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Secondary 1 Mathematics – Quadrilaterals and Polygons

1. Types of Polygons

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

Note: A regular polygon has all sides of the same length and all angles are equal.

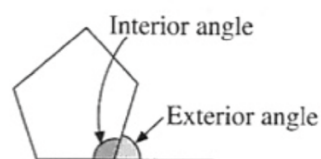
The **sum of interior angles** of an n -sided polygon = $(n - 2) \times 180^\circ$

The **size of each interior angle** of a regular n -sided polygon = $\frac{(n-2) \times 180^\circ}{n}$

The **sum of exterior angles** of a n -sided polygon = 360°

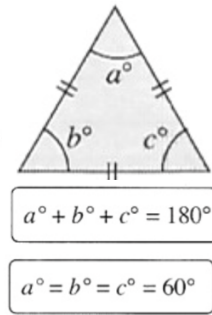
The **size of each exterior angle** of a regular n -sided polygon = $\frac{360^\circ}{n}$

Note: **Interior angle + Exterior angle** = 180° (supplementary angles)



Example: Triangle

$$\begin{aligned}\text{The sum of interior angles of a triangle} &= (3 - 2) \times 180^\circ \\ &= 1 \times 180^\circ \\ &= 180^\circ\end{aligned}$$



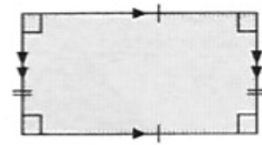
$$\begin{aligned}\text{The size of each interior angle of an equilateral triangle} &= \frac{(3-2) \times 180^\circ}{3} \\ &= 60^\circ\end{aligned}$$

$$\begin{aligned}\text{The size of each exterior angle of an equilateral triangle} &= \frac{360^\circ}{3} \text{ or } 180^\circ - 60^\circ \\ &= 120^\circ\end{aligned}$$

$$\text{The sum of the exterior angle of an equilateral triangle} = 360^\circ$$

Example: Rectangle

$$\begin{aligned}\text{The sum of interior angles of a rectangle} &= (4 - 2) \times 180^\circ \\ &= 2 \times 180^\circ \\ &= 360^\circ\end{aligned}$$



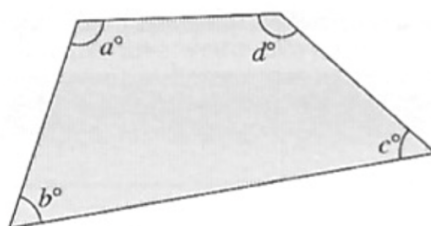
$$\begin{aligned}\text{The size of each interior angle of a rectangle} &= \frac{(4-2) \times 180^\circ}{4} \\ &= 90^\circ\end{aligned}$$

$$\begin{aligned}\text{The size of each exterior angle of a rectangle} &= \frac{360^\circ}{4} \text{ or } 180^\circ - 90^\circ \\ &= 90^\circ\end{aligned}$$

$$\text{The sum of the exterior angle of a rectangle} = 360^\circ$$

2. Angle Properties of Quadrilaterals

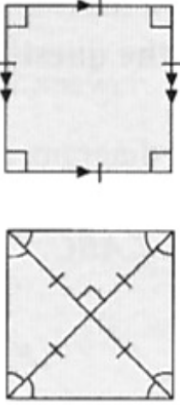
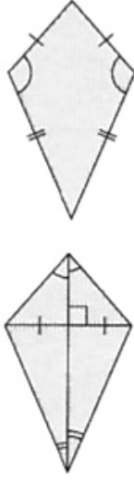
Angle Sum of Quadrilateral



$$a^\circ + b^\circ + c^\circ + d^\circ = 360^\circ$$

($\angle$ sum of quad.)

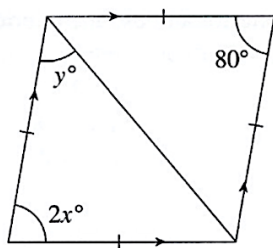
Name	Description	Figure
Trapezium	One pair of parallel opposite sides	
Parallelogram	- Two pairs of parallel opposite sides. - Opposite sides are equal in length - Opposite angles are equal - Diagonals bisect one another	
Rhombus	- Two pairs of parallel opposite sides. - Four equal sides - Opposite angles are equal. - Diagonals bisect one another at 90° - Diagonals bisect the interior angles.	
Rectangle	- Two pairs of parallel opposite sides. - Opposite sides are equal in length. - Diagonals are equal in length. - Diagonals bisect one another.	

Square	• Two pairs of parallel opposite sides. • Four equal sides • All four angles are right angles. • Diagonals bisect each other at 90°. • Diagonals bisect the interior angles.	
Kite	• No parallel sides • Two pairs of equal adjacent sides. • One pair of equal opposite angles. • Diagonals intersect at 90°. • One diagonal bisects the interior angles.	

Quadrilaterals and Polygons – Practice Questions 1

1. In the diagram below, determine the values of x and y .

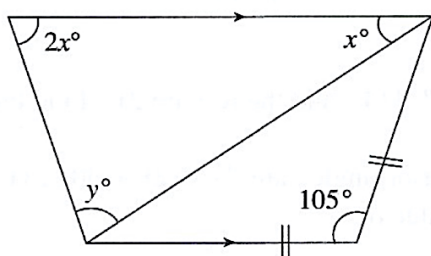
(a)



Answer: $x =$ _____ $^{\circ}$

Answer: $y =$ _____ $^{\circ}$

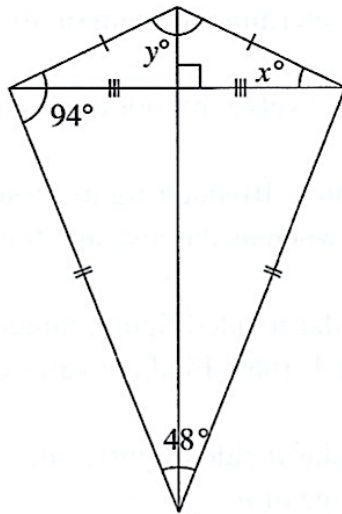
(b)



Answer: $x =$ _____ $^{\circ}$

$y =$ _____ $^{\circ}$

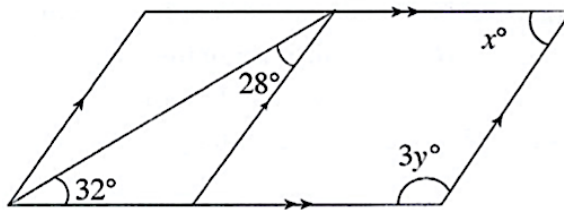
(c)



Answer: $x =$ _____ $^{\circ}$

$y =$ _____ $^{\circ}$

(d)



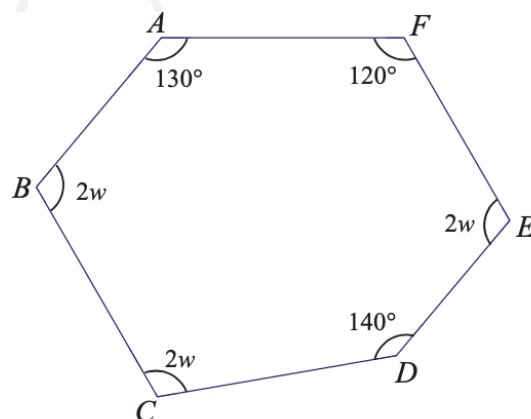
Answer: $x =$ _____ $^{\circ}$

$y =$ _____ $^{\circ}$

9. (a) Three of the exterior angles of a polygon with n sides are 60° , 45° and 75° . The remaining exterior angles are each 30° . Calculate the value of n .

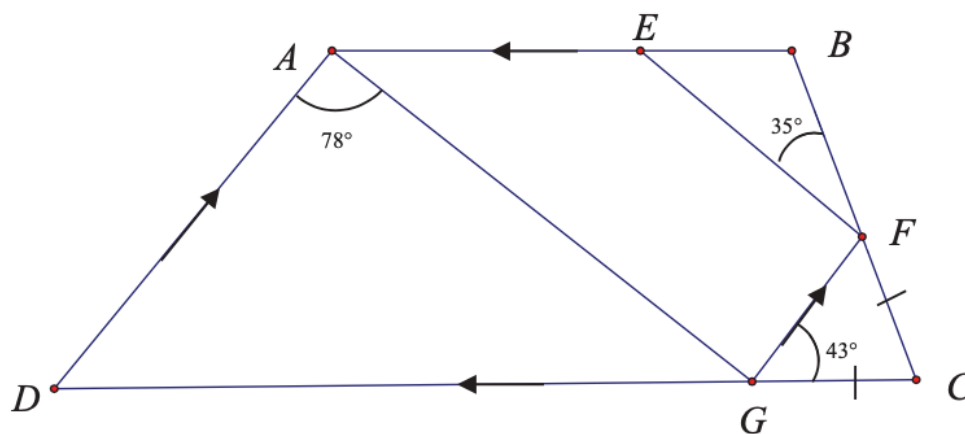
Answer: (a) $n =$ _____

- (b) $ABCDEF$ is a hexagon. Find the value of w .



Answer: (b) $w =$ _____

10. In the figure, $ABCD$ is a trapezium. Given that DA is parallel to GF , BA is parallel to CD , $CG = CF$, $\angle DAG = 78^\circ$, $\angle FGC = 43^\circ$ and $\angle BFE = 35^\circ$, **show** that AG is parallel to EF .



11. (a) Find the interior angle of a regular 15-sided polygon.
 (b) An n -sided polygon has 2 interior angles measuring 100 each and the remaining interior angles are q each. Find an expression for q in terms of n .

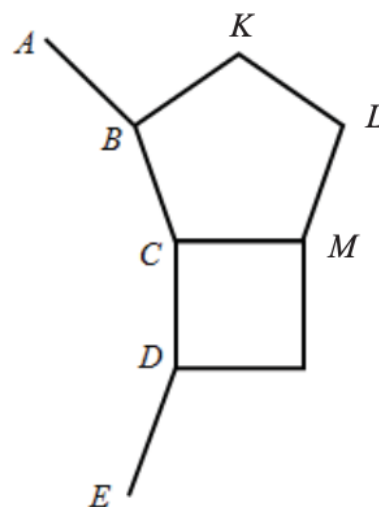
Answer: (a) interior angle = _____ $^\circ$

(b) q = _____

12. The diagram below is made up of a square, a regular pentagon and a regular polygon of n sides. ABCDE shows part of the n -sided polygon.

Find

- $\angle BCM$,
- the interior angle of n -sided polygon $\angle BCD$
- the number of sides n



Answer: (a) $\angle BCM =$ _____ $^\circ$

(b) $\angle BCD =$ _____ $^\circ$

(c) $n =$ _____