

## Investigating Angles in Polygons

Go to Start, Programs, and Geometers sketch pad.

Draw a triangle.

Label the corners.

Measure the corners.

Calculate their total.

Do the same for a quadrilateral.

Find the sum of the angles for any quadrilateral.

Now find the sum of the angles for a pentagon.

You can play games on :

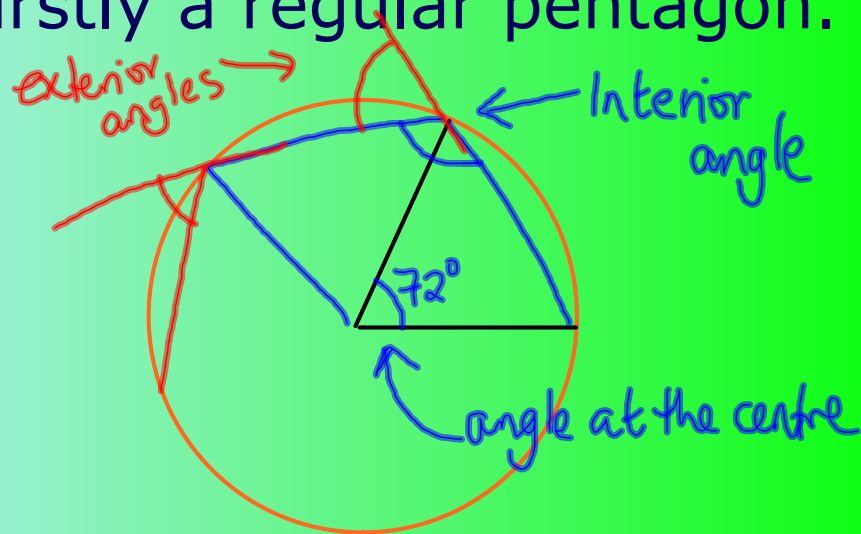
Virtual Image ( go to My Computer, shared all, maths.)

[www.bbc.co.uk/mathsfile](http://www.bbc.co.uk/mathsfile)

# Investigating the angles in polygons

You are going to construct regular polygons. You need to know about interior and exterior angles, so you will want to measure or evaluate and look for patterns.

Firstly a regular pentagon.



sides	polygon	angle at centre	interior angle	exterior angle

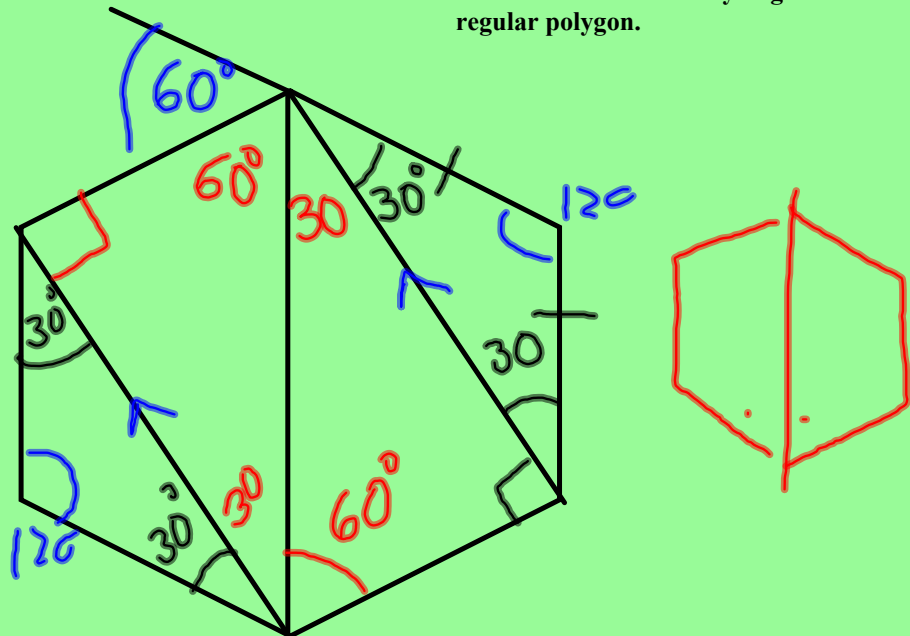
## Angles in polygons

Some conclusions:

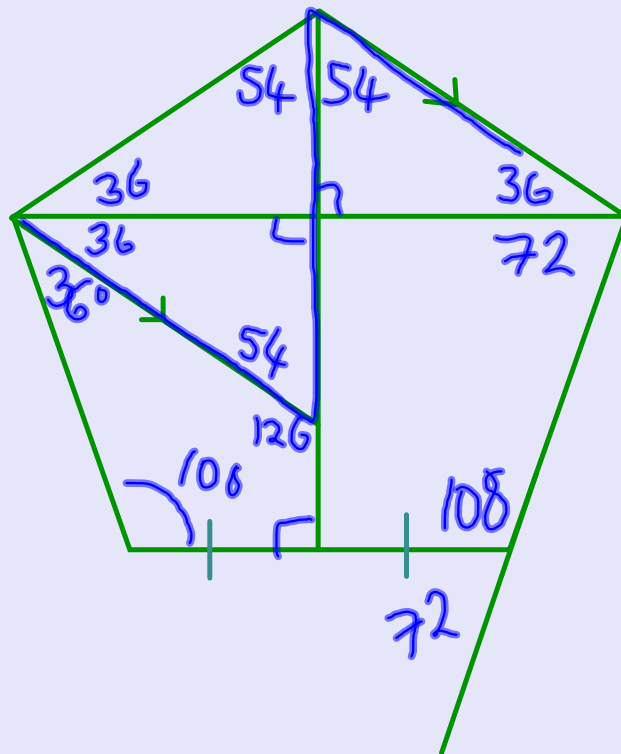
- Angles at the centre of a polygon total  $360$
- Angles at the centre of a regular polygon  $= \frac{360}{n}$
- Exterior angles of a regular polygon  $= \frac{360}{n}$
- Interior angles of a regular polygon  $= 180 - \frac{360}{n}$
- Sum of exterior angles of a polygon  $= 360^\circ$

$$\frac{360}{n} / 180 - \frac{360}{n}$$

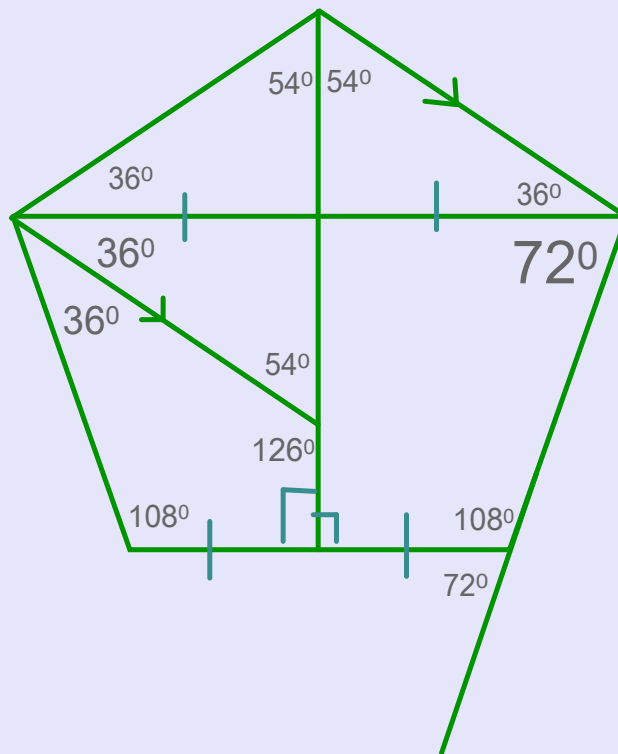
Mark in the size of every angle of this regular polygon.



This is a regular pentagon. Mark in the size of every angle.



This is a regular pentagon. Mark in the size of every angle.



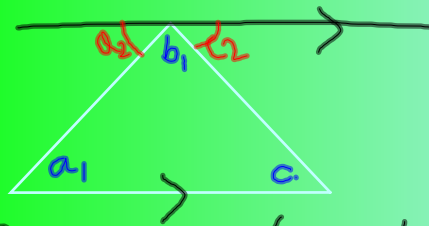
## Geometric proof

understand the properties of parallelograms and a proof that the angle sum of a triangle is 180 degrees

understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices

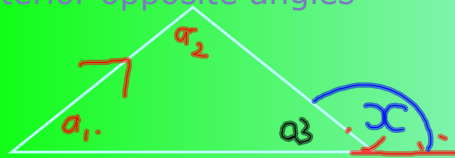
use angle properties of equilateral, isosceles and right-angled triangles explain why the angle sum of a quadrilateral is 360 degrees

1. Prove that the angle sum of a triangle is  $180^\circ$ .



Proof:  $a_1 = a_2$  (alternate)  
 $c_1 = c_2$  (alternate)  
 $a_2 + b_1 + c_2 = 180^\circ$  (angles on a straight line)  
 $\therefore a_1 + b_1 + c_1 = 180^\circ$  QED

2. Proof that the exterior angle of a triangle is equal to the sum of the 2 interior opposite angles

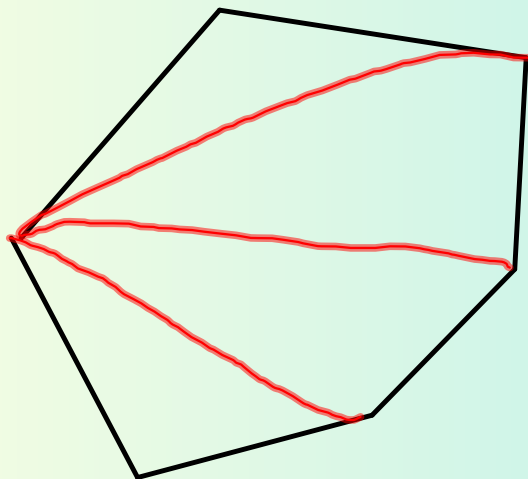
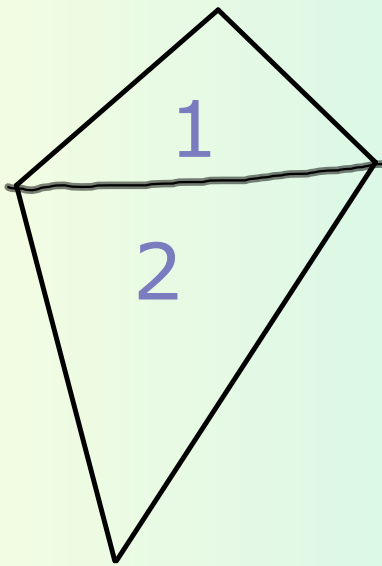


To prove  $x = a_1 + a_2$   
 $x + a_3 = 180^\circ$  (angles on a straight line)  
 $a_1 + a_2 + a_3 = 180^\circ$  (angles in a  $\Delta$ ) (2)  
 $a_3 = 180^\circ - a_1 - a_2$  (2)  
 $a_3 = 180^\circ - x$  (1)  
 $\therefore x = a_1 + a_2$  QED

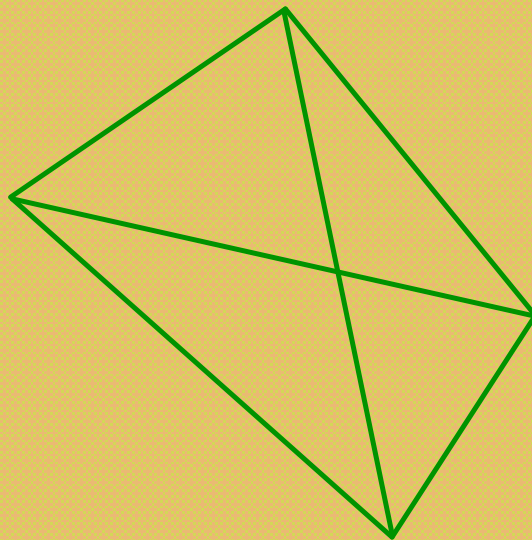
3. Explain why the angle sum of a quadrilateral is  $360^\circ$ .

4. Hence find the angle sum of a nonagon (9 sided polygon).

# The angle sum of a polygon



The sum of the interior angles of any polygon =  $(n-2) \times 180^\circ$



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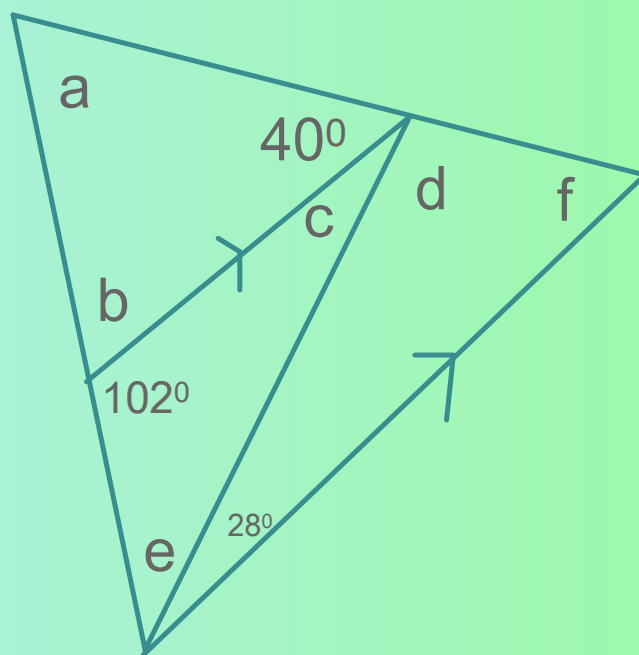
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4cm	4cm	4cm	4cm	$90^\circ$
3cm	6cm	4cm	4cm	$90^\circ$
5cm	5cm	5cm	5cm	$70^\circ$
3cm	3cm	7cm	7cm	$90^\circ$
4cm	4cm	6cm	6cm	$80^\circ$
5cm	7cm	5cm	7cm	$85^\circ$
6cm	6cm	6cm	6cm	$10^\circ$
2cm	2cm	7cm	7cm	$110^\circ$

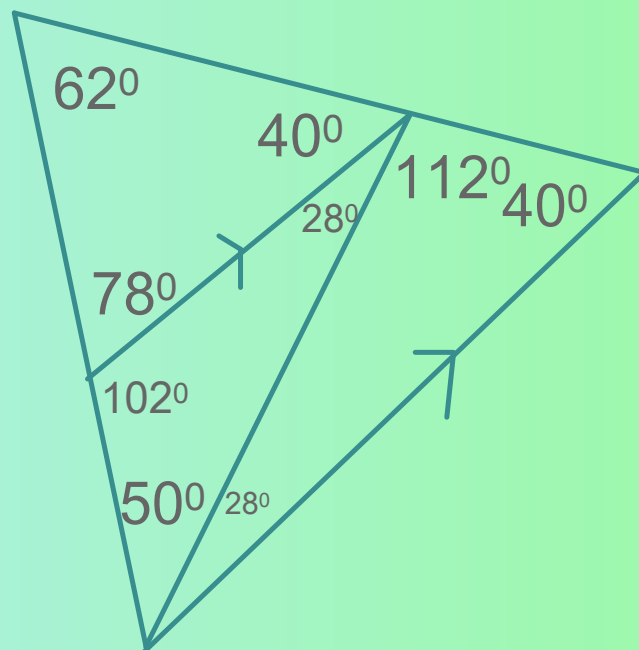
Recall the definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium and rhombus

classify quadrilaterals by their geometric properties

## Angles and parallel lines



## Angles and parallel lines



HWK for Tuesday is 3 exercises from Mymaths and