

CHAPTER SIX

POLYGON

Polygons:

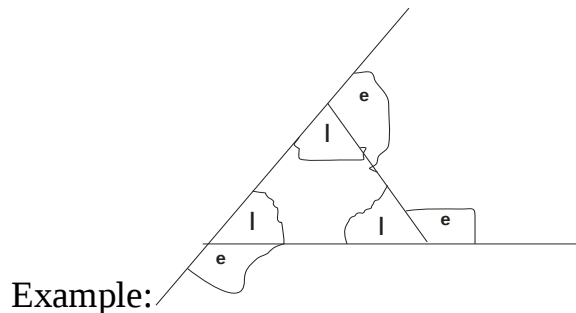
- A polygon is a plane figure bounded by straight lines.

Polygon	
Number of sides	Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

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The interior and exterior angles of a polygon:

- The interior angles of a polygon are those angles, which lie within the polygon.
- The exterior angles of a polygon are those ones, which lie outside the polygon.



I = interior angle.

E = exterior angle.

- For any polygon, the sum of the exterior angles = 360° .

Q1) Calculate the value of each exterior angle of a regular decagon.

Soln

Decagon has 10 sides and as such has 10 exterior angles. But since the sum of the exterior angles of any polygon = 360° ,

$\Rightarrow 10$ exterior angles = 360° ,

$\Rightarrow 1$ exterior angle = $\frac{1}{10} \times 360 = 36^\circ$.

$\Rightarrow$ Each exterior angle = 36° .

Q2) Find the value of each exterior angle of a regular pentagon.

Soln

Since pentagon has 5 sides, then it has 5 exterior angles.

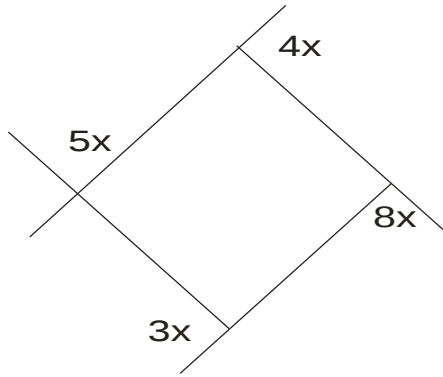
But since the sum of the exterior angles of a polygon = 360° ,

$\Rightarrow 5$ exterior angles = 360° ,

$\Rightarrow 1$ exterior angle = $\frac{1}{5} \times 360^\circ = 72^\circ$.

The value of each exterior angle of a pentagon = 72°

Q3).

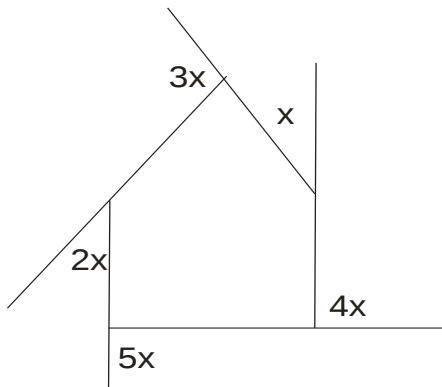


For the given figure, determine the value of x .

Soln

The given figure is a quadrilateral or a polygon. The angles marked $5x^\circ$, $4x^\circ$, $3x^\circ$ and $8x^\circ$ are the exterior angles, and since the sum of the exterior angles of a polygon = 360° , $\Rightarrow 3x + 8x + 5x + 4x = 360^\circ$, $\Rightarrow 20x = 360 \Rightarrow x = \frac{360}{20} = 18^\circ$.

Q4.



For the given figure, determine

- the value of x .
- the values of the angles marked x , $2x$, $3x$, $4x$ and $5x$.

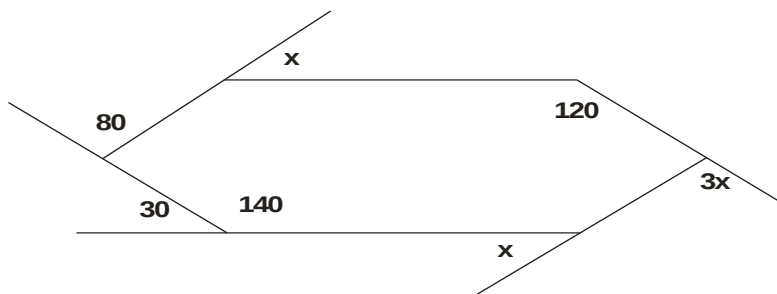
Soln

(a) The given figure has five sides and as such it is a pentagon which is a polygon. The angles marked x° , $2x^\circ$, $3x^\circ$, $4x^\circ$, and $5x^\circ$ are the exterior angles. Since the

sum of the exterior angles of a polygon = 360° , then $x^\circ + 2x^\circ + 3x^\circ + 4x^\circ + 5x^\circ = 360^\circ, \Rightarrow 15x^\circ = 360^\circ, \Rightarrow x = \frac{360}{15} = 24^\circ$.

- a) i. The angle marked $x^\circ = 24^\circ$.
 ii. The angle marked $2x = 2(24) = 48^\circ$.
 iii. The angle marked $3x = 3(24) = 72^\circ$.
 i. The angle marked $4x = 4(24) = 96^\circ$.
 ii. The angle marked $5x = 5(24) = 120^\circ$.

(Q5)



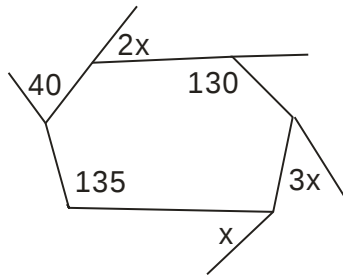
For the given figure, determine the values of the angles marked x and $3x$.

Soln.

The given figure is a polygon and the angles marked $x^\circ, x^\circ, 3x^\circ, 30^\circ$ and 80° are the exterior angles. Since the sum of the exterior angles = 360° , $\Rightarrow x^\circ + x^\circ + 3x^\circ + 30^\circ + 80^\circ = 360^\circ, \Rightarrow 5x + 110^\circ = 360, \Rightarrow 5x = 360 - 110 = 250, \Rightarrow x = \frac{250}{5} = 50 \Rightarrow x = 50^\circ$.

The value of the angle marked $x = 50^\circ$, and that of the angle marked $3x = 3(50) = 150^\circ$

Q6.

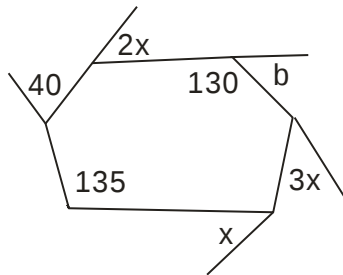


For this figure, calculate

- the value of x .
- the values of the angles marked x , $2x$ and $3x$.

N/B: The value of the exterior angle which lies next to the 130° angle must first be determined. Let this angle = b°

i.e



a) Since angle 130° and b° lie on a straight line, then $130^\circ + b = 180^\circ$, $\Rightarrow b = 180 - 130 = 50^\circ$.

The exterior angles of the given polygon are 40° , $2x^\circ$, b° , $3x$ and x . Since the sum of the exterior angles of a polygon = 360 , $\Rightarrow 40 + 2x + b + 3x + x = 360$, $\Rightarrow 40 + b + 6x = 360$, $\Rightarrow 40 + 50 + 6x = 360$, $\Rightarrow 90 + 6x = 360$, $\Rightarrow 6x = 360 - 90$, $\Rightarrow 6x = 270^\circ \Rightarrow x = \frac{270}{6} = 45^\circ$.

- The angle marked $x = 45^\circ$.
 - The angle marked $2x = 2(45^\circ) = 90^\circ$.
 - The angle marked $3x = 3(45^\circ) = 135^\circ$.