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Sahi Prep Hai Toh Life Set Hai

Lines & Angles and Polygons

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We missed 3 session

Today

11 - 12:30 → Introduction + Lines & Angles + Polygon

3:00 - 4:30 →

Doubt session of Trigonometry

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Geometry & Mensuration

(20 22)%

CGL

→ Lines & Angles + Polygons → 2

→ Triangles → 4

→ Quad → 3

→ Circles → 3

→ 2D Mensu → 4

→ 3D Mens → 5

Doubt → 1

1 month

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Class Question → 25Q × 20

+ Homework → 500 Question

+ Gradeup Quizzes → 300 Question

800 Question + Revise

BASIC TERMS USED IN LINES AND ANGLES

Point : A point has no size or shape. It just tells **about the position.**

Line : a line can be defined as a straight one- dimensional figure that has no thickness and extends endlessly in both directions.

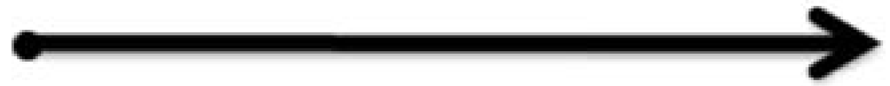
$\overleftrightarrow{PQ}$

Line Segment : A line segment is a portion of a line that is two endpoints.

$\overline{PQ}$

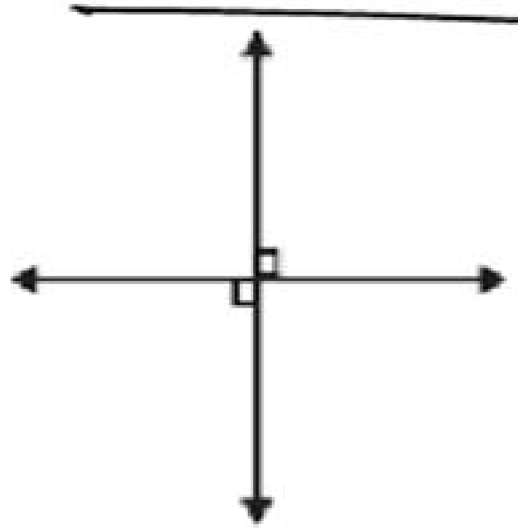
Ray : A ray is a portion of a line which has one endpoint and extends forever in one direction.

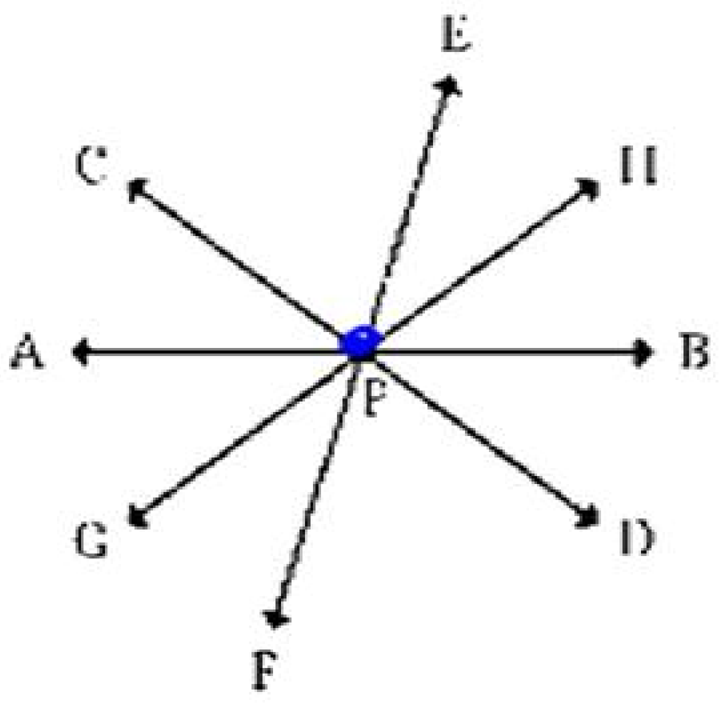
$\overrightarrow{PQ}$



Parallel Lines : Parallel lines can be defined as two lines in the same plane that are at equal distance from each other and never meet.

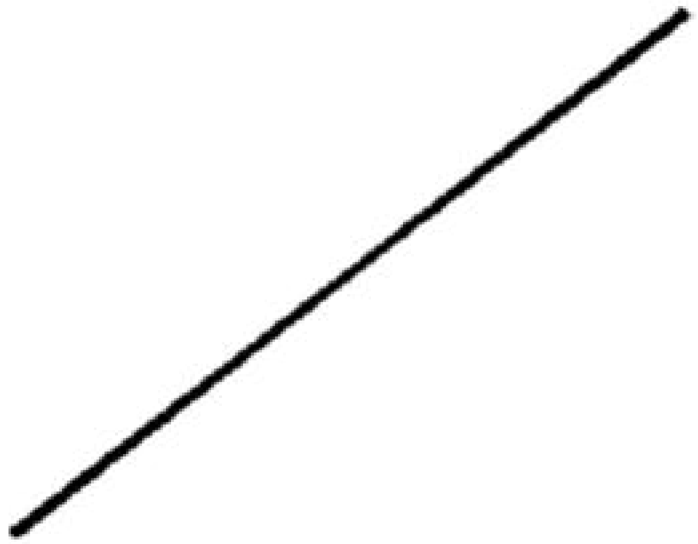
Perpendicular Lines: perpendicular lines are defined as two lines that meet or intersect each other at right angles (90°).





Concurrent Lines:

If 3 or more than 3 lines passes through a single point.



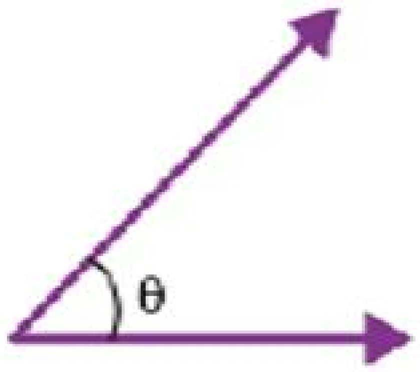
Coincident Lines

Two lines that lie on top of one another are called coincident lines.

Angles

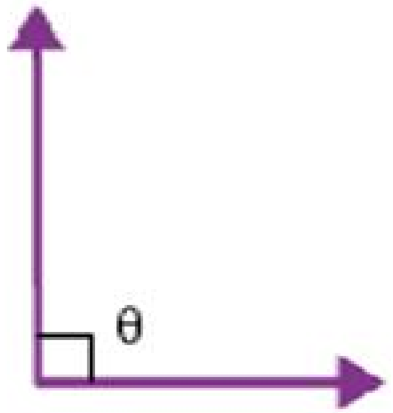
(1) Acute Angle

$0 < \theta < 90$



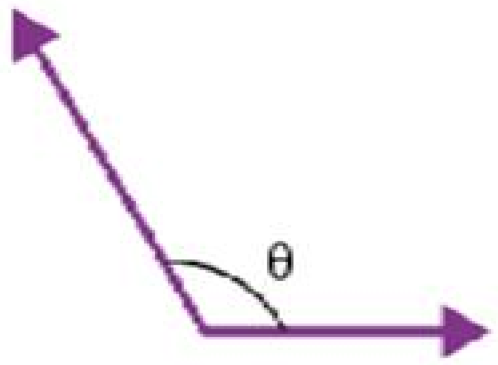
(2) Right Angle

$\theta = 90^\circ$



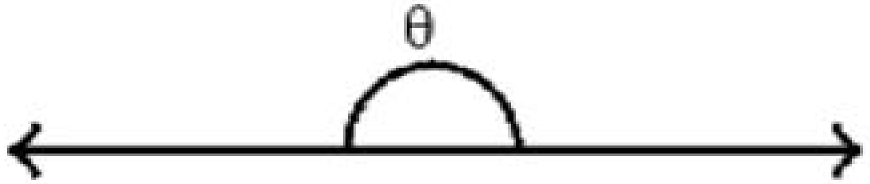
(3) Obtuse Angle

$90 < \theta < 180$

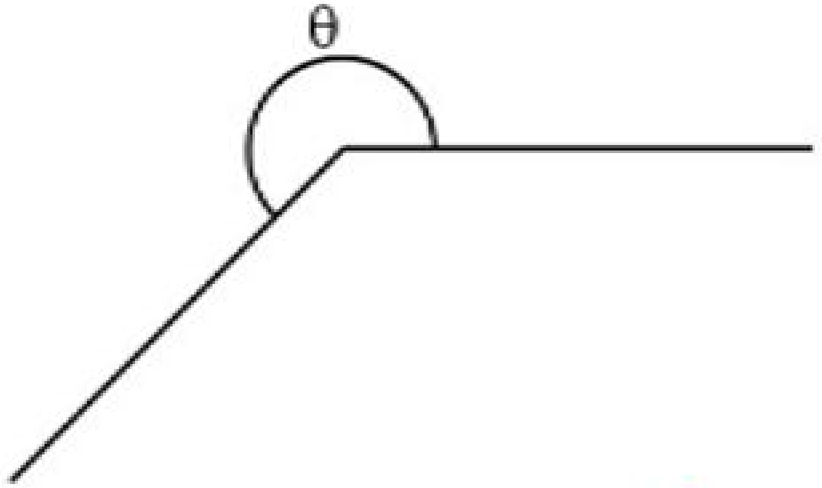


$\theta = 180$

(4) Straight Angle

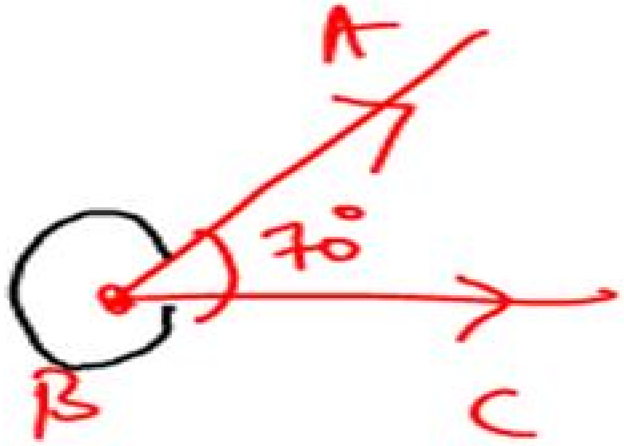


(5) Reflex Angle



$180 < \theta < 360$

Eg

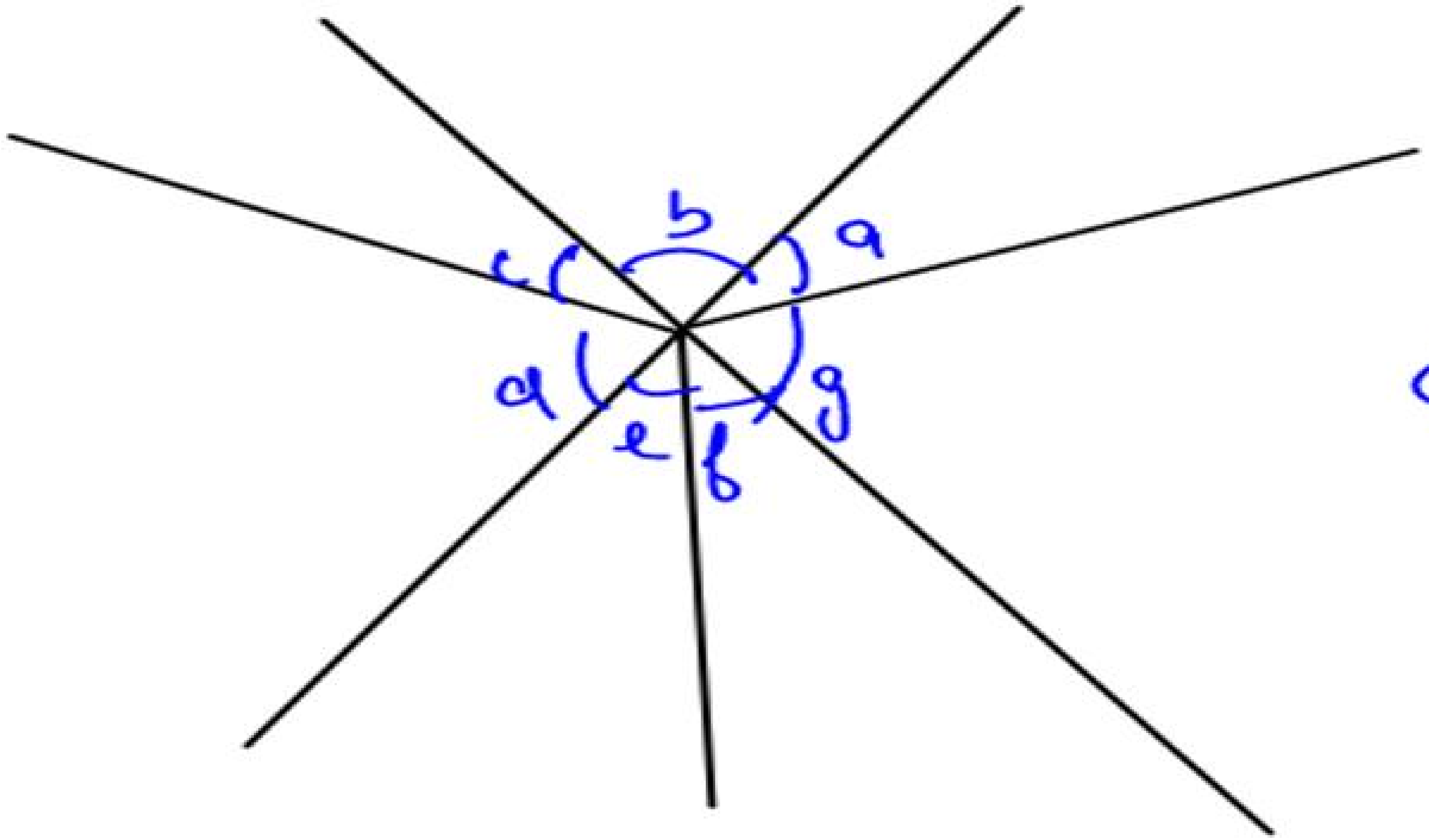


$\angle ABC = 70^\circ$

Reflex Angle $\angle ABC$

$= \underline{\underline{290}}$

Sum of angles around a point = 360°



$a+b+c+d+e+f+g$

$= 360^\circ$

Complementary Angle : $\theta_1 + \theta_2 = 90°$

Supplementary Angle : $\theta_1 + \theta_2 = 180°$

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Eg. If one angle is 20% less than its supplementary angle. Find the angle.

$20\% \left(\frac{1}{5}\right)$

One Angle

$4x$

Supplementary

$5x$

$4x+5x = 180$

$\boxed{x = 20}$

80° ✓

Ans. 80°

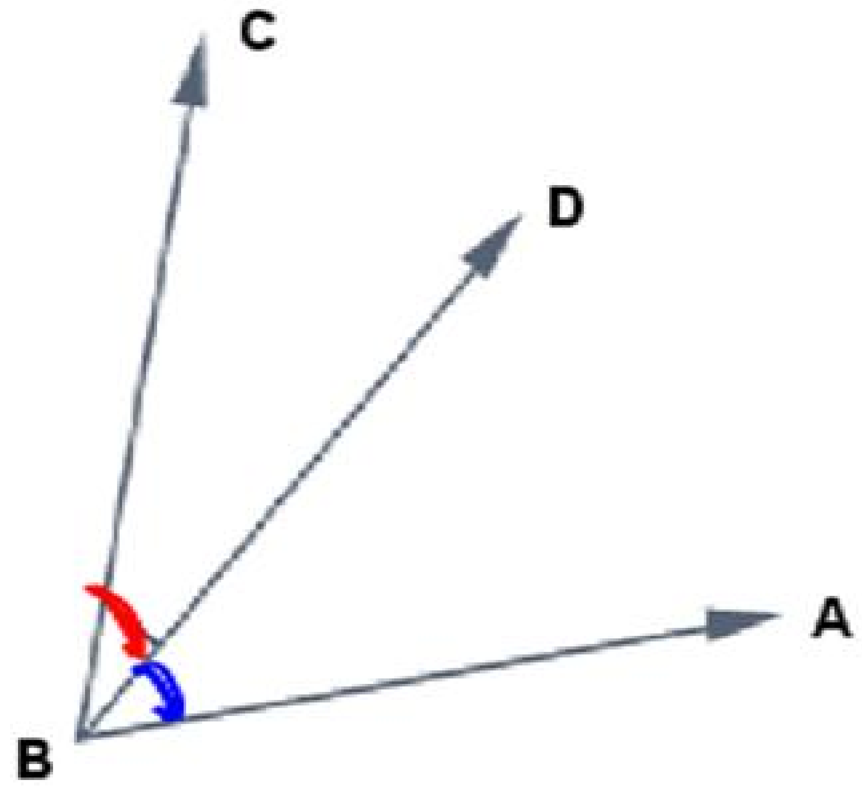
Adjacent Angle

2 angles are said to be **Adjacent.**

(1) Common vertex (B)

(2) Common arm (BD)

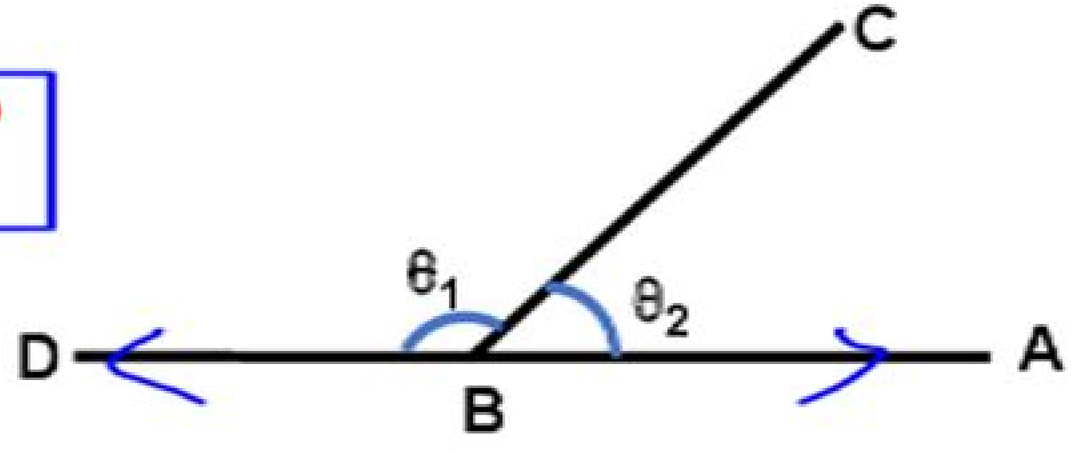
(3) Uncommon arm are on opposite side of common arm.



$\angle ABD$ & $\angle DBC$ are adjacent

Linear Pair : Pair of adjacent angles where the uncommon arms form a straight line.

$$\boxed{\theta_1 + \theta_2 = 180°}$$



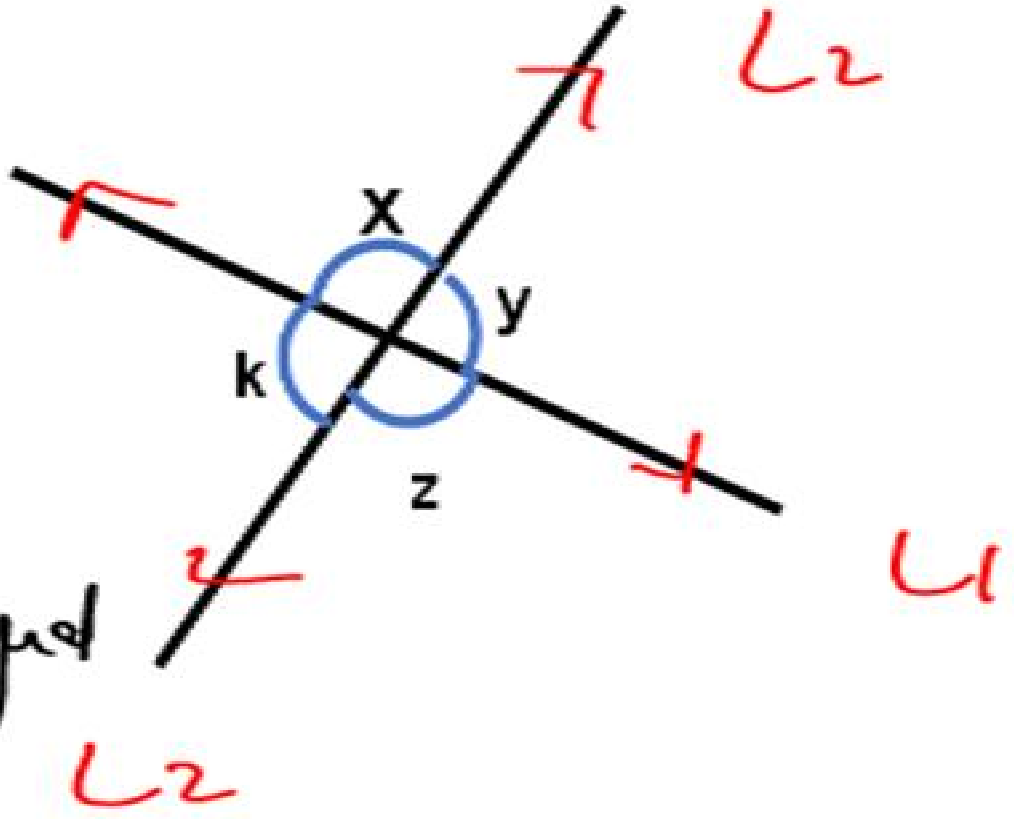
Diff B/w Linear Pair & Supplementary

→ supplementary Angles may not be adjacent

Vertically opposite angle

$\angle x = \angle z$

$\angle y = \angle k$



* Vertically opp angles are equal

<u>Reason</u>

$x + y = 180^\circ$

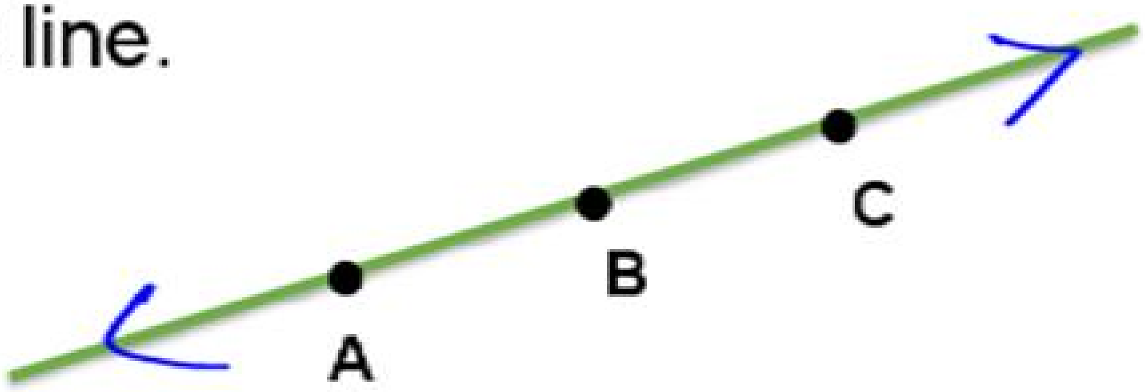
$y + z = 180^\circ$

$x + \cancel{y} = \cancel{y} + z$

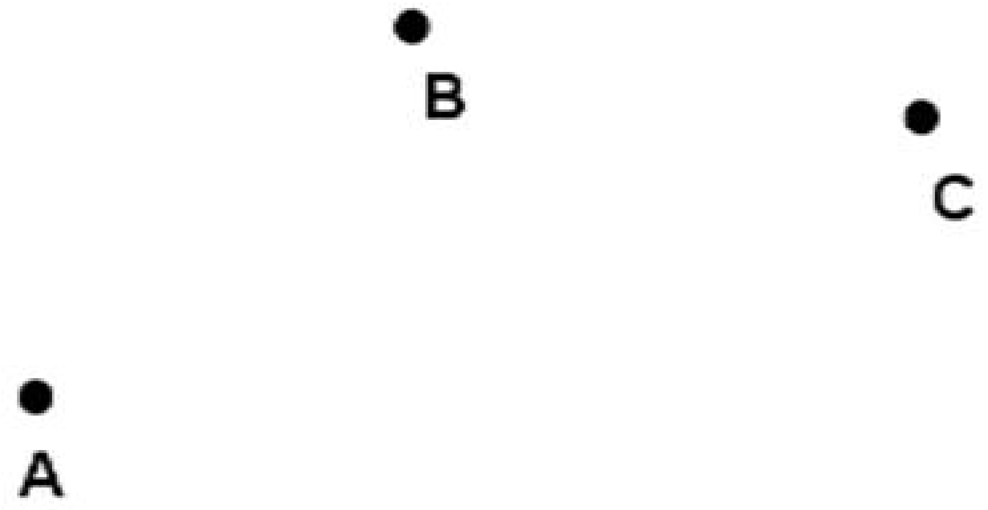
$\boxed{x = z}$

Collinear points :

If 3 or more than 3 points lie on a single line.

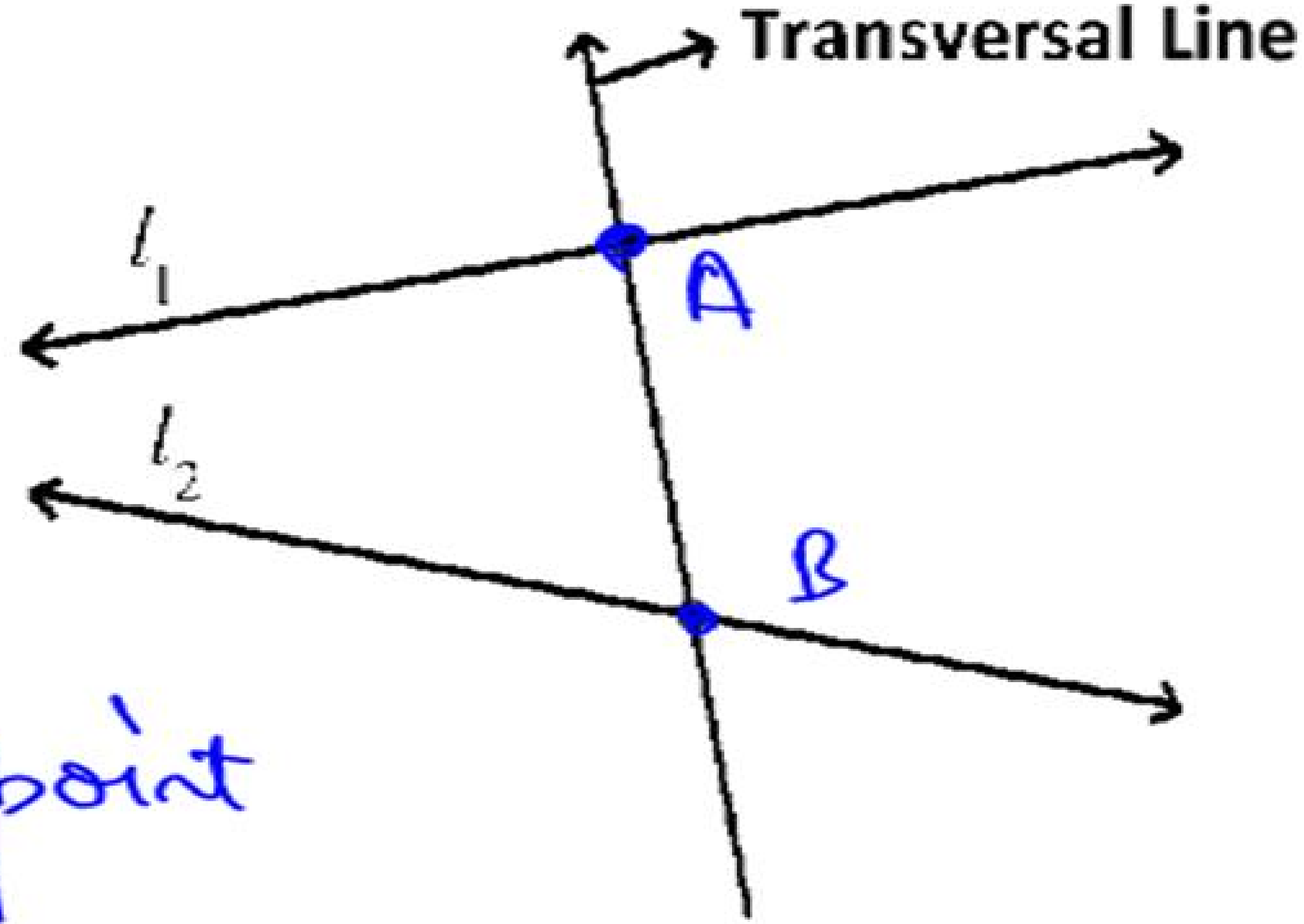


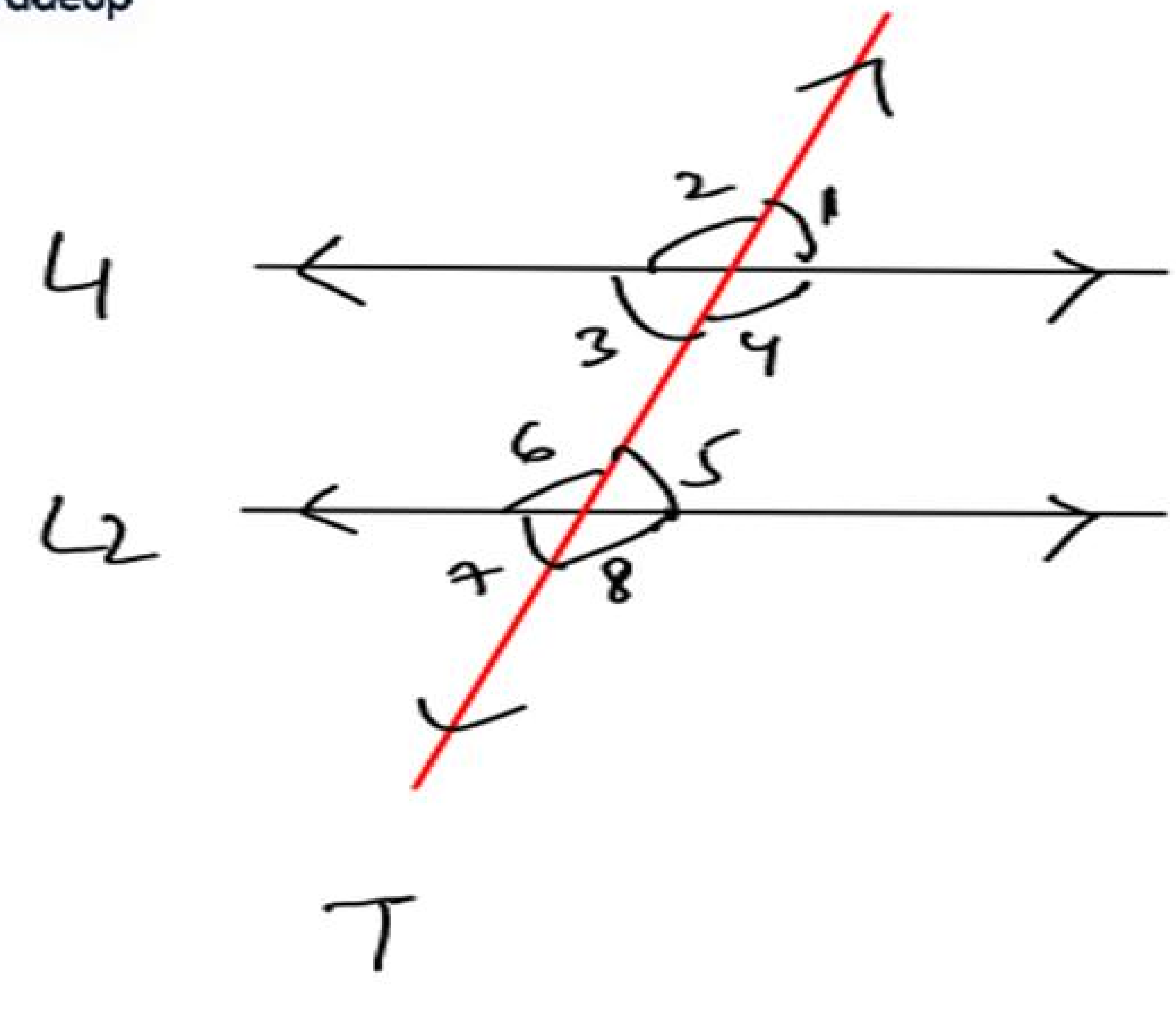
Non-Collinear points



Transversal Line

A line which intersect 2 or more lines at distinct point





$L_1 \parallel L_2$

& T is a transversal

Corresponding Angles

$\angle 1 = \angle 5$ $\angle 3 = \angle 7$

$\angle 2 = \angle 6$ $\angle 4 = \angle 8$

Alternate interior Angle

$\angle 3 = \angle 5$ & $\angle 4 = 6$

CO-interior Angles

$\angle 3 + \angle 6 = 180^\circ$

$\angle 4 + \angle 5 = 180^\circ$

If 2 lines are parallel:

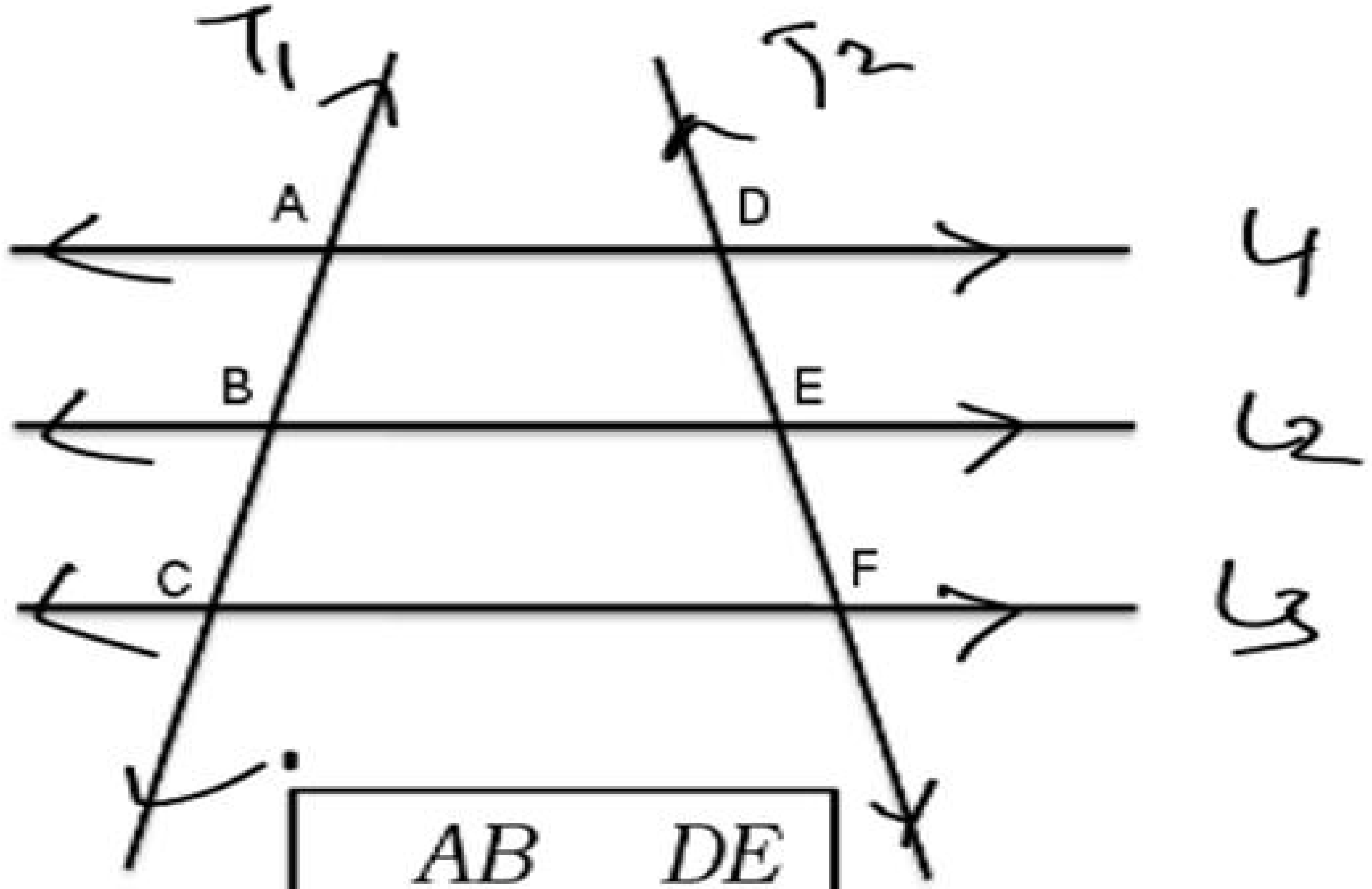
(i) Corresponding angles are equal.

(ii) Alternate interior angle are equal.

(iii) Sum of co-interior angles is 180°.

& their converse is also true

V.imp



$$\boxed{\frac{AB}{BC} = \frac{DE}{EF}}$$

$L_1 \parallel L_2 \parallel L_3$

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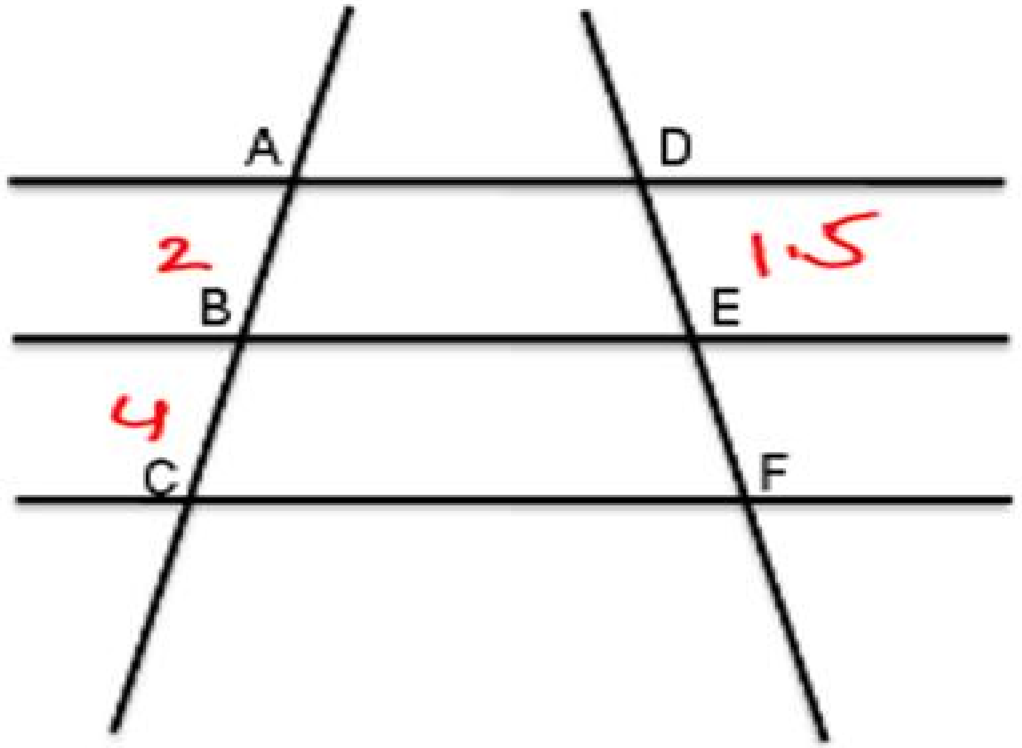
Eg. If AB = 2 cm, BC = 4 cm, DE = 1.5 cm, find DF.



$$\frac{AB}{BC} = \frac{DE}{EF}$$

$$\frac{\cancel{2}}{2\,\cancel{4}} = \frac{1.5}{EF}$$

$$EF = 3$$

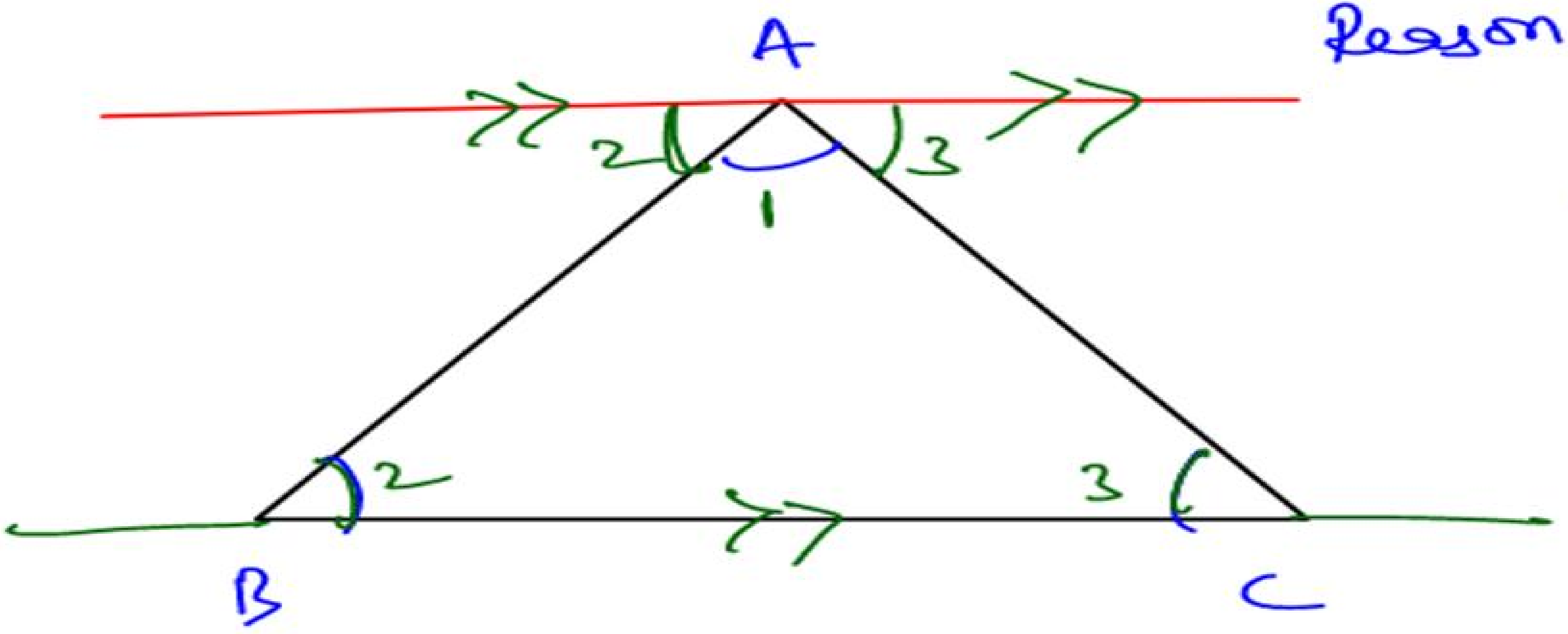
$$DF = DE + EF$$

$$1.5 + 3 = \underline{\underline{4.5}}$$

BASIC THEORY OF TRIANGLES

(1) Sum of all angles of a triangle = 180°

$\angle A + \angle B + \angle C = 180°$

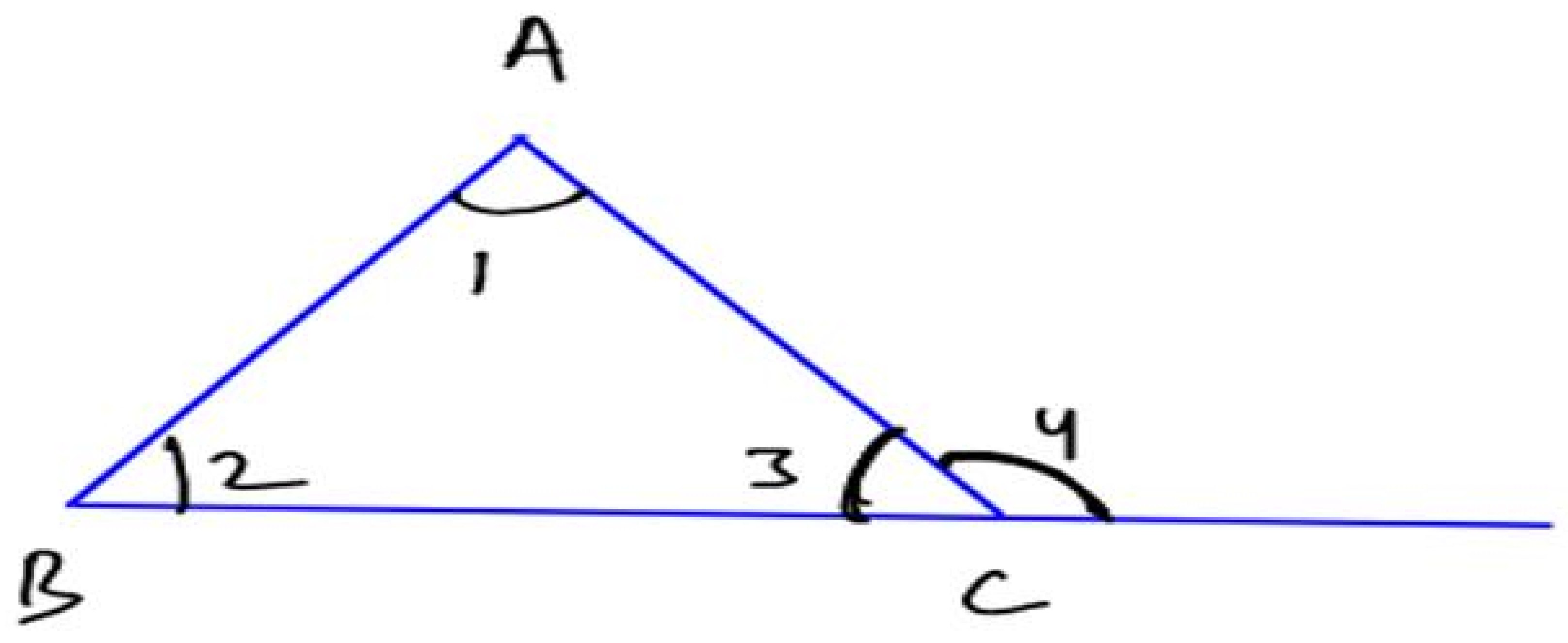


Reason

$\angle 1 + \angle 2 + \angle 3 = 180$

$\angle A + \angle B + \angle C = 180°$

(2) Exterior angle of a triangle is equal to sum of its interior opposite angle.



$\angle 4 = \angle 1 + \angle 2$

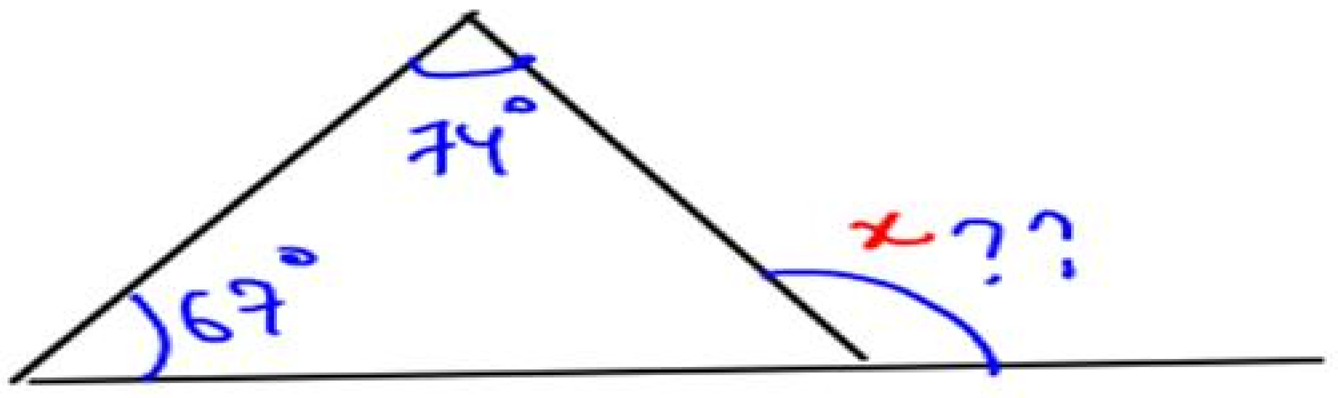
Reason

$\angle 1 + \angle 2 + \angle 3 = 180^\circ$ [sum of 3 angles of Δ]

$\angle 3 + \angle 4 = 180^\circ$ [St line]

$\angle 1 + \angle 2 + \cancel{\angle 3} = \cancel{\angle 3} + \angle 4$

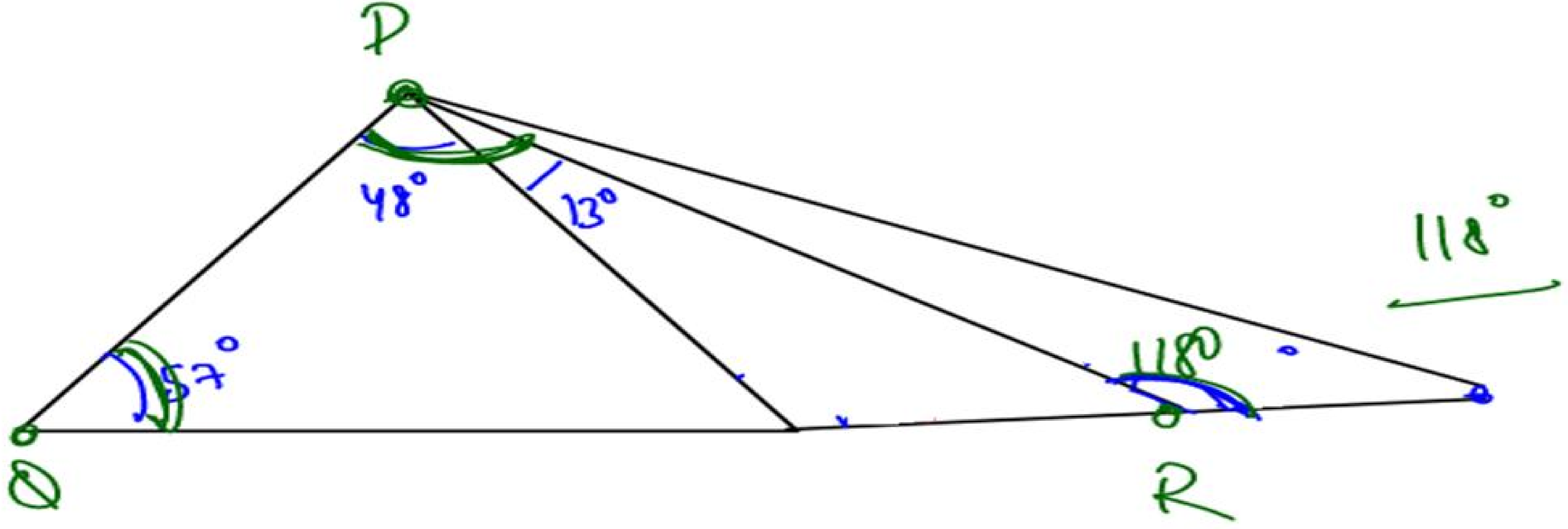
eg 1



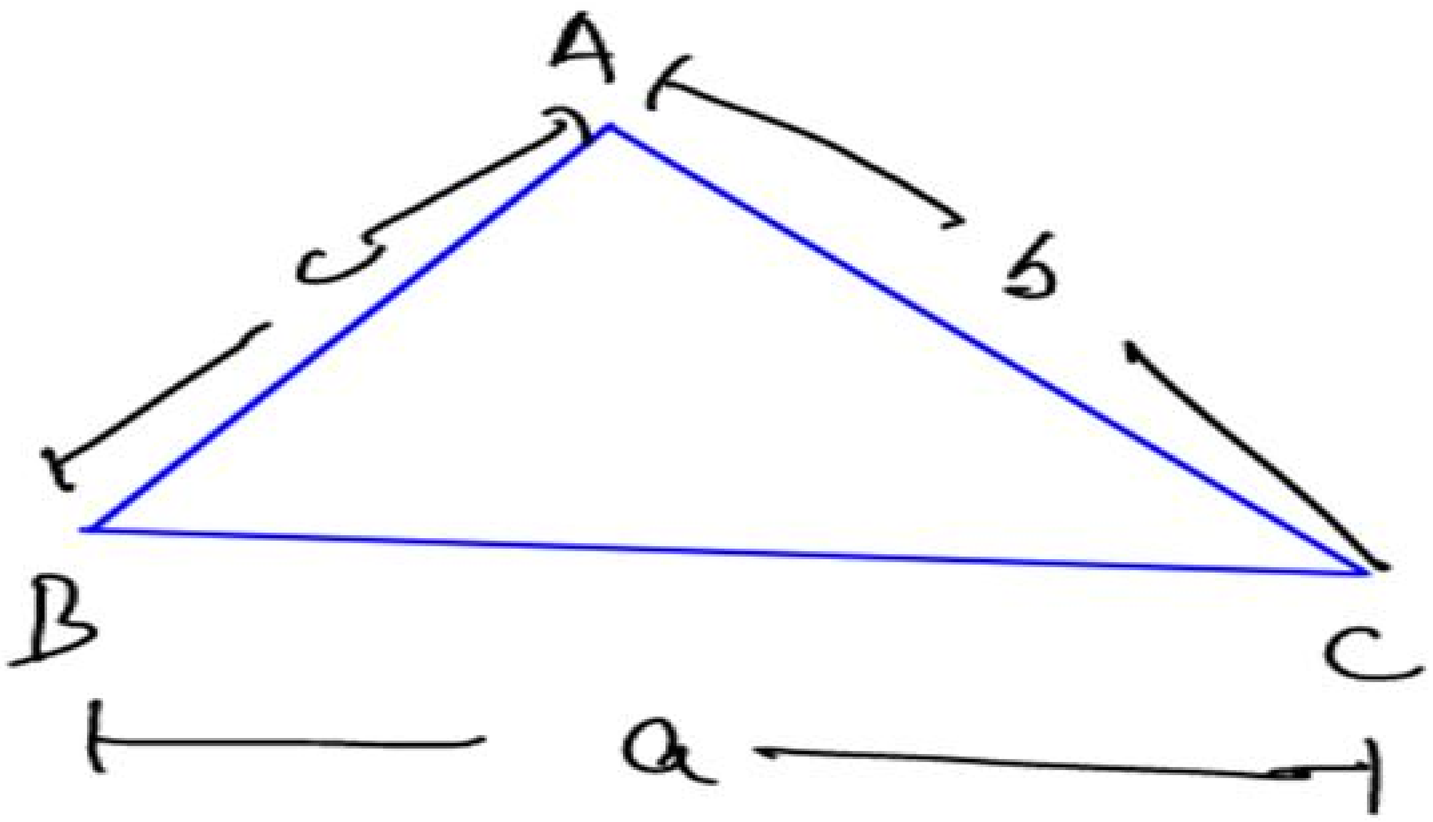
$x = 67 + 74$

$= 141°$

eg 2



(3) Side opposite to largest angle is largest.



If $\angle A > \angle B > \angle C$

$a > b > c$

TYPES OF TRIANGLES

I Scalene

Isosceles

Equilateral

II Acute

Right

Obtuse

(1) Scalene Triangle : Is a Δ in which all sides are distinct.

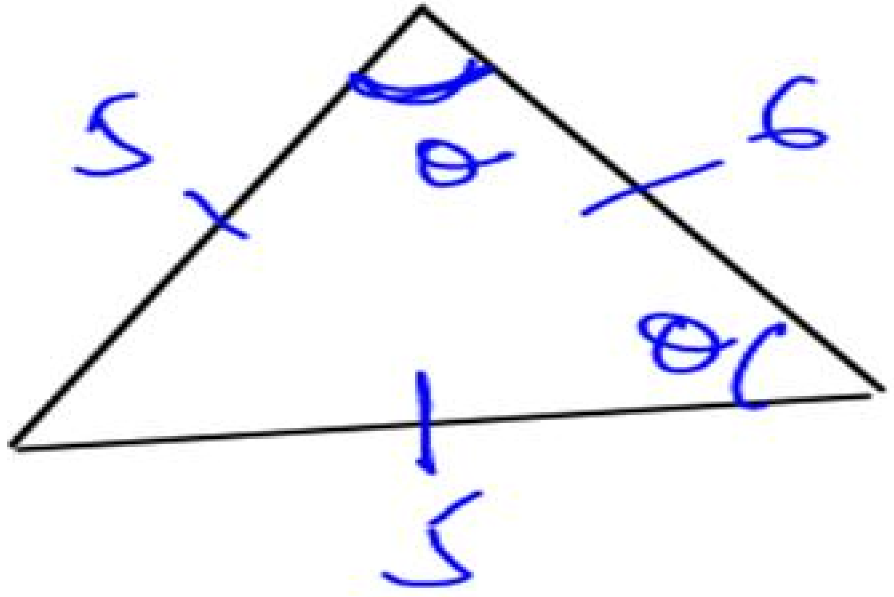
$a \neq b \neq c$

(2) Isosceles Triangle : Is a Δ in which atleast 2 sides are equal.

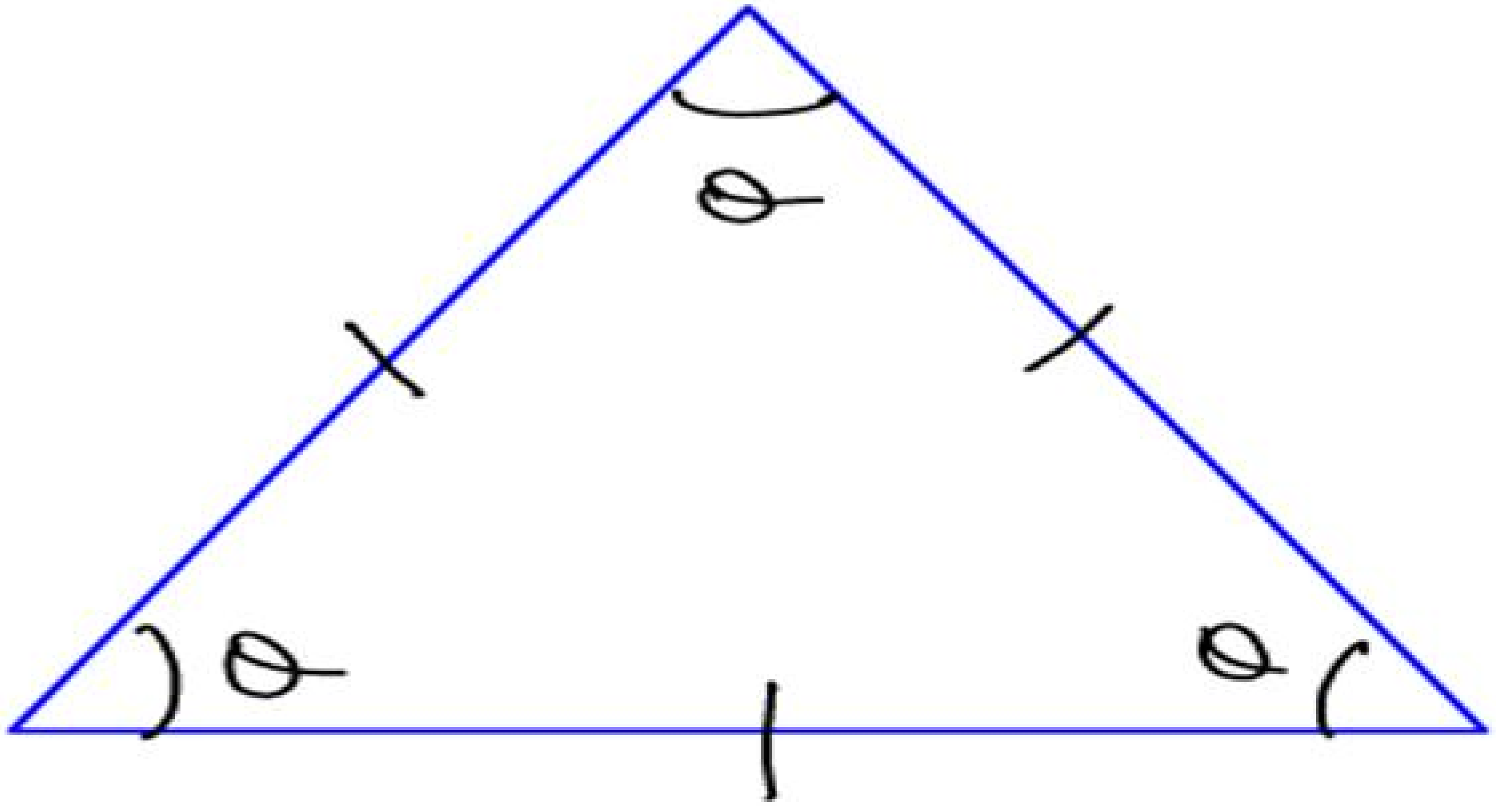
$a = b \neq c$

(3) Equilateral Triangle : Is a Δ in which all sides are equal.

$a = b = c$



Isosceles Δ

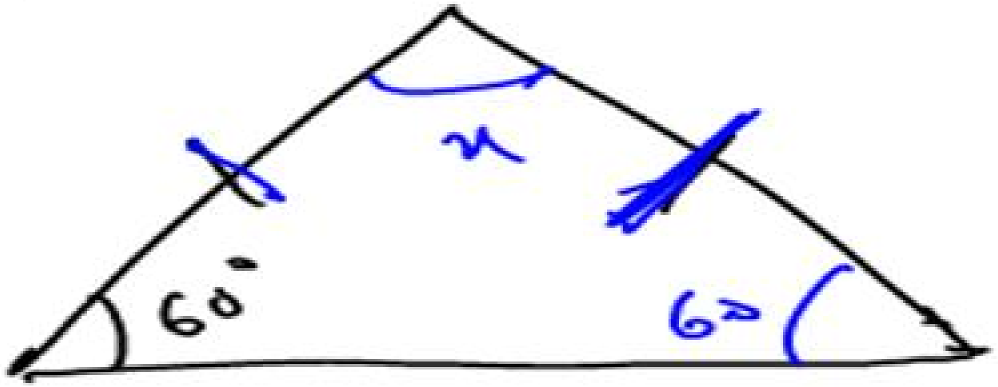


$3\theta = 180^\circ$

$\theta = 60^\circ$

If one angle of an Isosceles Δ is 60° then it is an "EQUILATERAL"

Reason



$120 + x = 180$

$\underline{\underline{x = 60^\circ}}$

$60 + 2K = 180$

$\underline{\underline{K = 60}}$

Isosceles Triangle :

A triangle in which at least 2 sides are equal.

(Equilateral triangle is also isosceles.)

(1) Acute Angle Triangle

All Angles → Acute

(2) Right Angle Triangle

One Angle = 90°

(3) Obtuse Angle Triangle

One Angle is Obtuse

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How to check which type of triangle it is? If length of the sides of triangle are there.

$a \leq b \leq c$

$a^2 + b^2 > c^2$	Acute angle Δ
$a^2 + b^2 = c^2$	Right angle Δ
$a^2 + b^2 < c^2$	Obtuse angle Δ

Reason $\longrightarrow$ COSINE RULE (In Δ's) eg $5, 6, 7$

$5^2 + 6^2 \quad 7^2$

$61 > 49$

Acute

eg $5, 6, 9$

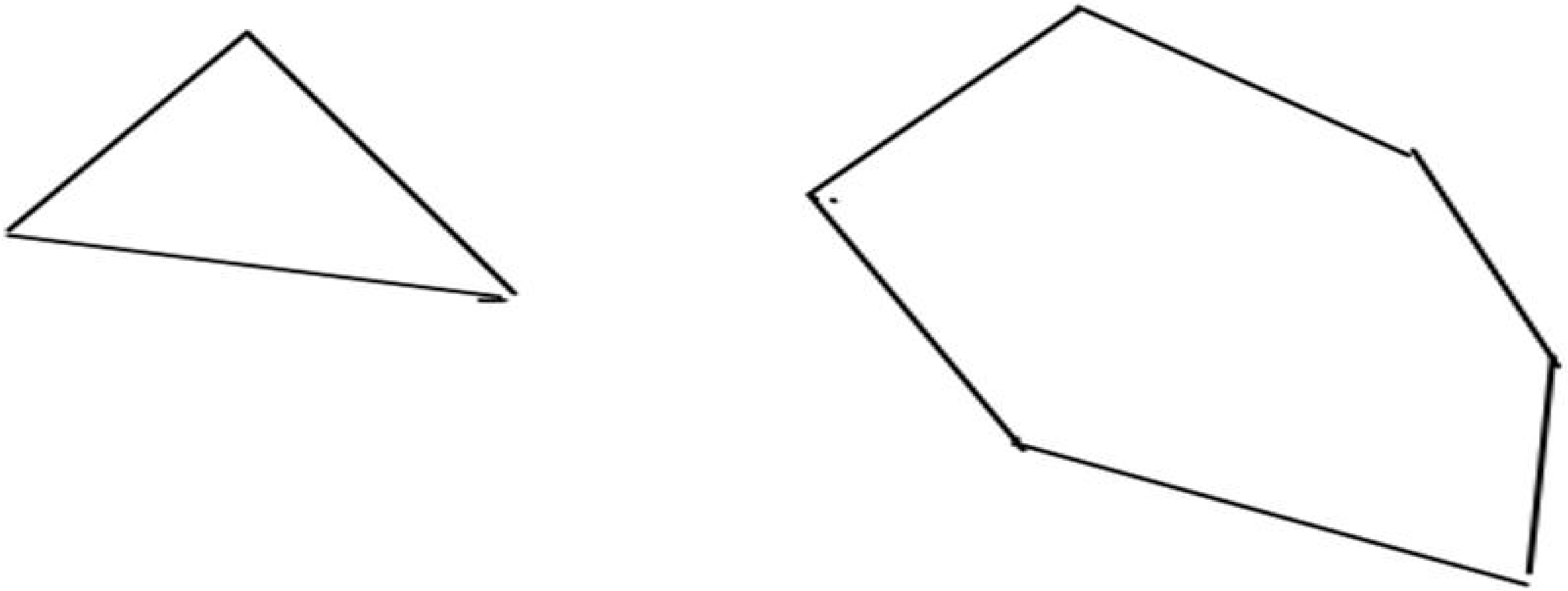
$5^2 + 6^2 < 9^2$

$61 < 81$

Obtuse

POLYGONS

Def: A polygon is a 'n' sided closed figure formed by line segments.



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(1) POLYGON

3 → Triangle

4 → Quad

5 → Pentagon

6 → Hexagon

7 → Heptagon

8 → Octagon

9 → Nonagon

10 → Decagon

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(2) REGULAR POLYGON

Both cond^{n} are necessary

A polygon in which :

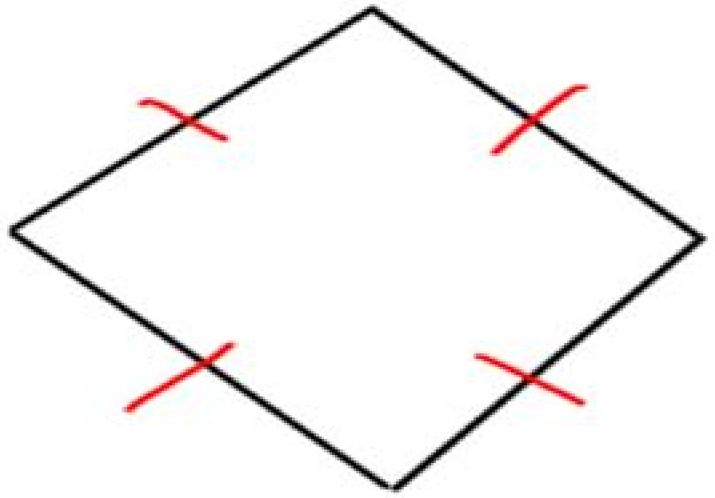
(i) all sides are equal.

(ii) all angles are equal.

Rectangle

Not a Regular Polygon

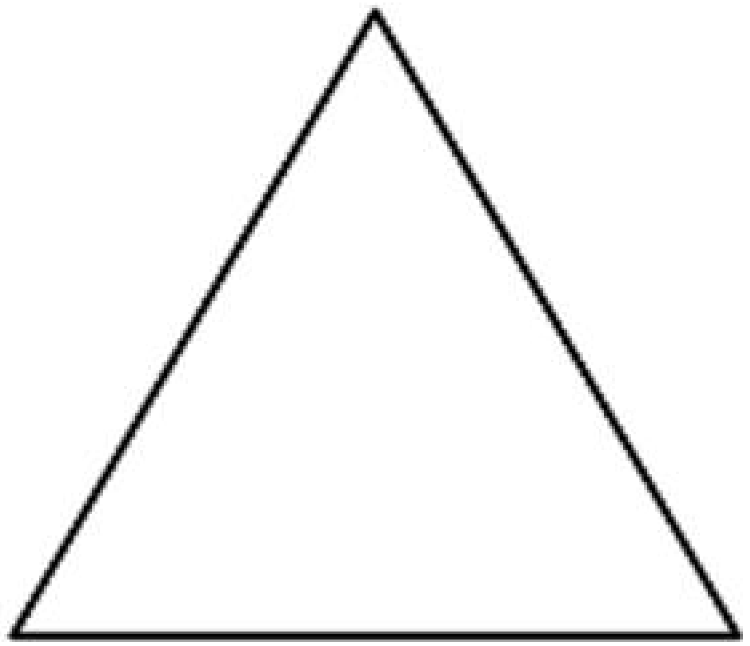
Rhombus



Not a Regular Polygon

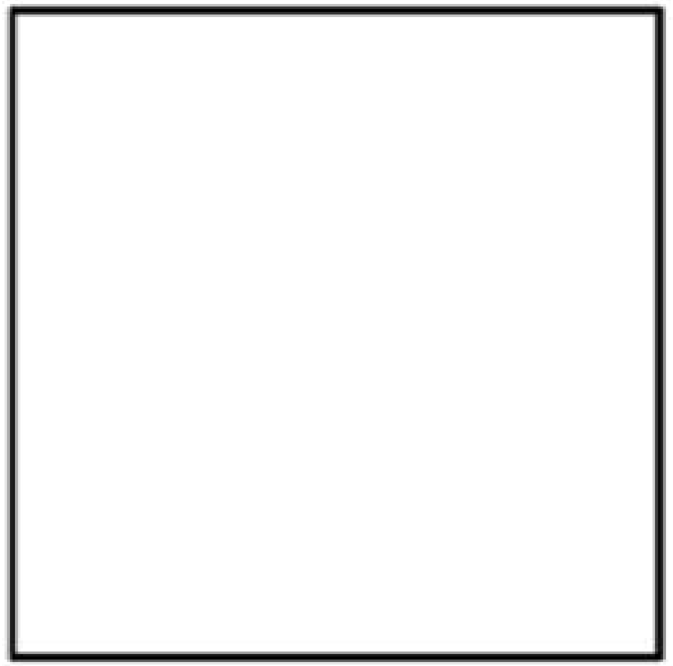
3-SIDED REGULAR POLYGON

→ " EQUILATERAL "

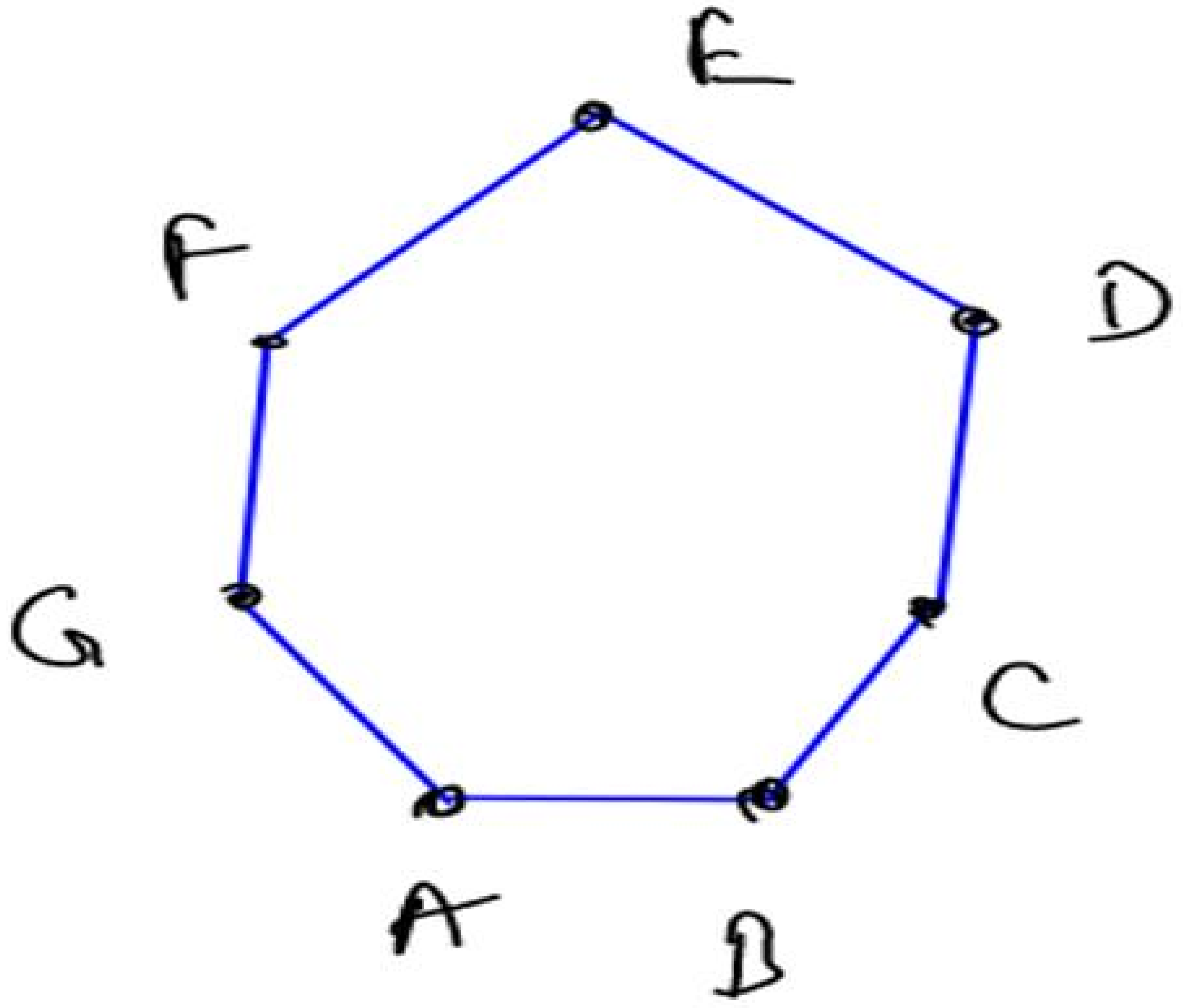


4-SIDED REGULAR POLYGON

"SQUARE"



Sum of all internal angles of a polygon of n sides = (n –2) 180°



$n = 7$

Sum of all Internal Angles

$(7-2)\,180$

$= \underline{900^\circ}$

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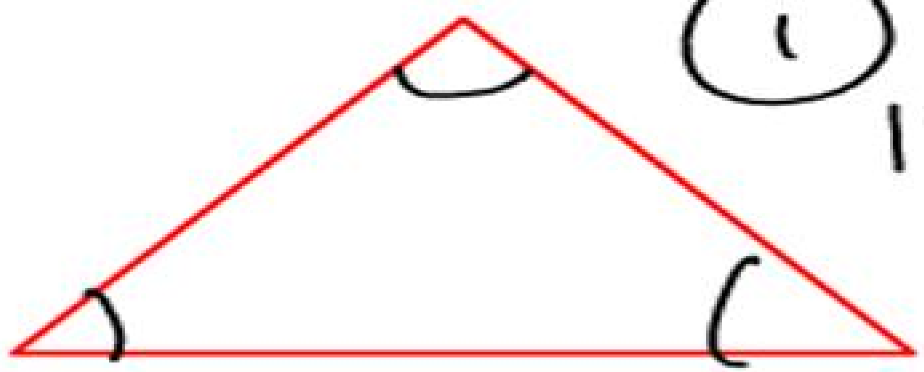
Eg. Find the sum of all interior angles of a 24 sided polygon.

Sol^n

22×180

$= 3960$

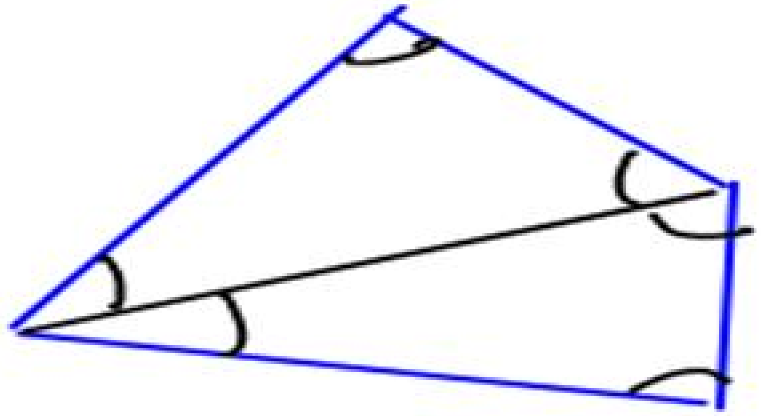
3



1

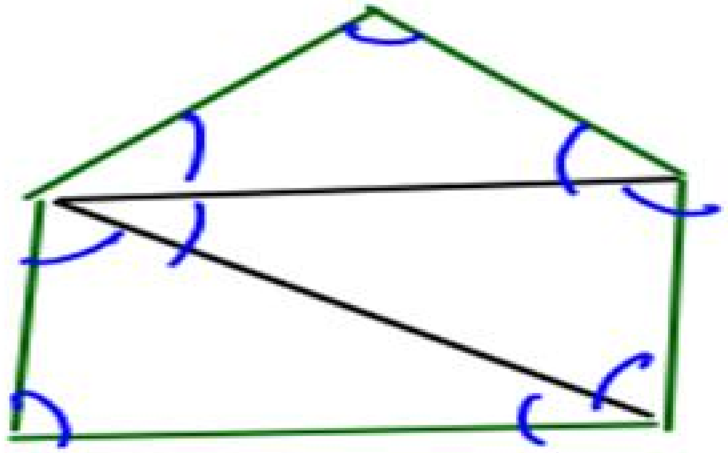
180°

4

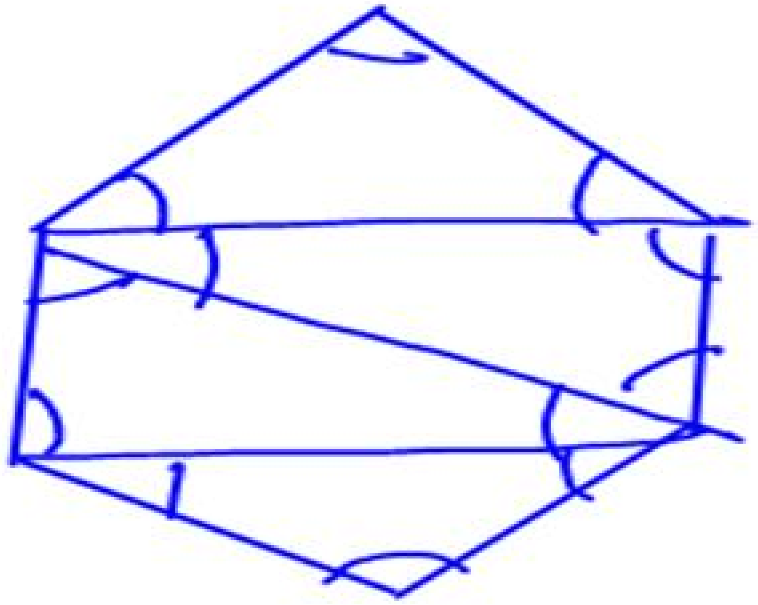


$2\Delta's$

5



$3\Delta's$



$4\Delta's$

n sides $\quad (n-2)\,\Delta's$

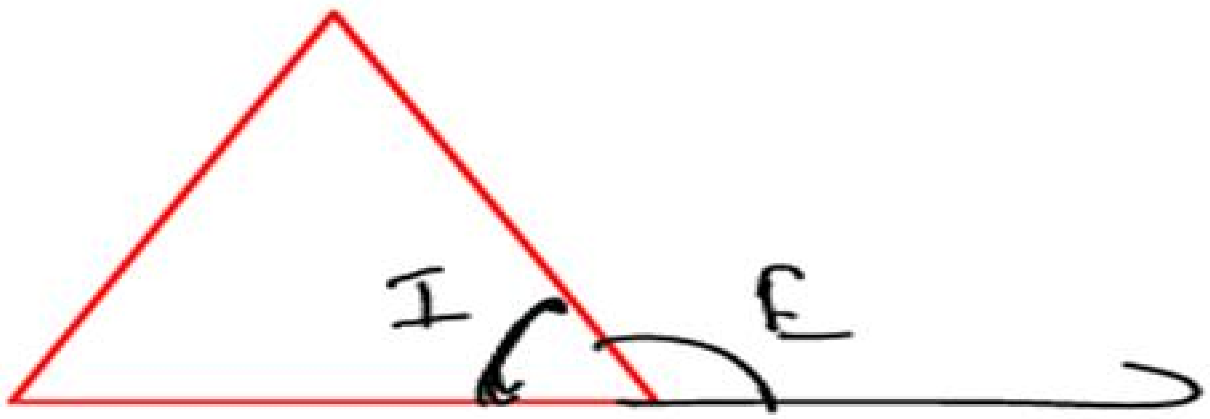
Sum of all Internal Angles $\rightarrow (n-2)\,180^\circ$

Proof :

Sum of all internal angles of a polygon of n sides = $(n - 2)\,180°$

Sum of all exterior angles of a polygon of n sides = 360°

Reason



$I + E = 180°$

n Interior + n Exterior = 180 n

Sum of all exterior = 180 n − (n−2) 180

= 360°

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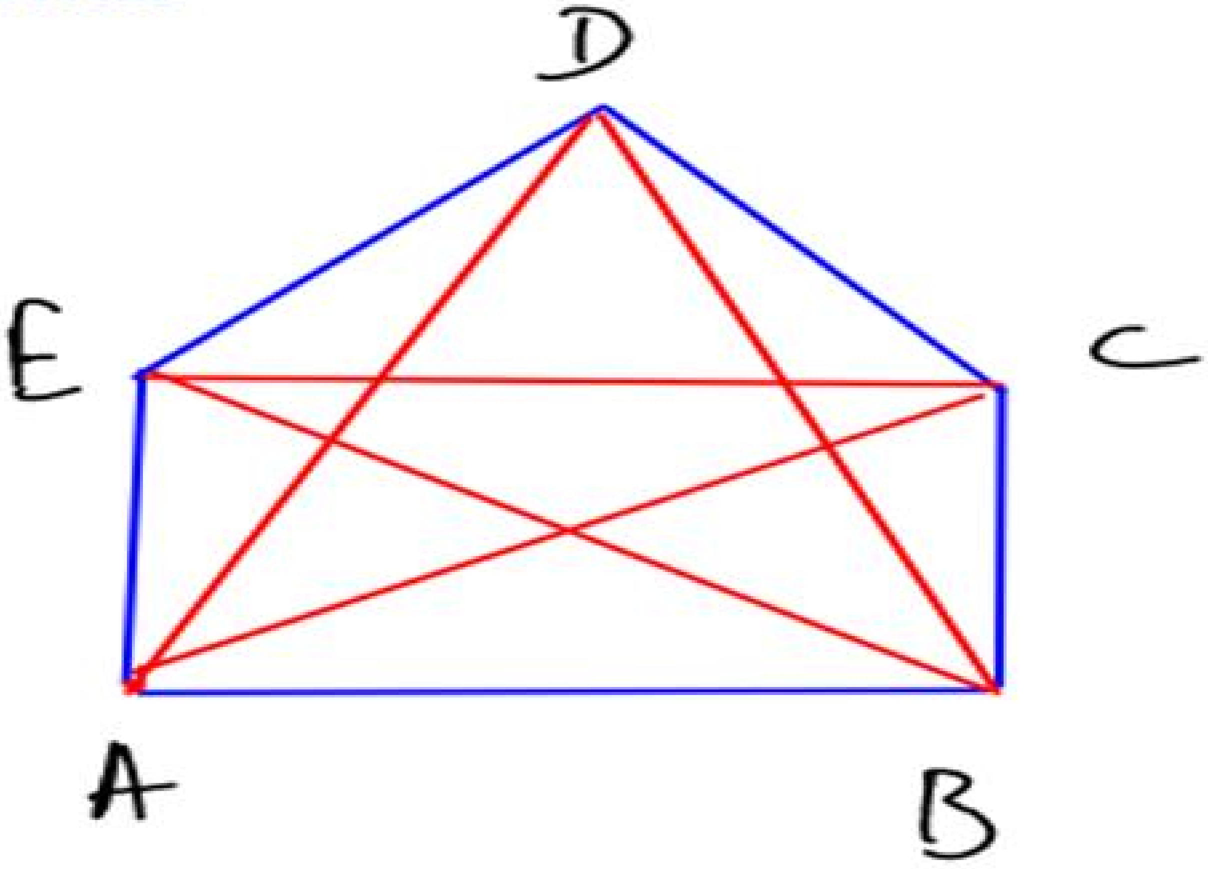
Each interior angle of a regular polygon of n sides = $\dfrac{(n-2)180}{n}$

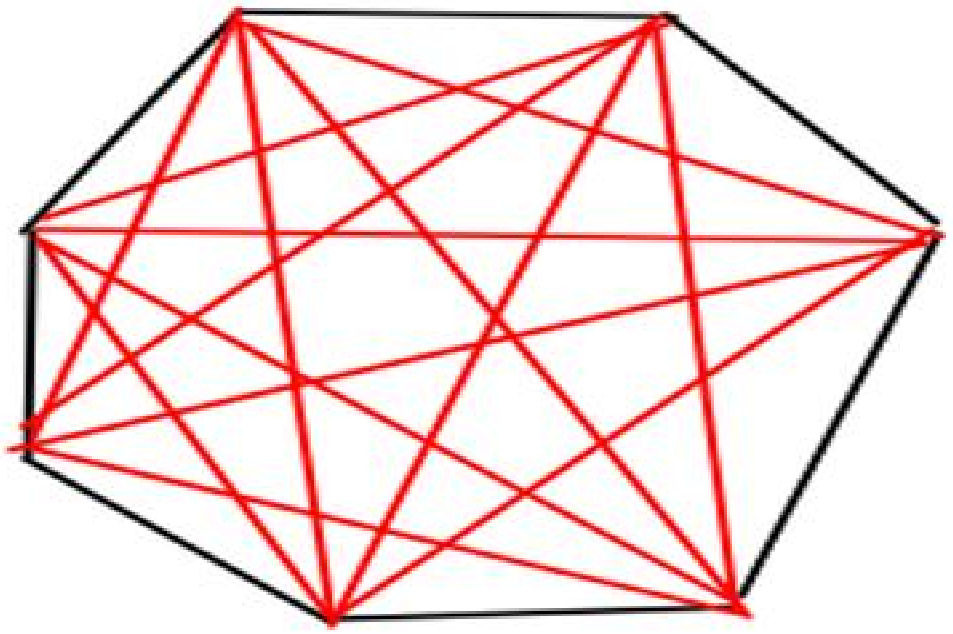
Each exterior angle of a regular polygon of n sides = $\dfrac{360}{n}$

DIAGONAL OF A POLYGON

If you join any 2 (non-adjacent) vertex of a polygon then that is a diagonal.



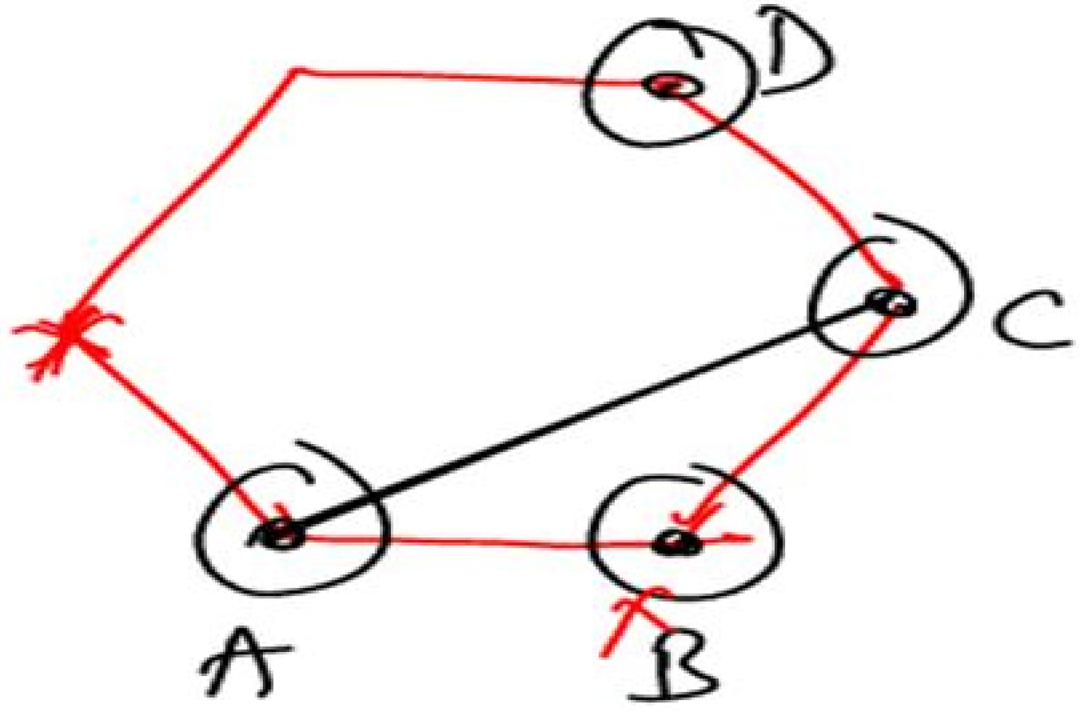
5 Diagonals



14 diagonals

No. of diagonals in a polygon of n sides = $\frac{n(n-3)}{2}$

Reason



Select 2 vertices

1 vertex → n ways

2 vertex → $(n-3)$ ways

$$\boxed{\frac{n(n-3)}{2}}$$

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Eg. How many diagonals are there in a 12 sided polygon.

$$\frac{n(n-3)}{2} \longrightarrow \frac{\overset{6}{\cancel{12}} \cdot 9}{\cancel{2}} \longrightarrow \underline{54 \text{ diagonals}}$$

No. of sides (n)	Name of polygon	Sum of all interior angles	Sum of all exterior angles	No. of diagonals	Regular Polygon		
					Name	Each interior	Each exterior
3	Triangle	180°	360°	0	Equilateral Δ	60°	120°
4	Quadrilateral	360°	360°	2	Square	90°	90°
5	Pentagon	540°	360°	5	Regular Pentagon	108°	72°
6	Hexagon	720°	360°	9	Regular Hexagon	120°	60°
n		$\boxed{(n-2)\,180^\circ}$	$\boxed{360^\circ}$	$\boxed{\frac{n(n-3)}{2}}$		$\frac{(n-2)180}{n}$	$\left(\frac{360}{n}\right)$

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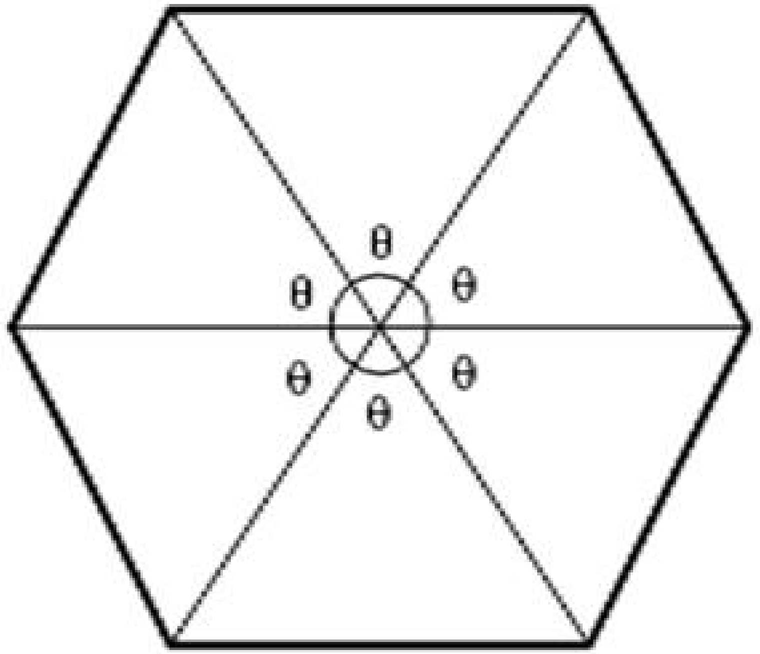
Area of a regular polygon of n sides where length of each side is a :

$$n\frac{a^2}{4}\cot\frac{180}{n}$$

$$\frac{na^2}{4}\cot\left(\frac{180}{n}\right)$$

$n \rightarrow$ no. of sides

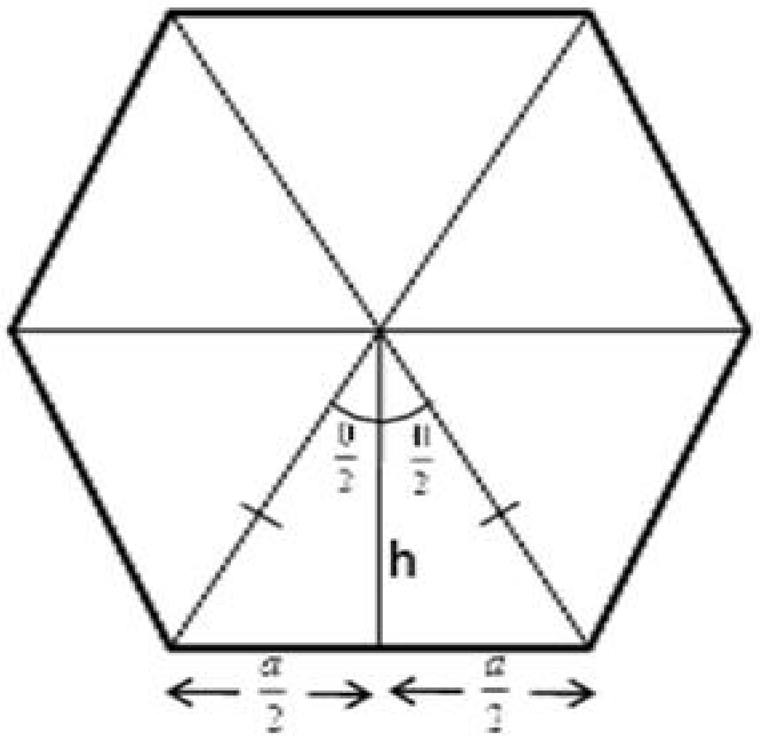
$a \rightarrow$ length of each sid



If there are 'n' sides then

$n \cdot \theta = 360$

$$\theta = \frac{360}{n}$$



$$\cot\frac{\theta}{2} = \frac{h}{\frac{a}{2}}$$

$$h = \frac{a}{2}\cot\frac{\theta}{2}$$

Area of each Δ = ½ ah

Area of regular polygon = n × ½ ah

$$\frac{na^2}{4}\cot\frac{\theta}{2}$$

$$\frac{na^2}{4}\cot\left(\frac{180}{n}\right)$$

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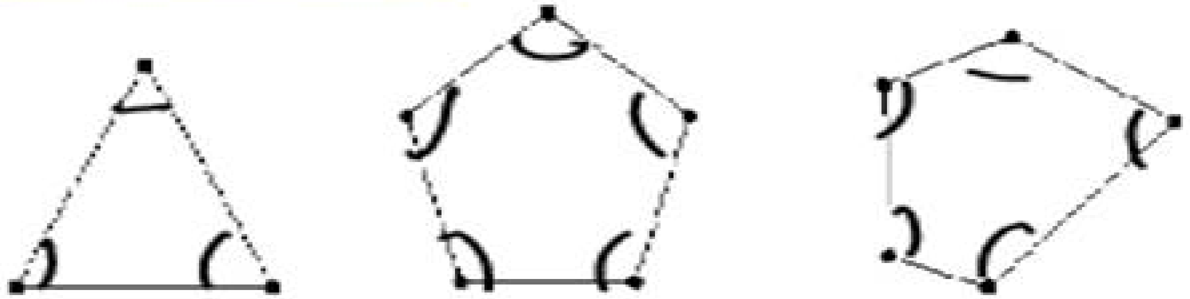
Convex Polygon

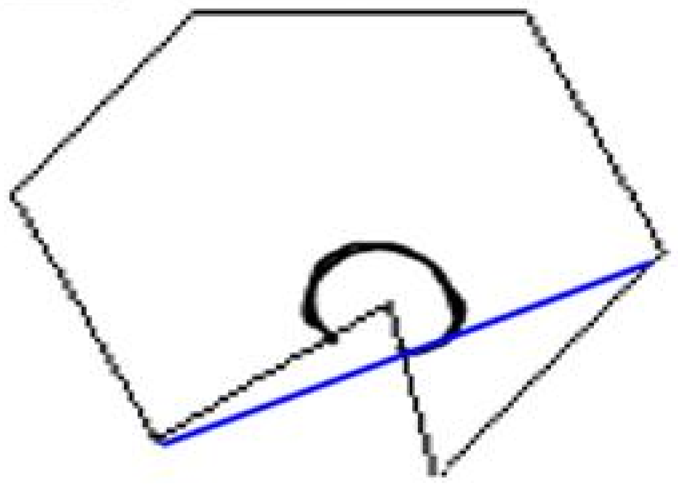


(i) All angles are less than 180º.

(ii) All diagonals lie inside the polygon.

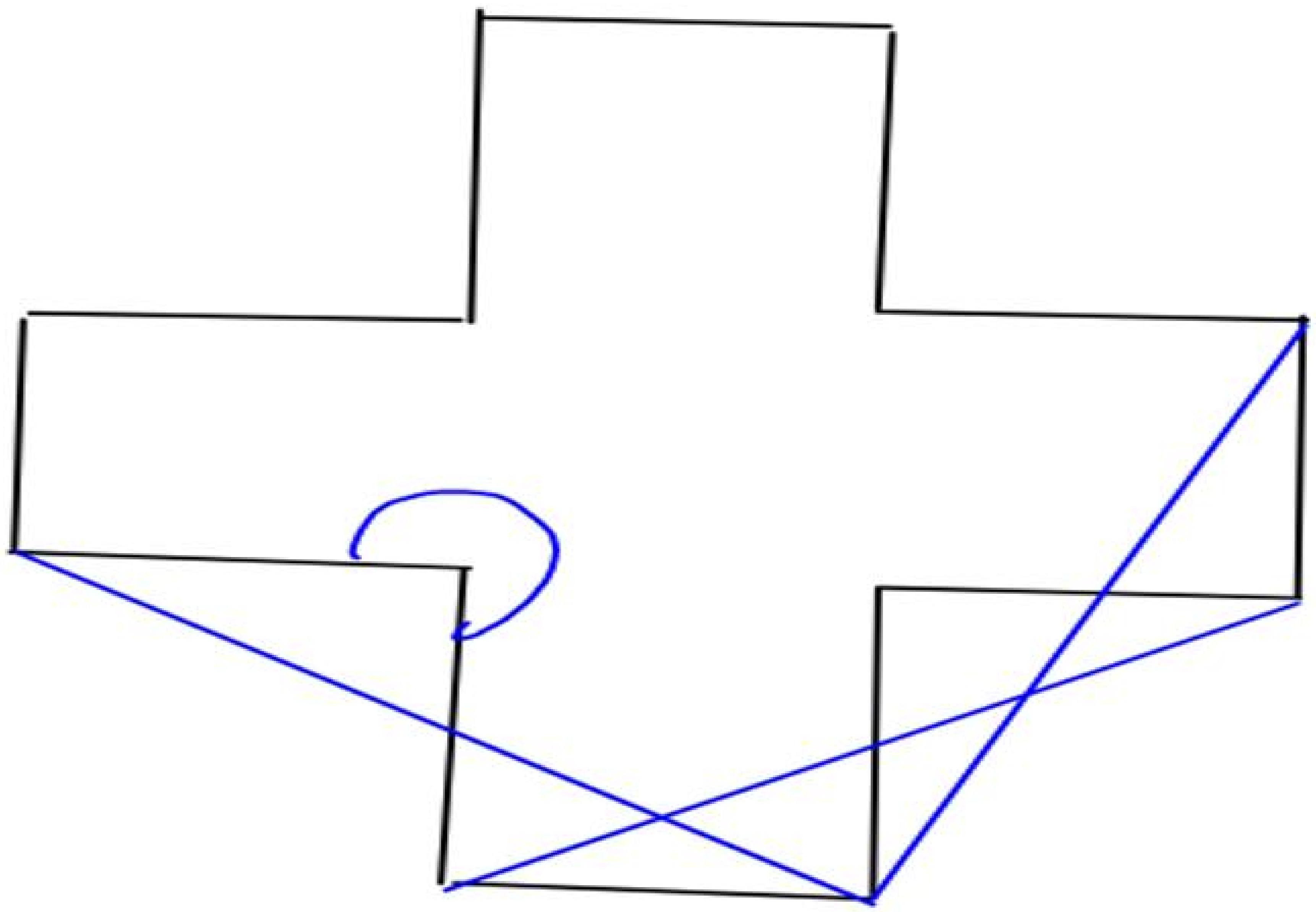
* By default if nothing is given it is always a Convex Polygon

Concave Polygon



(i) Atleast one angle > 180º.
(ii) Atleast one diagonal will lie outside the polygon.

Concave



(1) By default, if nothing is given in the question, we consider it as convex polygon.

(2) Triangle is always a convex polygon.

(3) All the regular polygons are convex.

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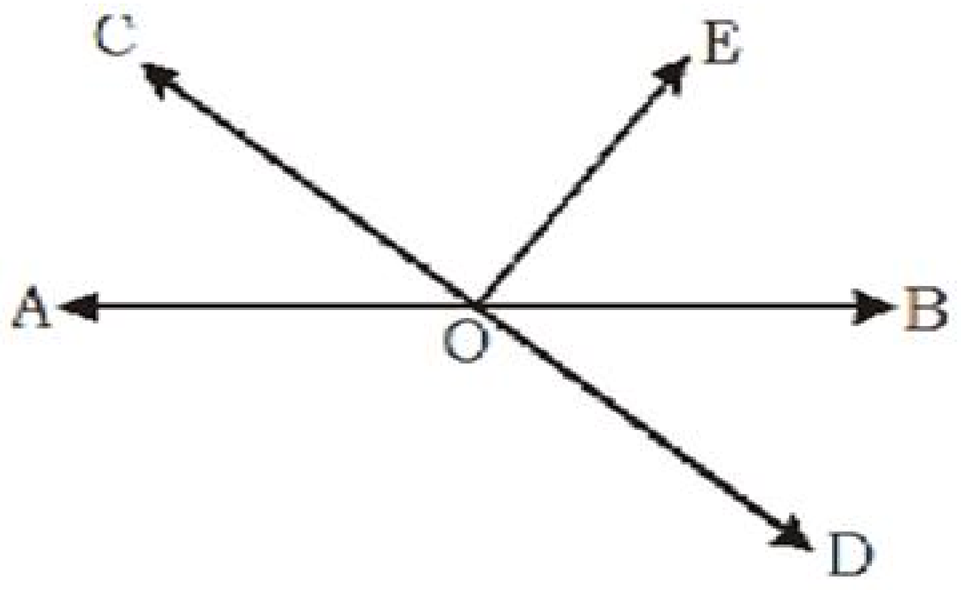
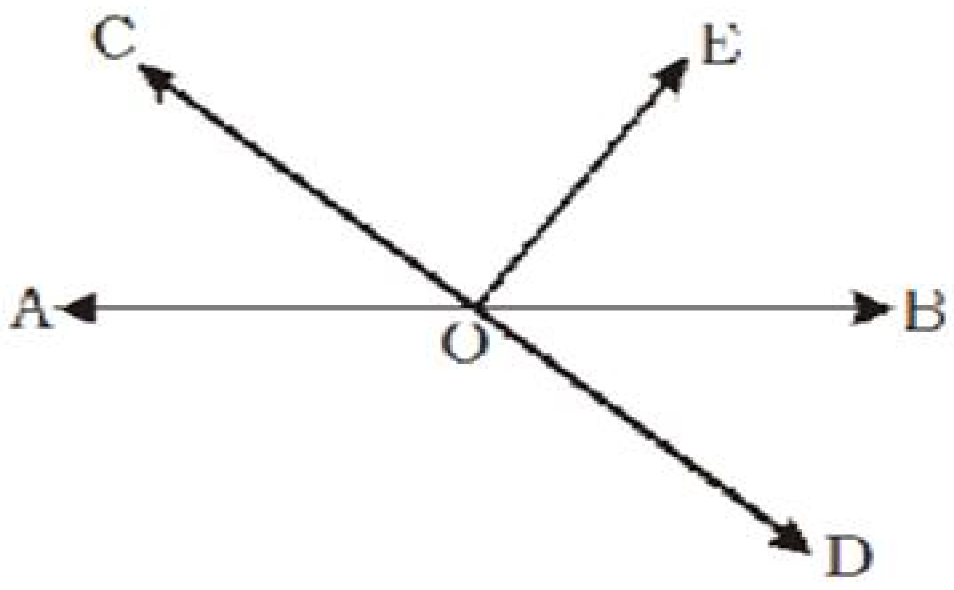
Q1. In the given figure lines AB and CD intersect at O. If $\angle AOC + \angle BOE = 70^\circ$ and $\angle BOD = 40^\circ$ then find $\angle BOE$ and reflexive $\angle COE$



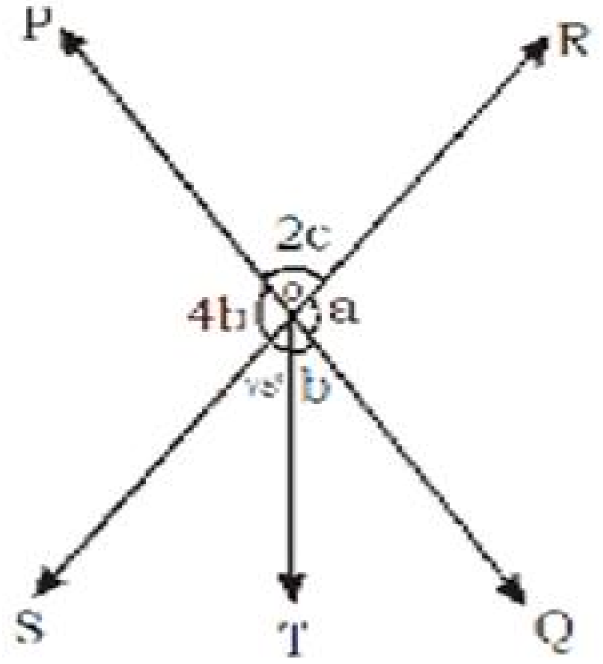
(a) $30^\circ, 250^\circ$ (a) $70^\circ, 250^\circ$ (c) $30^\circ, 210^\circ$ (d) $70^\circ, 210^\circ$


C
E
A
O
B
D

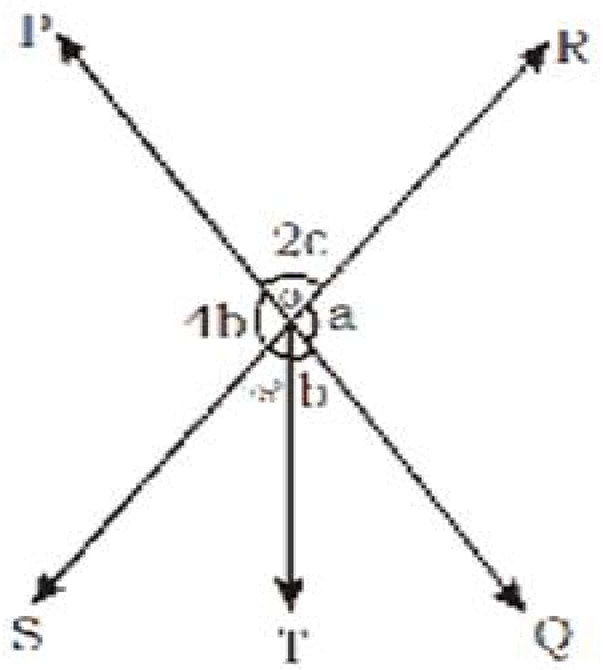
Ans. (a)

gradeup

Q2. In the given fig. two straight lines PQ and RS intersect each other at O. If $\angle SOT = 75^\circ$, find the value of a, b and c.



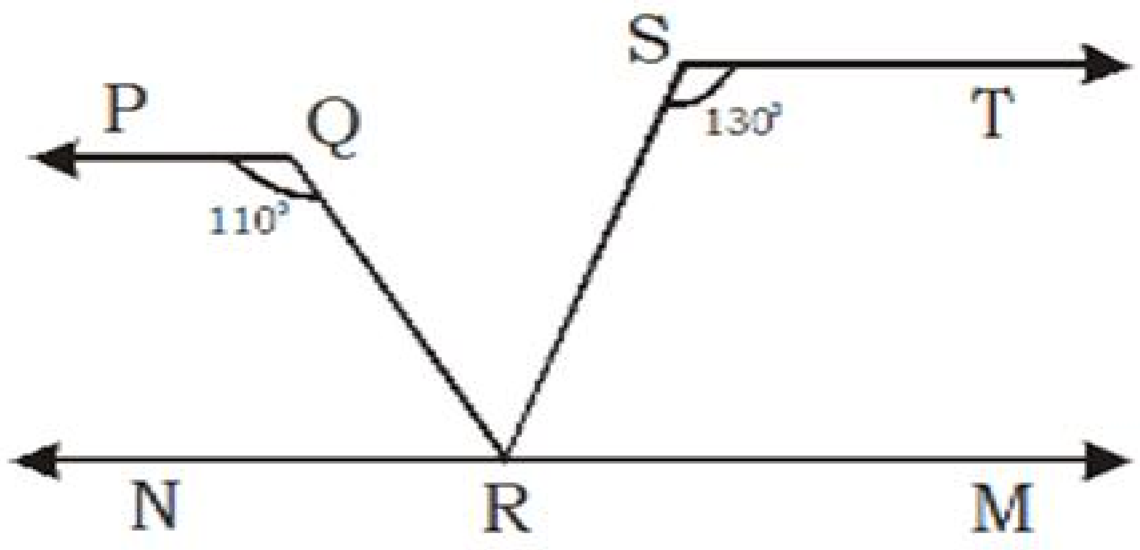
(a) $a = 84^\circ, b = 21^\circ, c = 48^\circ$
(b) $a = 48^\circ, b = 20^\circ, c = 50^\circ$
(c) $a = 72^\circ, b = 24^\circ, c = 54^\circ$
(d) $a = 64^\circ, b = 28^\circ, c = 45^\circ$


P
R
2c
4b
a
b
S
T
Q

Ans. (a)

gradeup

Q3. In the given figure if PQ||ST, ∠PQR = 110^0 and ∠RST = 130^0, find ∠QRS

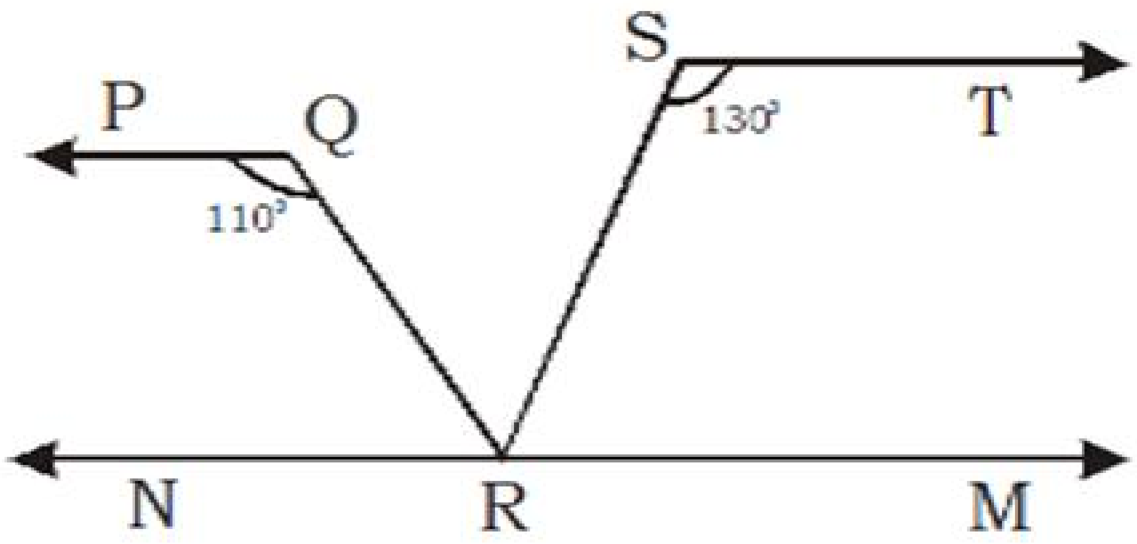


(a) 50^0

(b) 60^0

(c) 70^0

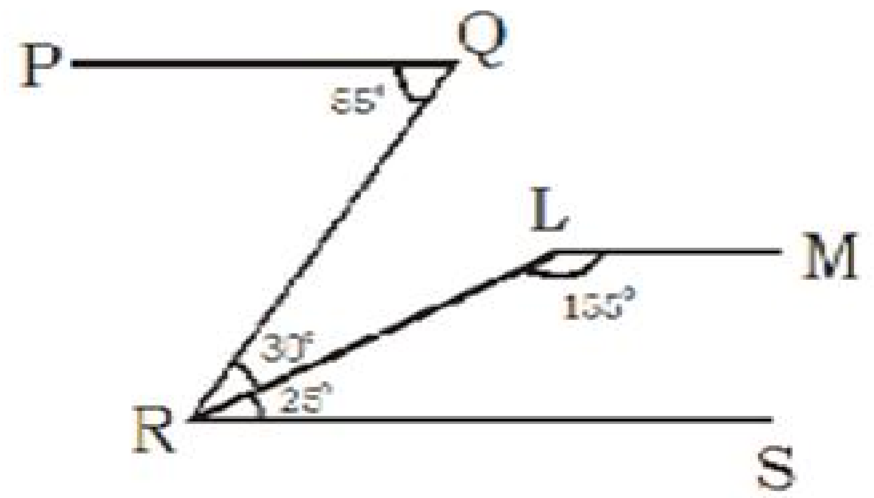
(d) 80^0


S
P
Q
130°
T
110°
N
R
M

Ans. (b)

ANGLE BETWEEN 2 PARALLEL LINES

Q4. In the fig. given below RS is parallel to PQ what is the angle between lines PQ and LM?

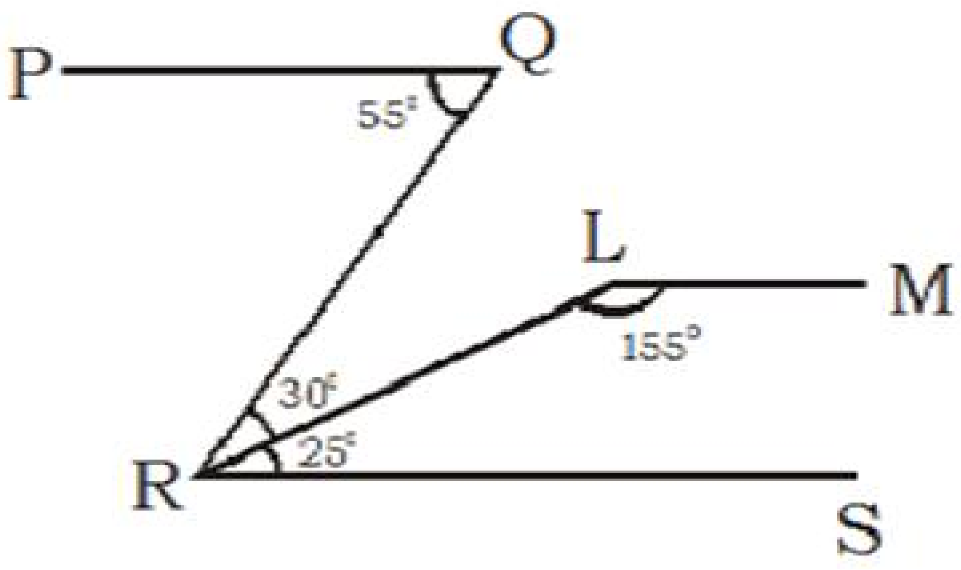


(a) 175^0

(b) 177^0

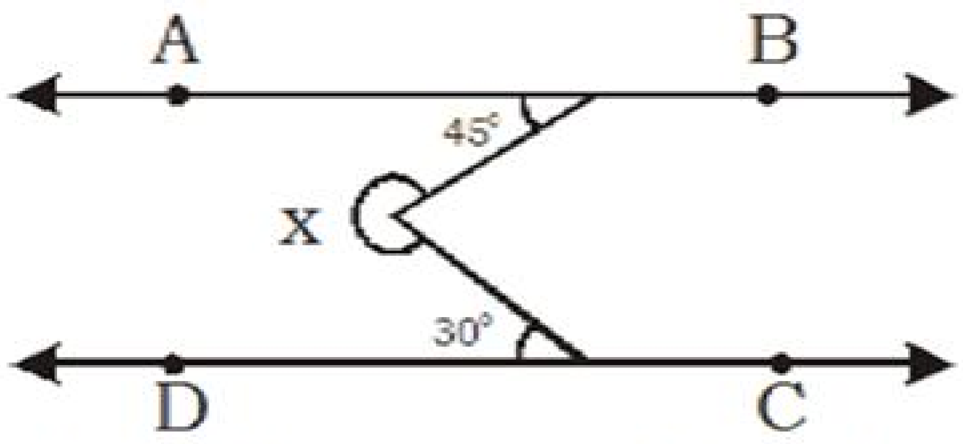
(c) 179^0

(d) 180^0

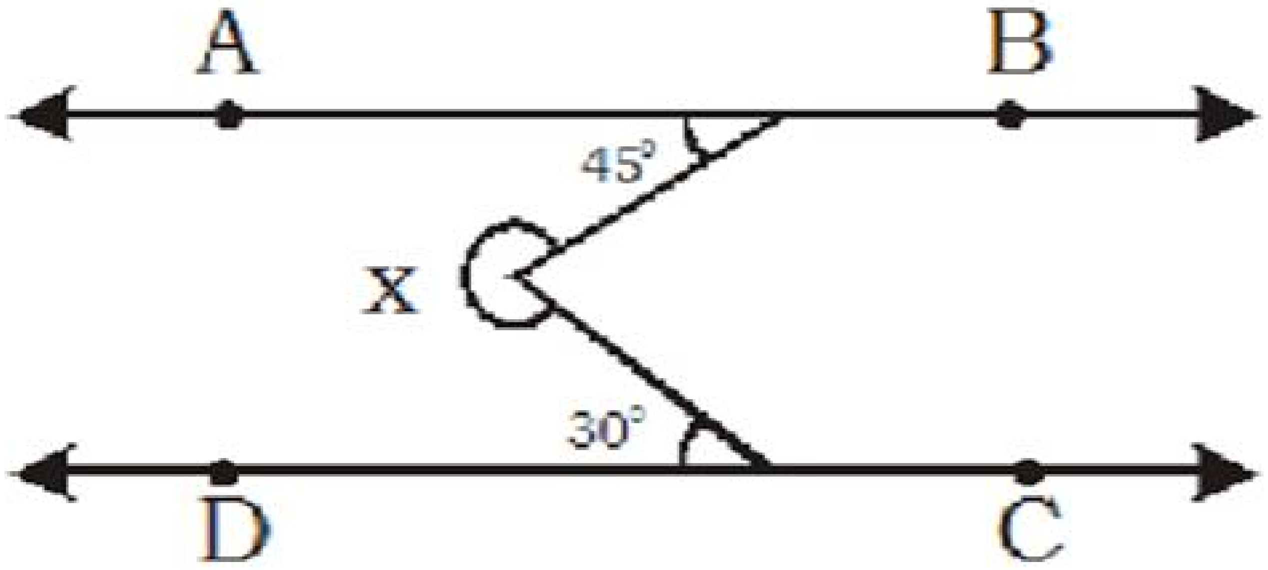

P
Q
55°
L
M
155°
30°
25°
R
S

Ans. (d)

Q5. In the given fig. AB || CD, then x is equal to



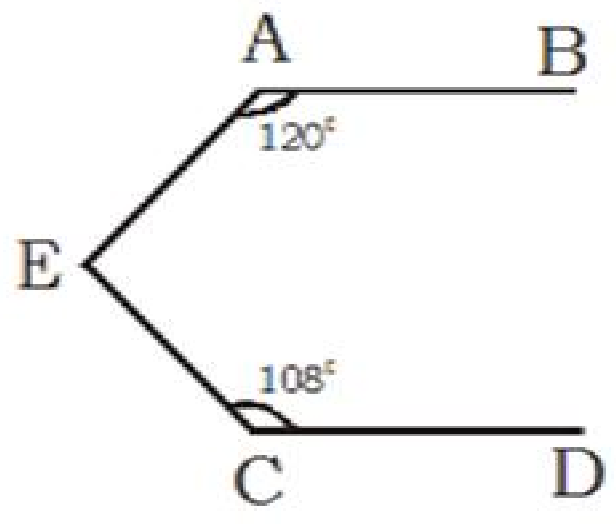
(a) 290^0 (b) 300^0 (c) 280^0 (d) 285^0


A
B
45°
x
30°
D
C

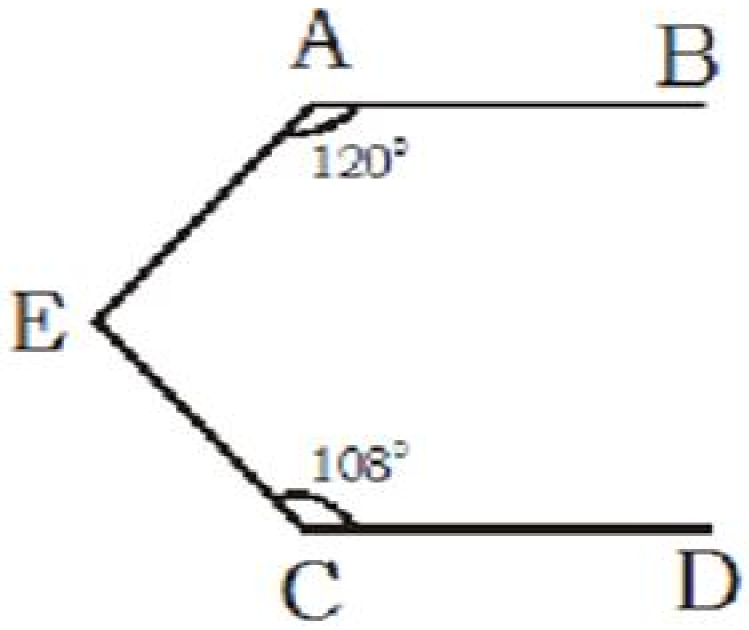
Ans. (d)

gradeup

Q6. In the fig. AB | |CD, find ∠AEC

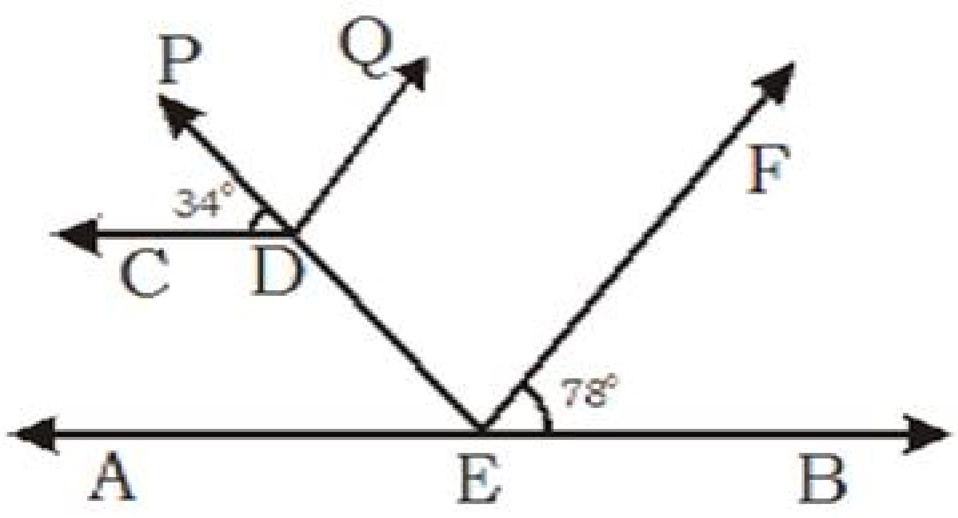


(a) 220° (b)140° (c)150° (d) 132°


A
B
120°
E
108°
C
D

Ans. (d)

Q7. In the figure AB | | CD and EF | | DQ, find the value of $\angle PDQ$

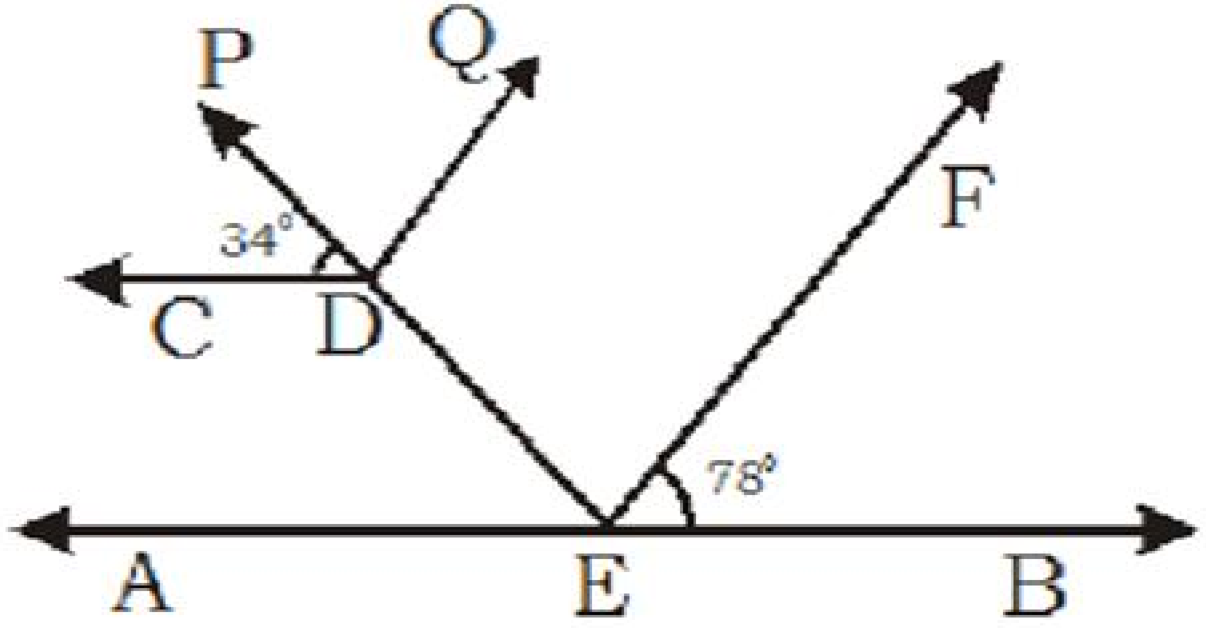


(a) 68^0

(b) 78^0

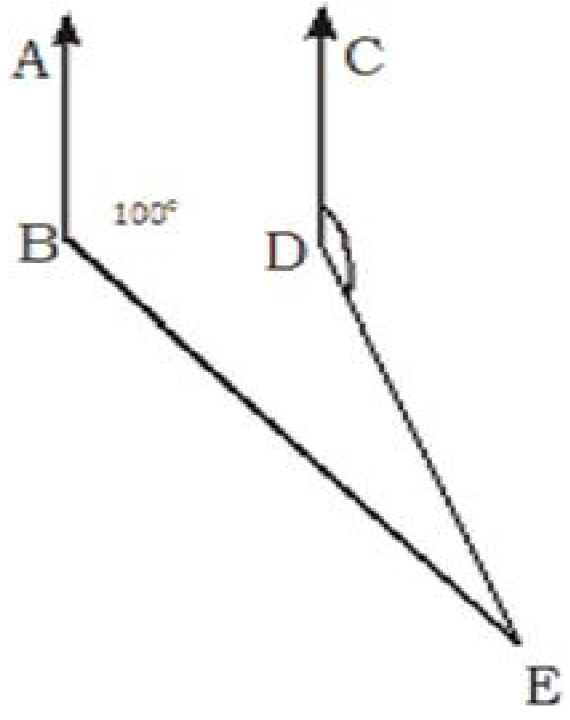
(c) 56^0

(d) None of these

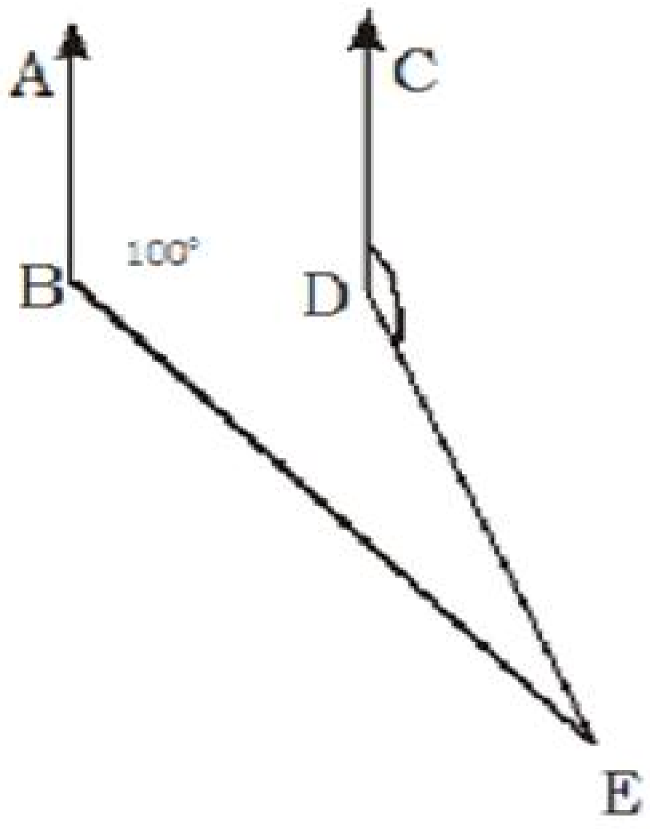

P
Q
F
34°
C
D
78°
A
E
B

Ans. (a)

Q8. In the given figure AB||CD, ∠ABE = 100^0 ∠BED = 25^0. Find ∠CDE

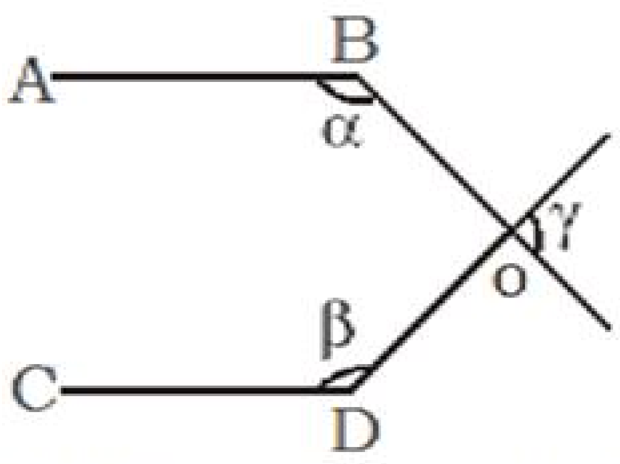


(a) 125^0 (b) 55^0 (c) 65^0 (d) 75^0


A
C
100°
B
D
E

Ans. (a)

Q9. If AB||CD then find the value of $\alpha+\beta+\gamma$.

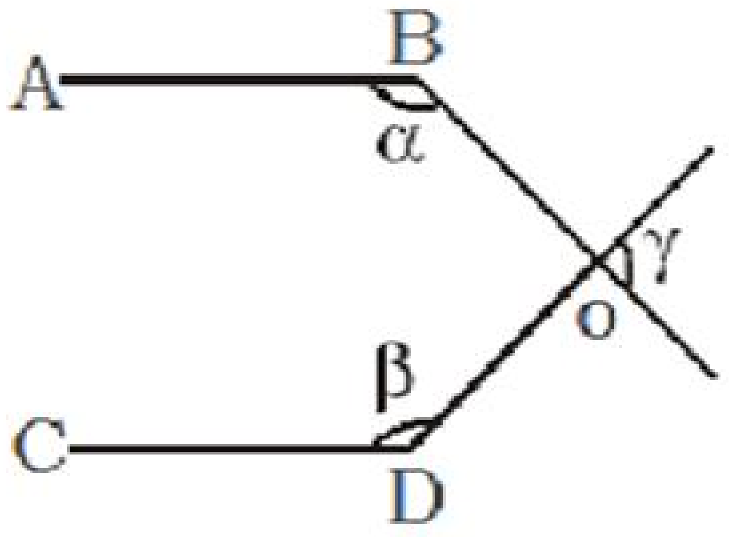


(a) 180^0

(b) 270^0

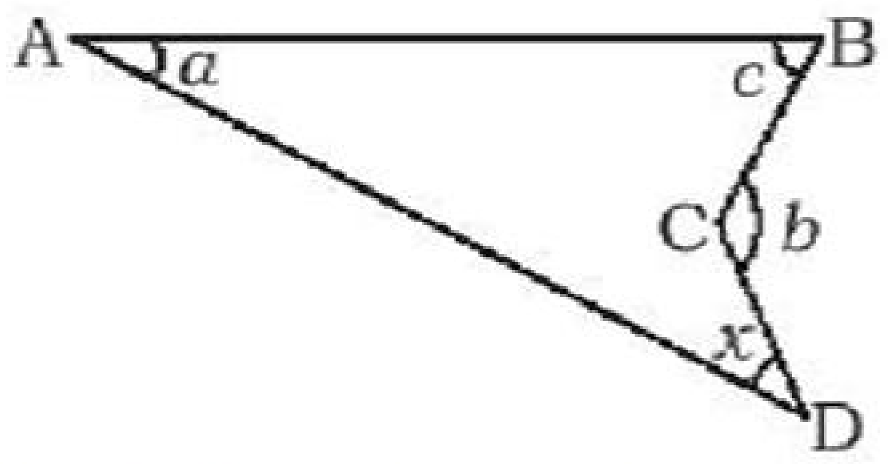
(c) 360^0

(d) 90^0



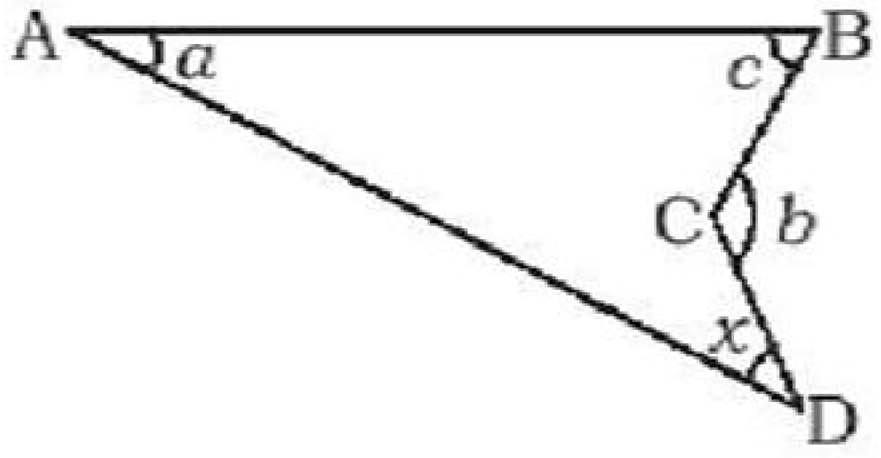
A
B
α
γ
o
β
C
D

Ans. (c)

Q10. 

Find the value of x in above figure.

(a) $b - a - c$
(b) $b - a + c$
(c) $b + a - c$
(d) $\pi - (a + b + c)$


A
a
B
c
C
b
x
D

Ans. (a)

gradeup

Q11. If a straight line L makes an angle θ ($\theta > 90^0$) with the positive direction of x - axis then the acute angle made by a straight line L_1 Perpendicular to L, with the y axis is

(a) $\frac{\pi}{2} + \theta$ (b) $\frac{\pi}{2} - \theta$ (c) $\pi + \theta$ (d) $\pi - \theta$

Ans. (d)

Q12. In Regular Polygon, the exterior and interior angles are in the ratio 1:4. The number of sides of the polygon is :

(a) 10
(b) 12
(c) 15
(d) 16

Ans. (a)

Q13. The difference between the interior angle and the exterior angle at a vertex of a regular polygon is 150°. The number of sides of the polygon is :

(a) 10 (b) 15 (c) 24 (d) 30

Ans. (c)

Q14. Each interior angle of a regular polygon is $144°$. The number of sides of the polygon is :

(a) 8 (b) 9 (c) 10 (d) 11

Ans. (c)

gradeup

Q15. The number of sides in two regular polygons are in the ratio 5 : 4 and the difference between each interior angle of the polygon is 6°. Then the number of sides are :

(a) 15, 12 (b) 5, 4 (c) 10, 8 (d) 20, 16

Ans. (a)

Eg. Number of sides of 2 polygons are in the ratio 5 : 2 and difference between the interior angles is 27°. Find the number of sides in the 2 polygons.

Q16. Which of the following cannot be measure of an interior angle of a regular polygon

(a) 150^0 (b) 105^0

(c) 108^0 (d) 144^0

Ans. (b)

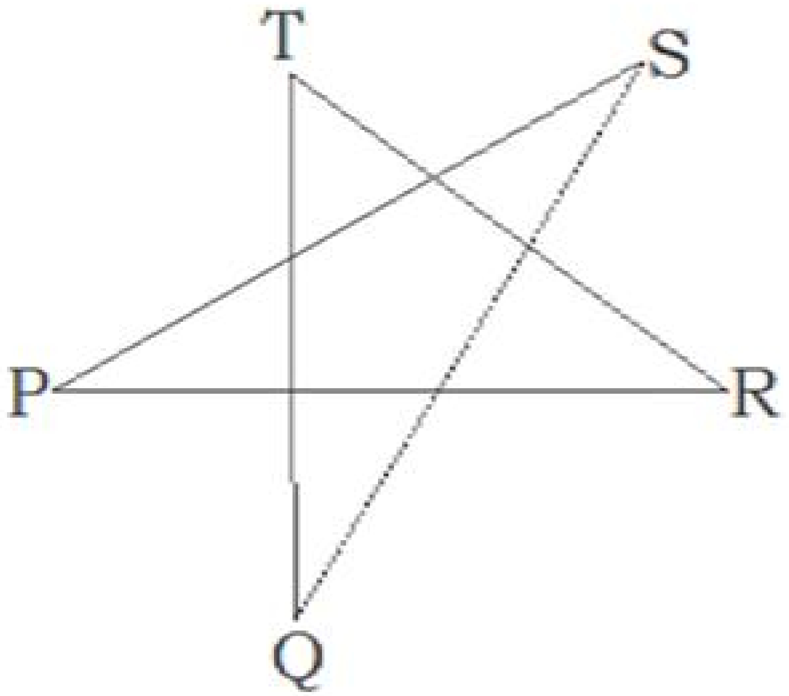
Q17. The ratio of sides of two regular polygon is 1:2 and ratio of their internal angles is 2:3, what is the number of sides of polygon having more sides.

(a) 4 (b) 8

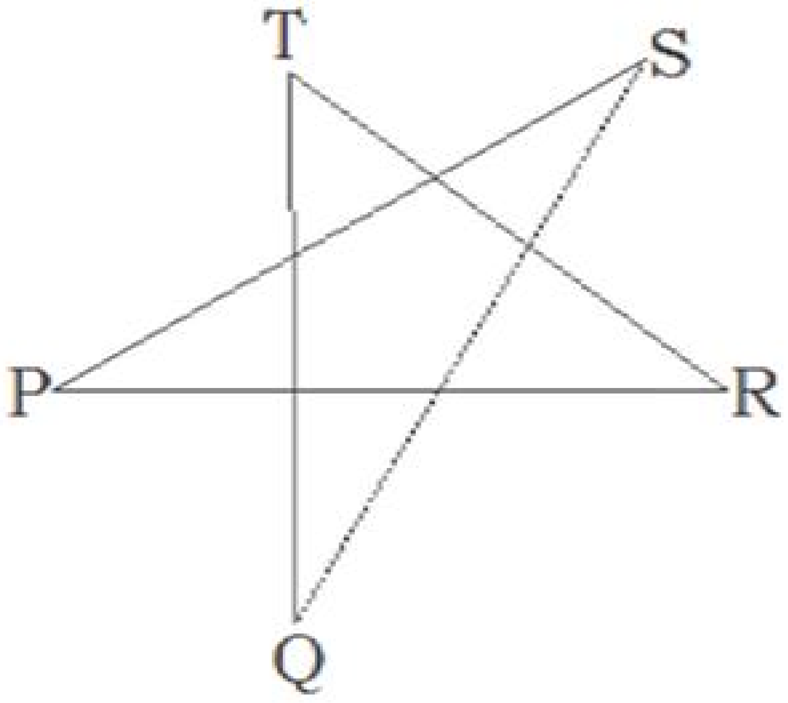
(c) 6 (d) 12

Ans. (b)

Q18. Find the value of $\angle P + \angle Q + \angle R + \angle S + \angle T$ in the given figure :



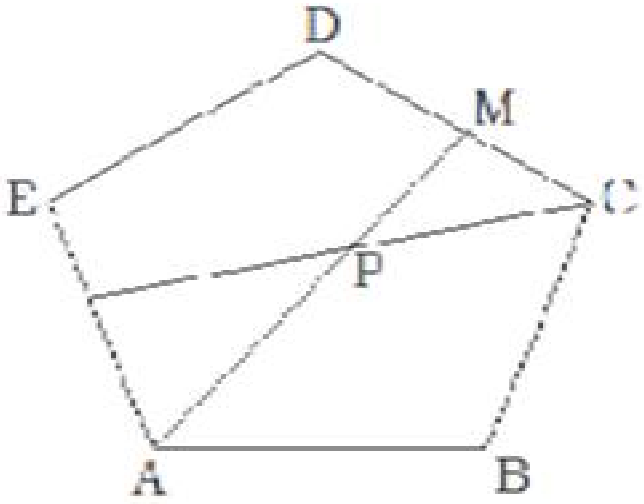
(a) 180 (b) 270 (c) 300 (d) 360


T
S
P
R
Q

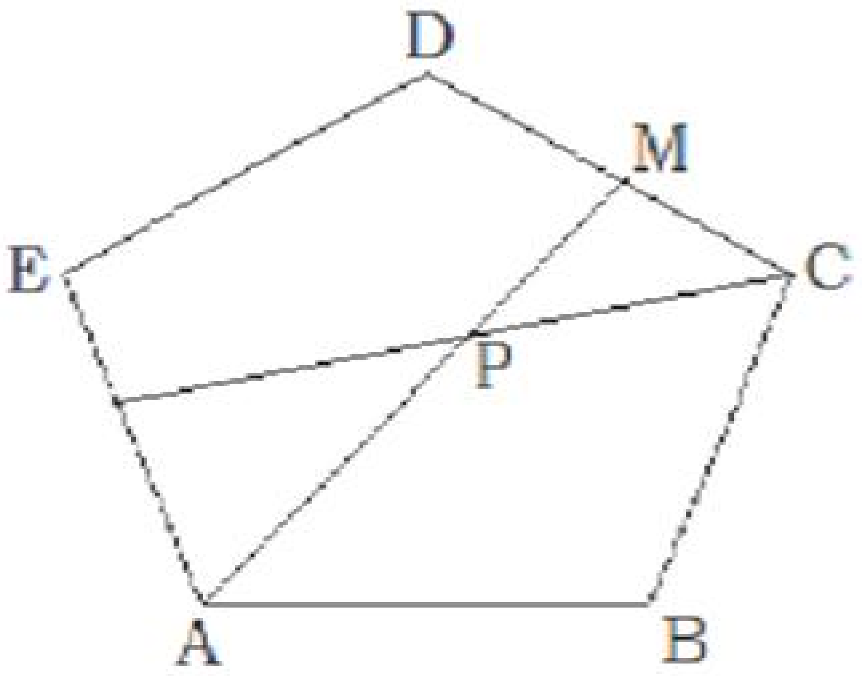
Ans. (a)

gradeup

Q19. In Regular Pentagon ABCDE, angle bi-sector of A meets at side CD on point M and angle bi-sector of C meets side AM at point P, then find the value of $\angle CPM$.



(a) 18 (b) 36 (c) 54 (d) 72


D
M
E
C
P
A
B

Ans. (b)

HOMEWORK