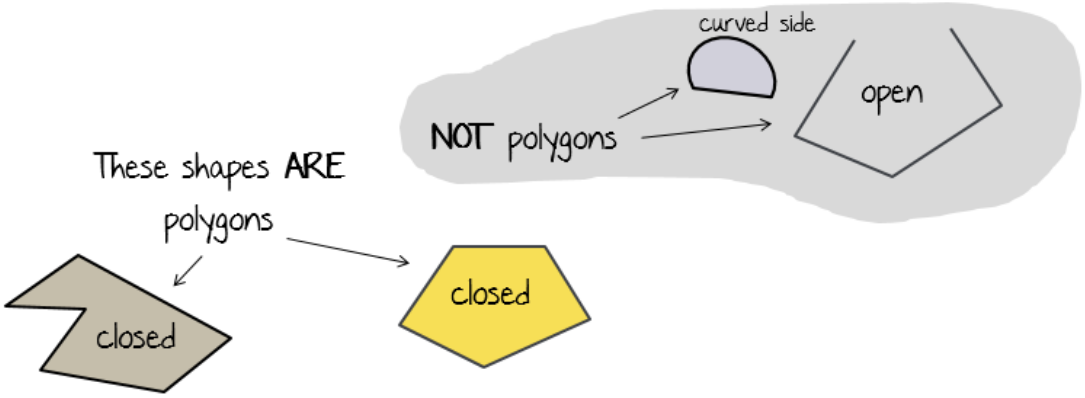
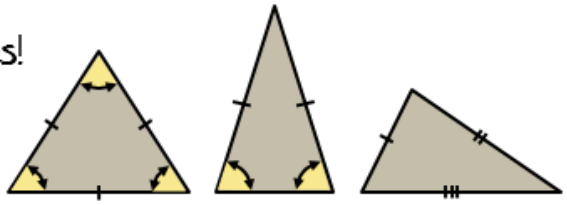
Angles in Polygons

Q. What is a polygon?

A. It is a _____ figure made of __ **or more** _____ sides.



Some of the things I know about **triangles**!



- Number of sides is; _____
- Number of internal angles; _____
- The **sum** of the 3 internal angles is _____
- All sides (and all angles) are equal. This is an _____ triangle.
- Two sides (and 2 angles) are equal. This is an _____ triangle.
- No sides (or angles) are equal. This is called a _____ triangle.
- If one angle is 90° it is called a _____ angled triangle.
- The largest side is always opposite the _____ angle
- The _____ side is always opposite the smallest angle.
- Use _____ theorem for working out length of one side given the other two - this only works in a _____ angled triangle.
- Use the trigonometric _____ sine, cosine and tangent for working out lengths and _____ - only works in a _____ angled triangle
- For working out lengths and angles in a **non** right angled triangle, use the _____ rule or _____ rule. (You may not have covered these rules yet so don't worry if you do not know these two!)

Angles in Polygons – Triangle

GeoGebra Exercise

Findings: _____

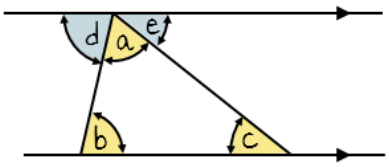
_____

Triangle 1		Triangle 2	
	a = _____ b = _____ c = _____		a = _____ b = _____ c = _____

Angles in Polygons – Triangle

Exercise

Consider the figure shown.
Prove that a + b + c = 180°,
i.e. Prove that the sum of the interior angles of a triangle is 180°.



Solution: Introduce angles d and e

Write down an equation involving angles d, a and e.

_____

Looking at the diagram, which angles are equal? (Write as 2 equations)

_____ _____

Now write down an equation involving just the angles a, b and c.

_____

So, what have you just proved?

_____

Angles in Polygons – Triangle

Exercise

What are the interior angles in an equilateral triangle?

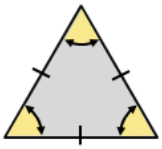
Solution:

_____

_____

_____

_____

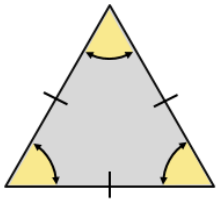


VICTORIAN VIRTUAL LEARNING NETWORK Seminotes

Topic: Geometry

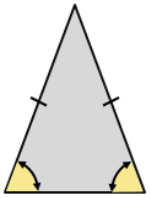
Lesson: Angles in polygons

Summary – Equilateral triangles



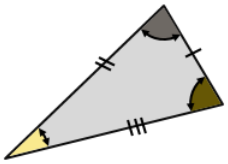
- _____
- _____

Summary – Isosceles triangles



- _____
- _____

Summary – Scalene triangles

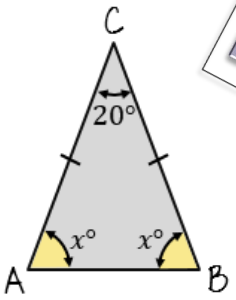


- _____
- _____

How do you work out the angles in an **isosceles** triangle?

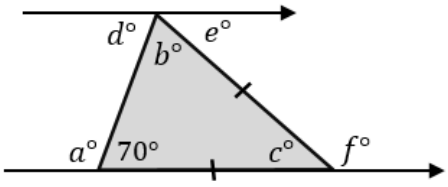
Exercise

Problem 1: Find the size of ∠CAB and ∠CBA .



Exercise

Problem 2: Find all the missing angles. Show working.



Solution:

$a =$ _____

$b =$ _____

$c =$ _____

$d =$ _____

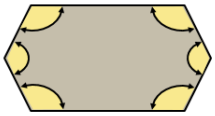
$e =$ _____

$f =$ _____

VICTORIAN VIRTUAL LEARNING NETWORK Seminotes

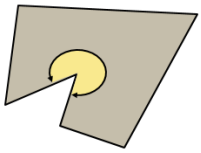
Topic: Geometry
Lesson: Angles in polygons

A polygon with all interior angles **less than 180°** is called a _____ polygon



This is a convex hexagon

A polygon with **one or more** interior angles **greater than 180°** is called a _____ polygon



This is a concave hexagon

Complete the names of the popular convex polygons

No. of sides	Convex polygon name
3	
4	
5	
6	
8	
10	
12	

In a **REGULAR** polygon all **side lengths** are

_____

and

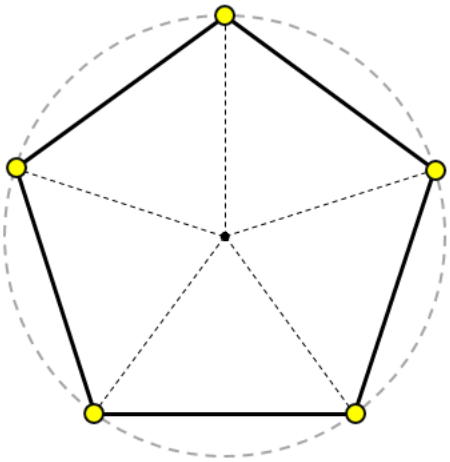
all **angles** at the **vertices** (corners) and all angles at the **centre** are

_____

Complete the missing information

Regular convex pentagon

- All _____ lengths are _____
- All interior angles are _____
- Angles at the centre are _____
- _____ - each _____ lies on the circumference of a _____.



Notes:

_____

_____

_____

_____

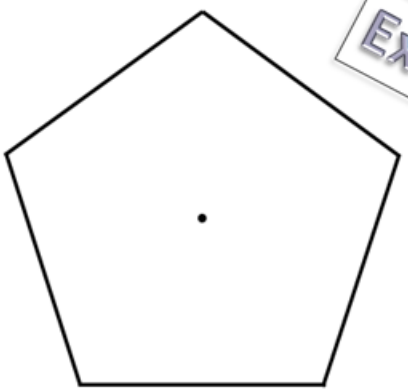
_____

Topic: Geometry
Lesson: Angles in polygons

Example: **Regular convex pentagon**

a) Find the value of the angle at the centre

b) Find the value of the internal angle at the corner



Solution:

(a) _____

_____

_____

(b) _____

_____

_____

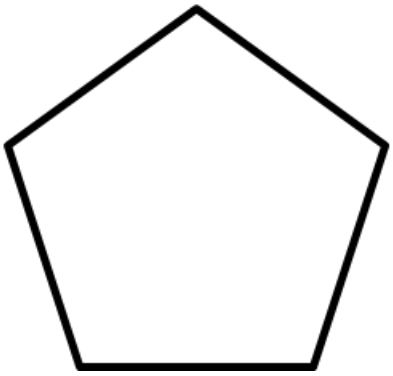
_____

_____

_____

_____

Exercise



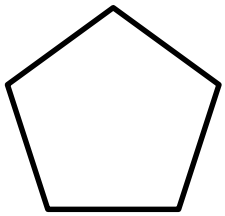
Find the sum of the interior angles of a pentagon.

Method 1 - knowing the interior angle

_____

_____

Method 2 - using triangles



_____

_____

_____

Use the result from **method 2** to find the **interior** angle of a pentagon.

_____

_____

Notes:

_____

_____

_____

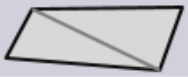
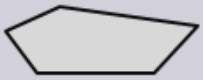
_____

_____

_____

Investigation

1. Complete the table for n = 3, 4, 5 and 6.
2. Write down the rule for "No. of triangles" in terms of n, in the space provided.
3. Hence write down the rule for "Sum of interior angles" in terms of n.

No. sides n	Example of convex polygon	No. of triangles	Sum of interior angles
3		1	180°
4		2	
5			
6			
n			

Example

Use the rule to find the sum of the interior angles for a polygon with;
(a) 10 sides (b) 12 sides

$$sum = \square$$

where n = number of sides

Solution:

(a) _____ (b) _____

_____ _____

_____ _____

_____ _____

_____ _____

Example continued...

Use the rule to find the interior angle for a **regular** polygon with;
(a) 5 sides (b) 12 sides

$$angle = \frac{180(n-2)}{n}$$

where n = number of sides

Solution:

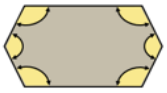
(a) _____ (b) _____

_____ _____

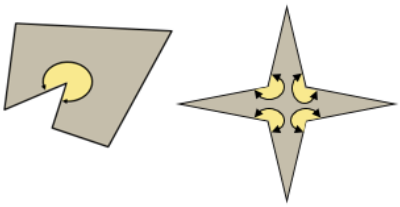
_____ _____

Angles in polygons - Summary

Polygons with **all** interior angles **less than 180°** are said to be **convex**.



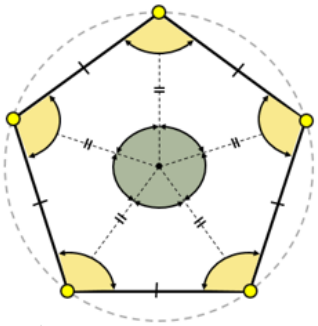
A polygon with **one or more** angles **greater than 180°** is said to be **concave**.



* Stars are examples of concave polygons

In a **regular convex** polygon;

- all **side lengths** are **equal** and
- **angles at the vertices** (corners) are **equal**, and
- **angles** at the **centre are equal**.
- each **vertex** lies on the circumference of a **circle**



The **angle at the centre** of a regular polygon is given by the rule...

$$angle\ at\ centre = \frac{360^\circ}{n}$$ where n = number of sides

The **sum of the interior angles** in any **convex polygon** can be found by the rule...

$$sum = 180(n-2)$$

where n = number of sides

The **interior angle** in a **regular convex** polygon can be found by the rule...

$$interior\ angle = \frac{180(n-2)}{n}$$

where n = number of sides

Notes: