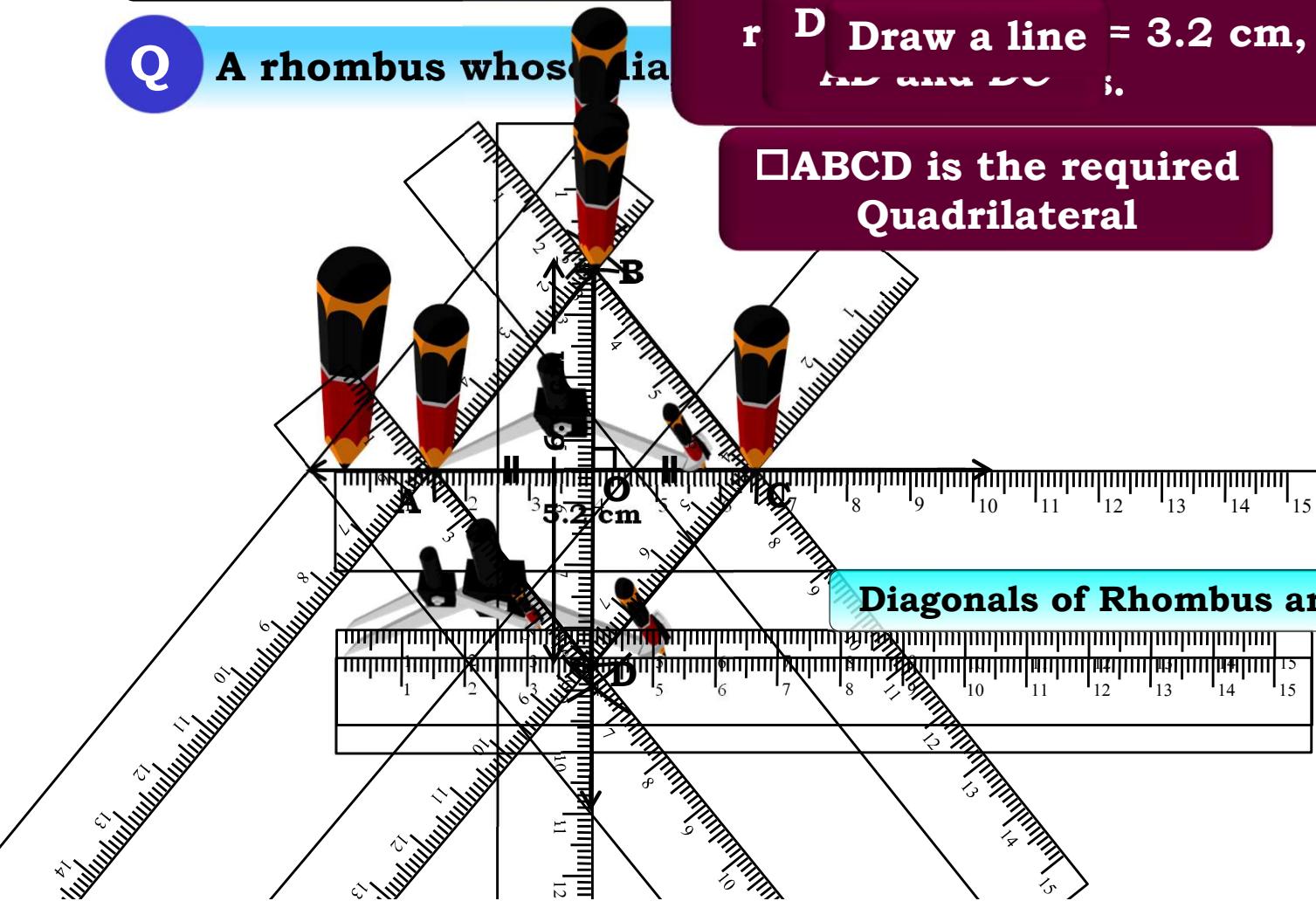
Q A rhombus whose diagonal $AC = 5.2 \text{ cm}$ and $BD = 6.4 \text{ cm}$.

With centre at O and radius 3.2 cm , draw arcs above and below the line segment BD .

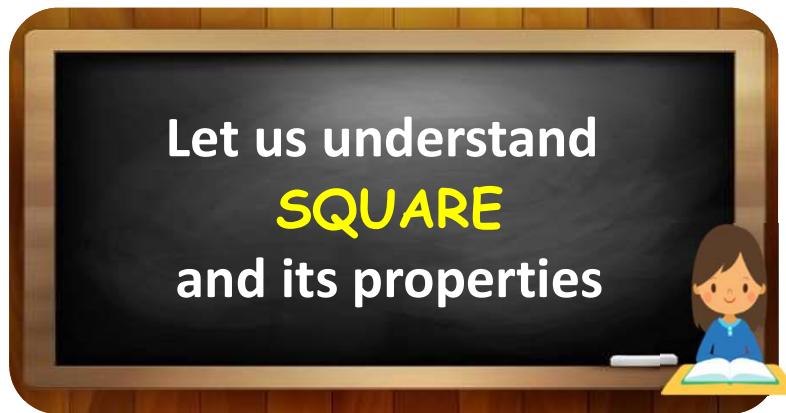
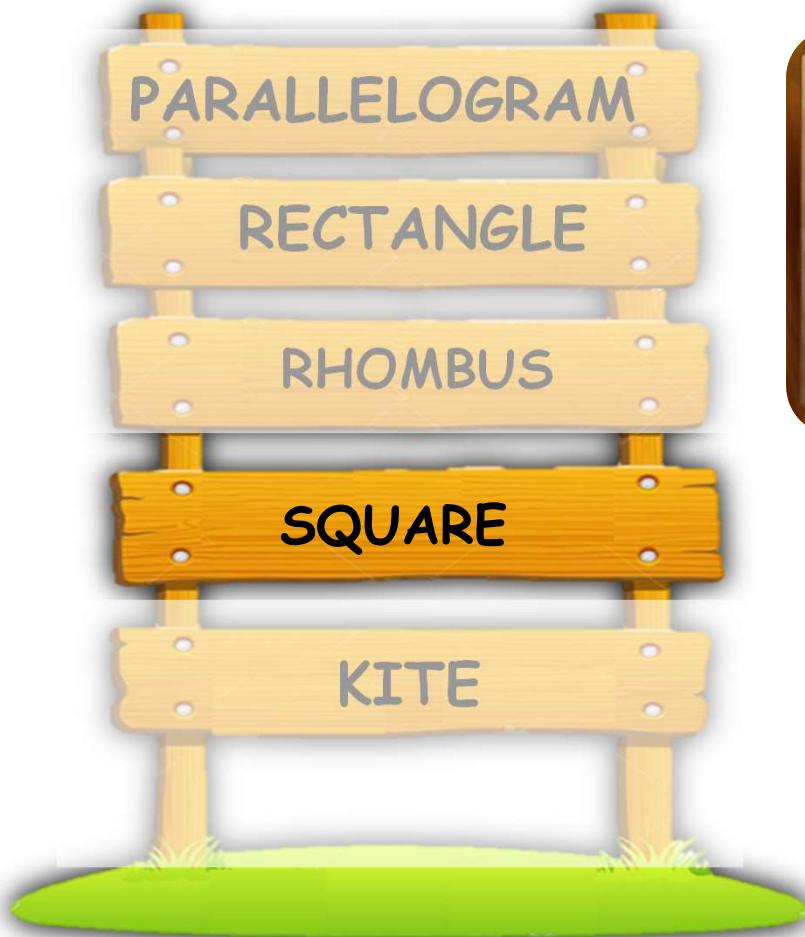
$\square ABCD$ is the required Quadrilateral



Diagonals of Rhombus are perpendicular bisectors.



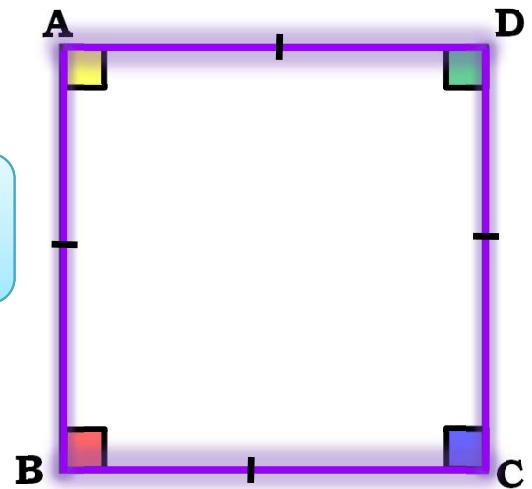
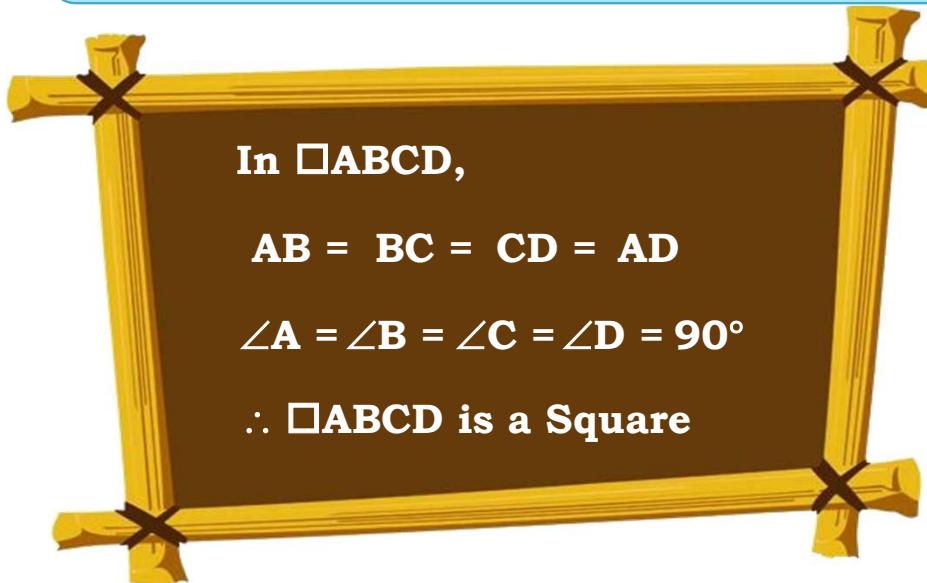
Module 29



SQUARE

Definition:

A quadrilateral with all sides equal and every angle a right angle is called a square.



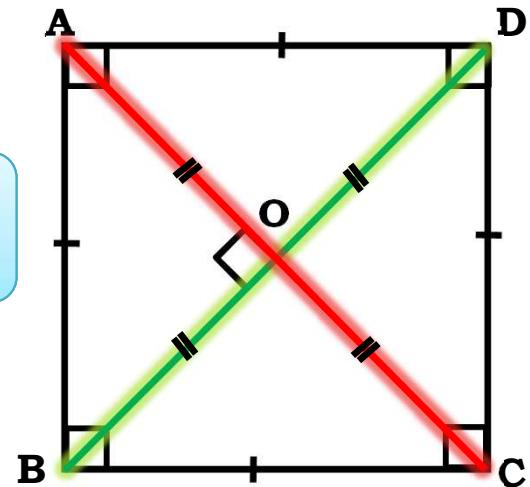
SQUARE

Definition:

A quadrilateral with all sides equal and every angle a right angle is called a square.

Properties of a Square:

- The **diagonals** of a square are **equal**.
i.e. $AC = BD$
- The **diagonals** of a square are **perpendicular bisectors** of each other.
i.e. $\angle AOB = 90^\circ$
 $OB = OD, AO = OC$

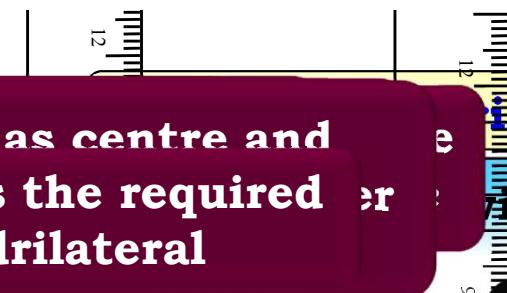


Module 30

Now, P as centre and
READ is the required
Quadrilateral

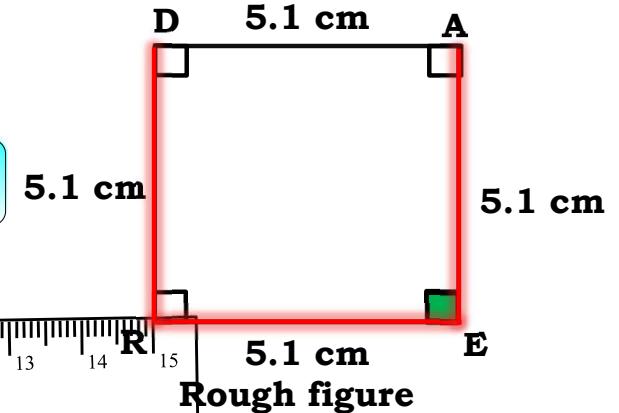
Draw ES

Material of following measures.



RE = 5.1 cm

All sides of a Square are equal

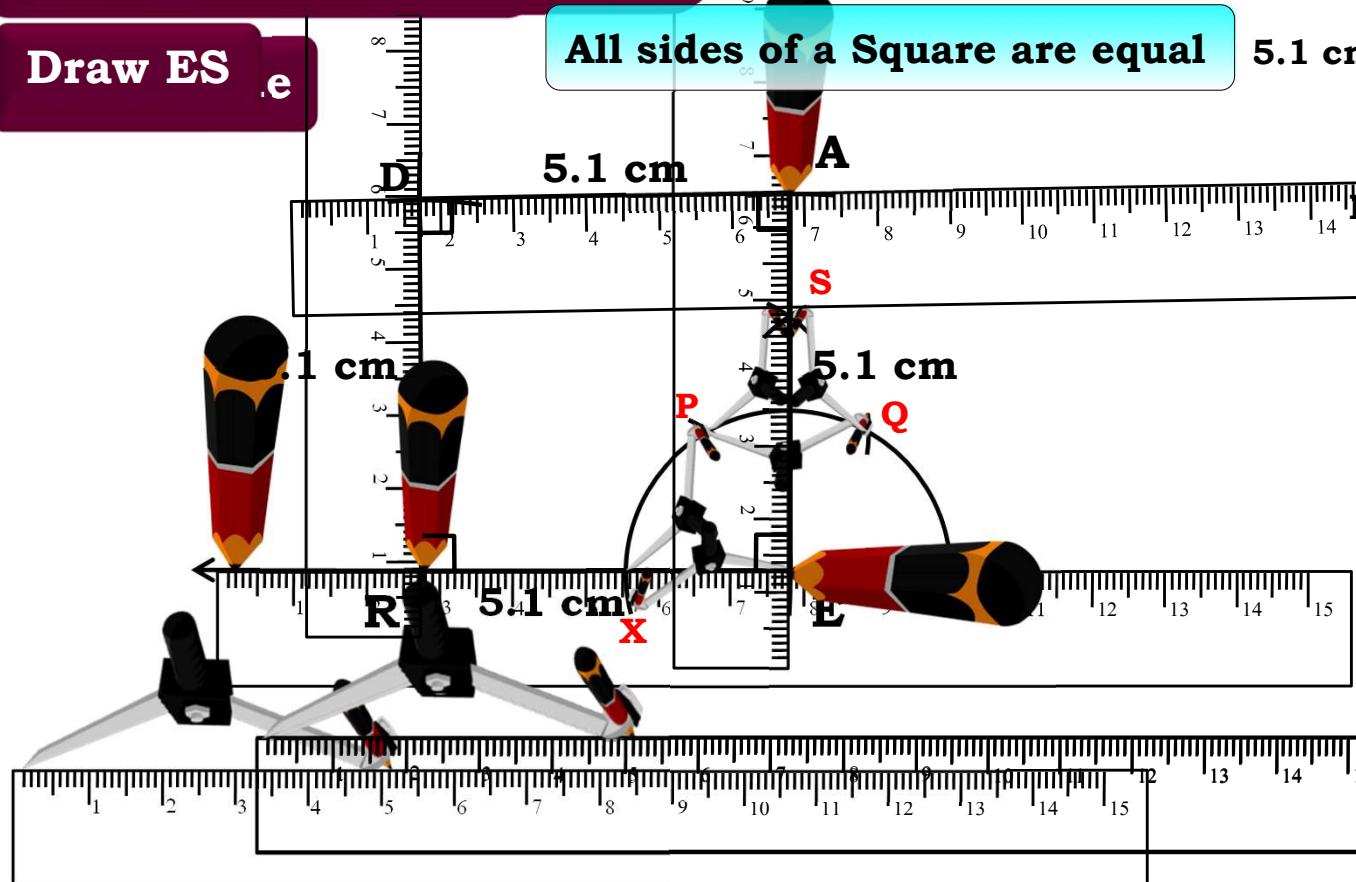


5.1 cm

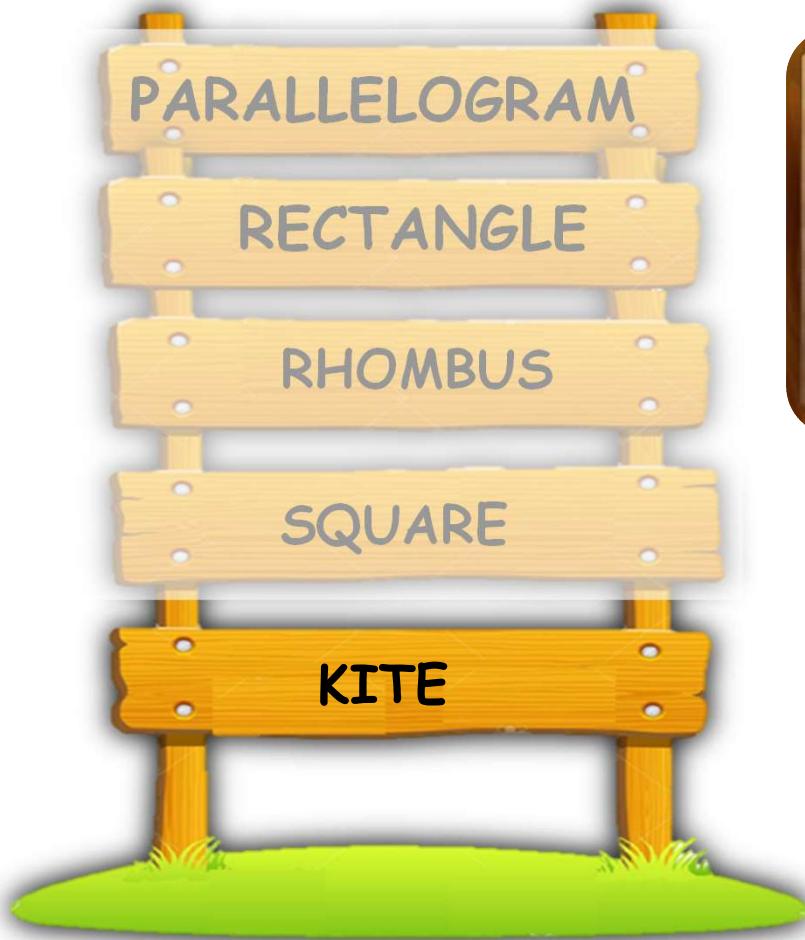
D 5.1 cm A

5.1 cm

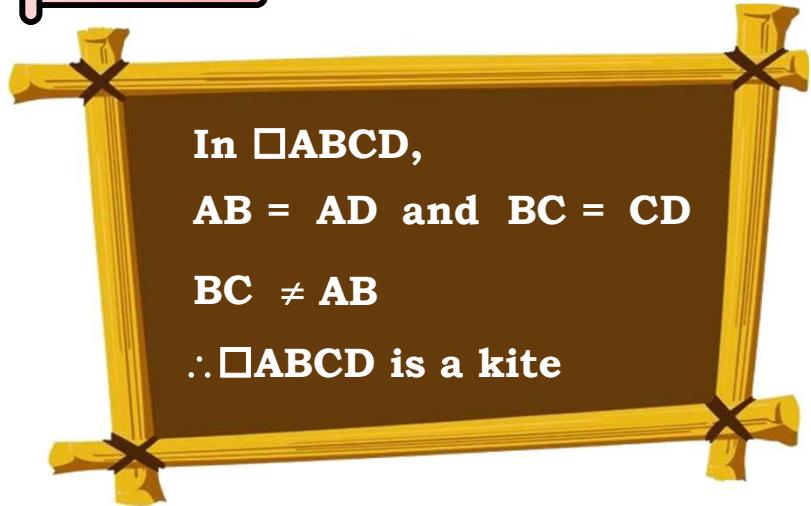
E 5.1 cm
Rough figure



Module 31



KITE

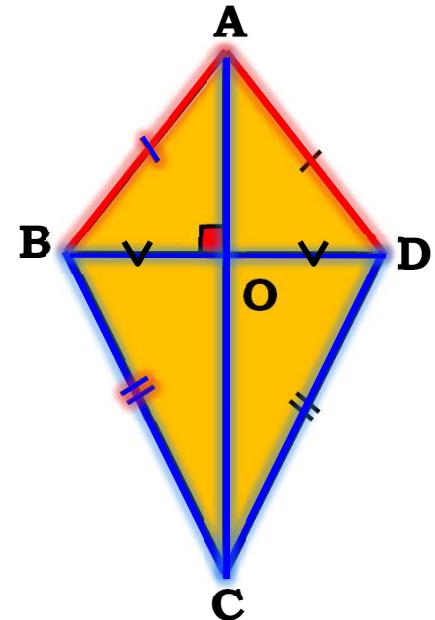


Property of a Kite:

- Longer diagonal is the Perpendicular Bisector of the shorter diagonal.

$$AC \perp BD$$

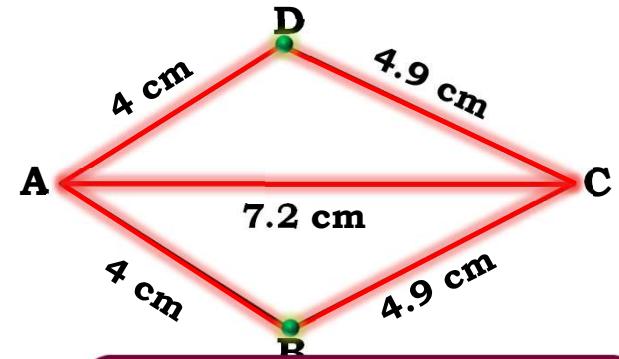
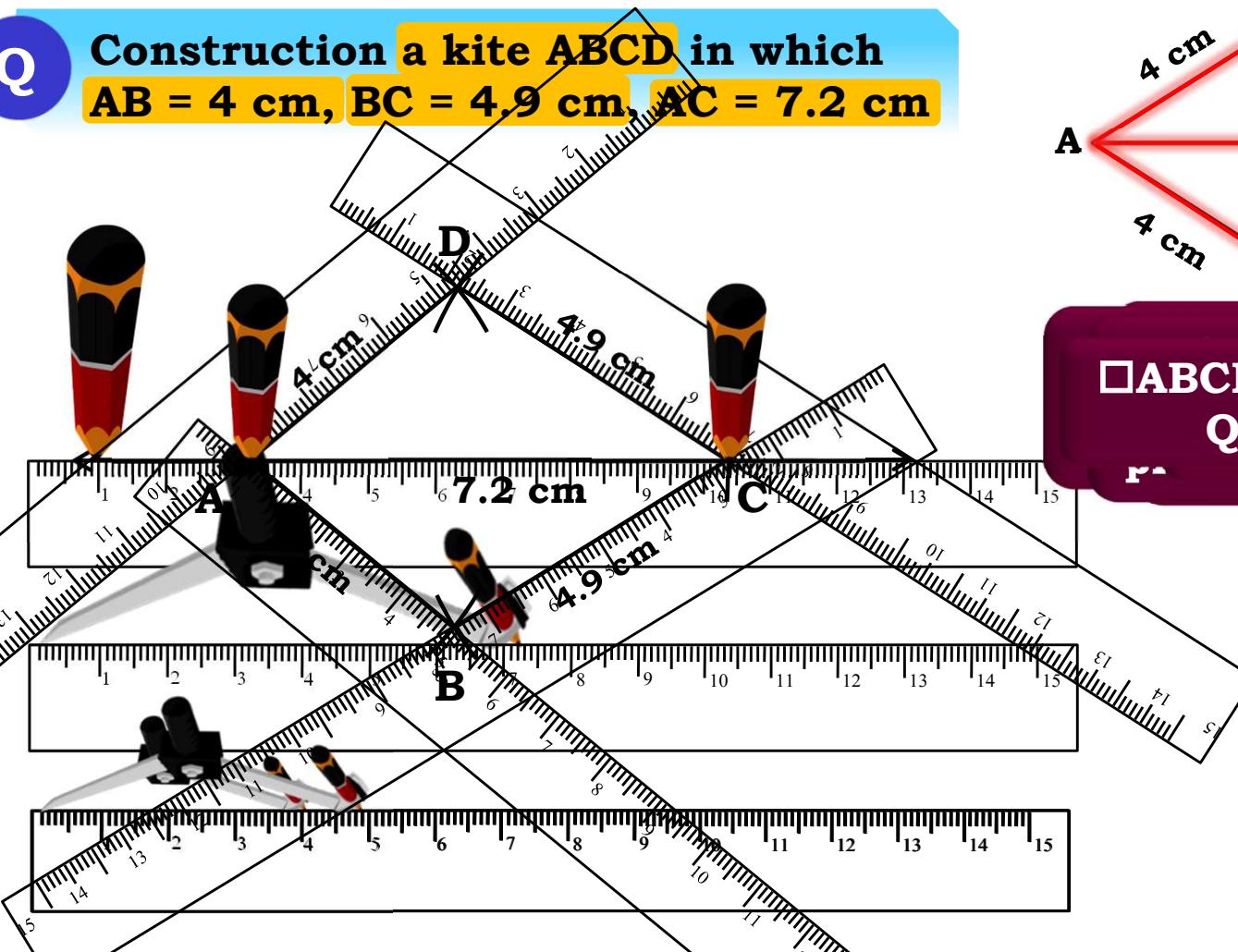
$$OB = OD$$



Construct the following quadrilaterals.

Q

Construction a kite ABCD in which
 $AB = 4 \text{ cm}$, $BC = 4.9 \text{ cm}$, $AC = 7.2 \text{ cm}$



□ABCD is the required
Quadrilateral

F

