Quadrilaterals and other polygons

Year 9 Mathematics
Mainstream

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- Know what a polygon is
- Know what a quadrilateral is
- Know what regular, convex and non-convex polygons are
- Know how to find the interior angle sun of a polygon
- Know the properties of different types of quadrilateral
- Find unknown angles in polygons

RECAP

In the last lesson we looked at parallel lines and how we can use the properties of parallel lines to help us find missing angles.

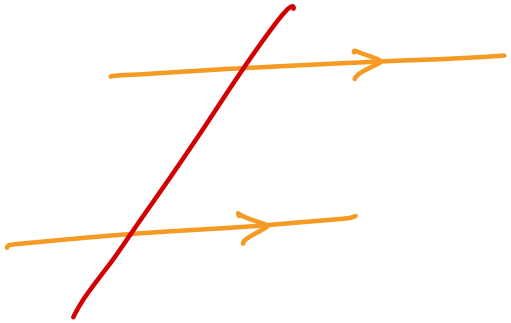
The rules we learned were FUZX:

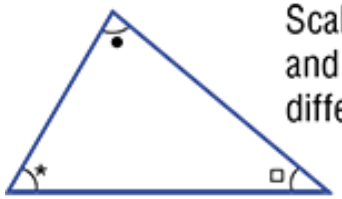
- Corresponding angles
- Co-interior angles
- Alternate angles
- Vertically opposite angles

This built on the knowledge from the first lesson where we had a lot of terminology to remember.

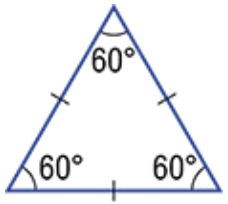
This is shown on the right.

- **Ray**: A straight line which extends from a point to infinity and beyond
- **Line**: A set of points which continue
- **Line Segment**: A section of a straight line
- **Acute angle**: between 0° and 90°
- **Obtuse angle**: between 90° and 180°
- **Right angle**: 90°
- **Straight angle**: 180°
- **Reflex angle**: between 180° and 360°
- **Revolution**: 360°
- **Complementary angles**: Add to 90°
- **Supplementary angles**: Add to 180°

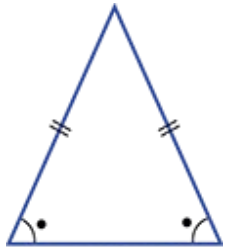




Scalene (all sides and angles are different sizes)



Equilateral (all angles 60° and all sides equal)



Isosceles (two angles equal and two sides equal)

A missing parrot?

It's an old joke – but I can't resist.

What do you call a missing parrot?

A Poly-gone!!

OK.

So, today I'm going to be looking at what **Polygons** are!

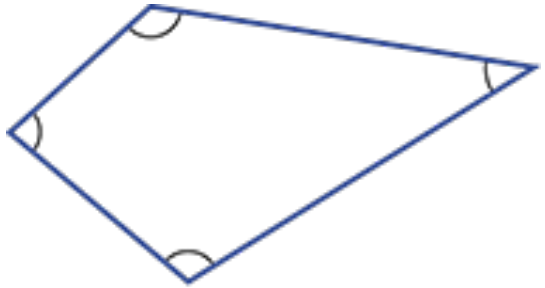
These are "*closed two dimension shapes with straight sides".*

The sides do not need to be the same length – they just need to be straight and the shape must be closed.

Types of polygons: Convex and non-convex

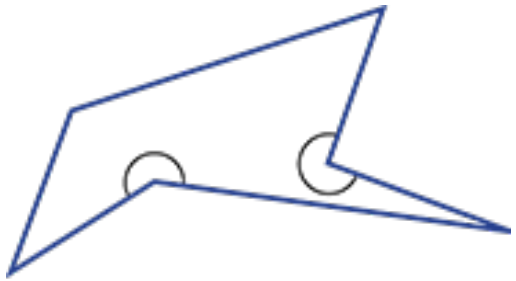
I always get these wrong as I'm still in therapy from my Physics teacher (when I was back in school) talking about convex and concave lenses.

A **convex polygons** is one where the interior angles are all less than 180°



Convex quadrilateral

A **non-convex polygon** is one where at least one interior angle is greater than 180°.



Non-convex hexagon

Regular polygons

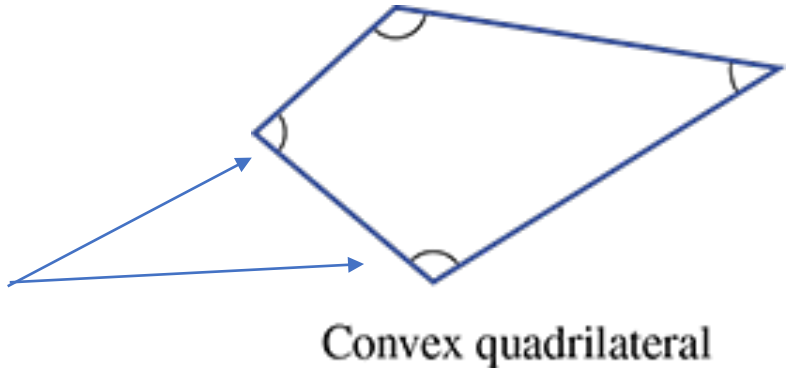
A regular polygon is one where all the side lengths are the same. **They also have the same size interior angles.**

Hold on!

What's an interior angle?

It's the angle what is inside the shape.

These are interior angles.
They are inside the shape!



Convex quadrilateral

Finding the sum of the interior angles of any polygon

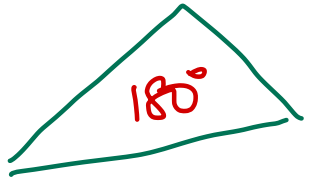
There is a pretty awesome rule we can use to find the sum of the angles in any polygon.

Angles in a triangle add to 180 degrees.

WHAT?

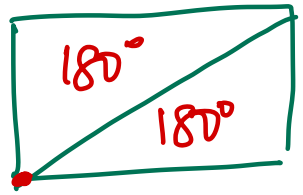
Yup. If you can split a shape into triangles then you can find the sum of all the internal angles.

There is a formula we can use, but it's nice to know where it comes from!

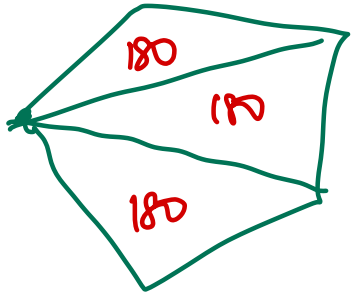


n n-2

3 1



$= 360°$ 4 2



$= 540°$ 5 3

$(n-2) \times 180° = \text{Int}$

Finding the sum of the interior angles of any polygon

OK, you want the formula.

The ‘n’ stands for the number of sides.

Remember, the number of triangles was always two less than the number of sides.

$$Sum\ of\ internal\ angles = 180(n-2)$$

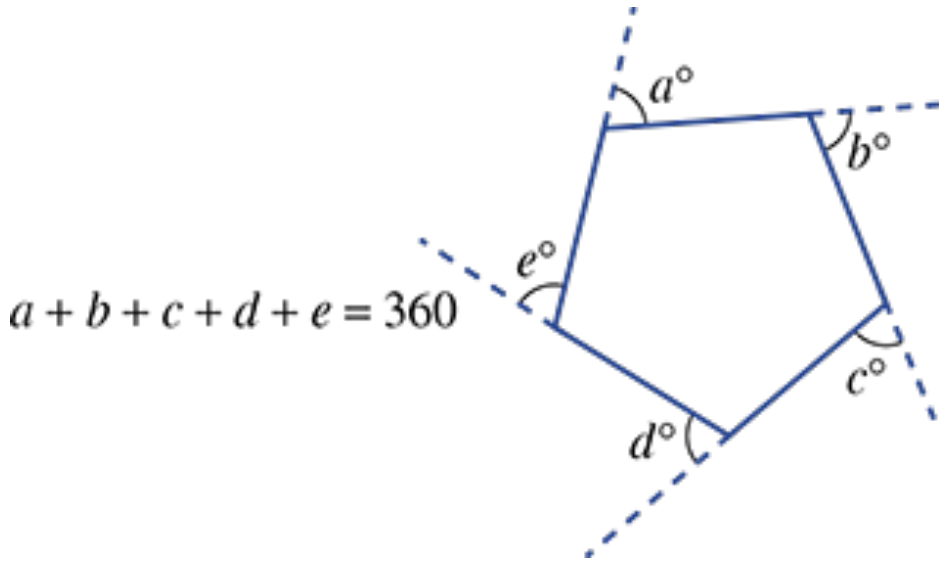
$$= 180 \times (n-2)$$

Sum of exterior angles

This always make me sad when people don't remember this one.

The sum of the exterior angles of a polygon is always 360°

To go around any shape you're always going to be going around one circle; hence the 360°



$$a + b + c + d + e = 360$$

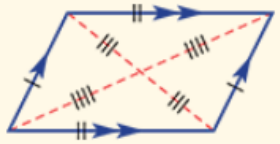
Properties of quadrilaterals

This is summary book stuff. Put it in your summary book.

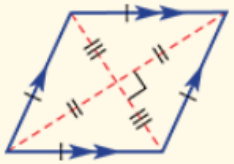
Learn it. But know where it is if you need it.

■ **Parallelograms** are **quadrilaterals** with two pairs of parallel sides. They include:

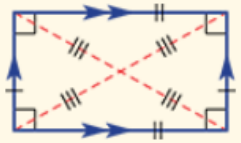
- Parallelogram: a quadrilateral with two pairs of parallel sides



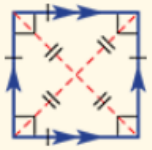
- Rhombus: a parallelogram with all sides equal



- Rectangle: a parallelogram with all angles 90°

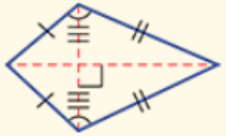


- Square: a rhombus with all angles 90°.



■ The kite and trapezium are also special quadrilaterals.

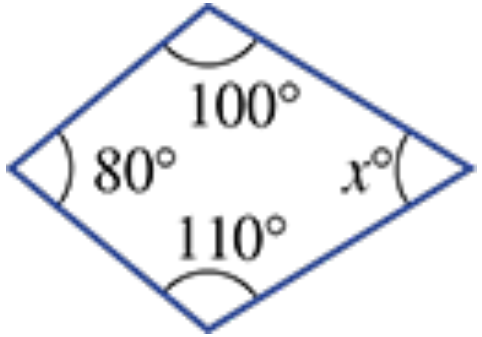
- Kite



- Trapezium

Finding angles in quadrilaterals

Find the value of the pronumeral in the quadrilateral shown



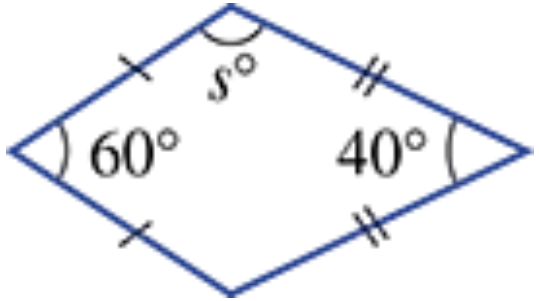
360°
-100°
-110°
-80°

$x = 70^\circ$

$S = 180(n-2)$
$= 180(4-2)$
$= 180 \times 2$
$= 360^\circ$

Finding angles in quadrilaterals

Find the value of the pronumeral in the quadrilateral shown

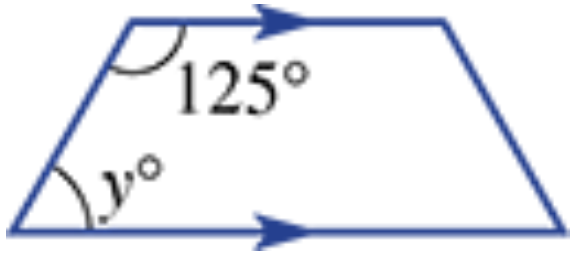


$360°$
$- \ 100$
$260°$

$s = 130°$

Finding angles in quadrilaterals

Find the value of the pronumeral in the quadrilateral shown



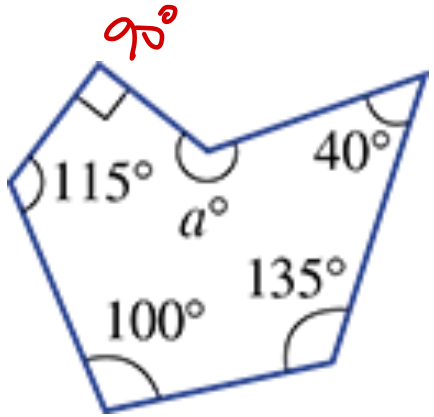
$180°$

$-\ 125°$

$y = 55°$

Finding angles in polygons

For each polygon find the angle sum using $S = 180(n - 2)$, then find the value of any pronumerals.

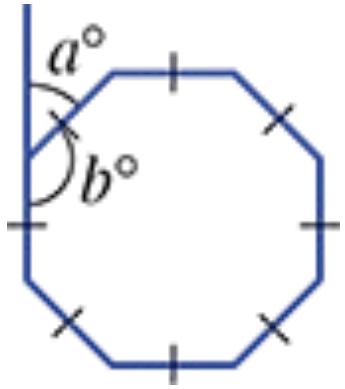


180
− 40
− 135
− 100
− 115
− 90°
$a = 240°$

$S = 180(n-2)$
$= 180(6-2)$
$= 180 \times 4$
$= 720°$

Finding angles in polygons

For each polygon find the angle sum using $S = 180(n - 2)$, then find the value of any pronumerals.



$a = 180° - 135°$

$= 45°$

$S = 180(n-2)$

$= 180(8-2)$

$= 180 \times 6$

$= 1080°$

$8 \overline{)1080}$

$b° = 135°$

Questions to complete:

The questions I would like you to complete for this lesson are:

Exercise 7C Quadrilaterals and polygons
Questions: 1a, 2df, 3acde, 4acegi, 5, 6, 7acdf, 10

Extension: 11

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