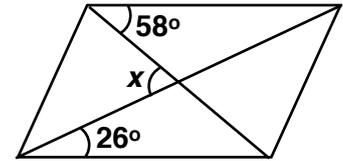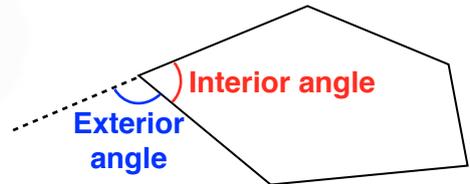## Angles in Polygons

Starter

1. **(Review of last lesson)**
   Find the value of x, which is the angle between the diagonals
   of the parallelogram. Give reasons for each step

   58°
   x
   26°

N.B. A polygon is a 2-D shape with straight sides.

2. **(Review of previous material)**
   Using the diagram write down a relationship
   between the interior and exterior of a polygon.

   Interior angle
   Exterior angle

3. **(Review of previous material)**
   Consider the square and the pentagon.
   Starting from one **vertex** of the shape,
   we can draw **lines** to the other vertices.

   The **line(s)** drawn splitting the shape
   into triangles cannot cross.
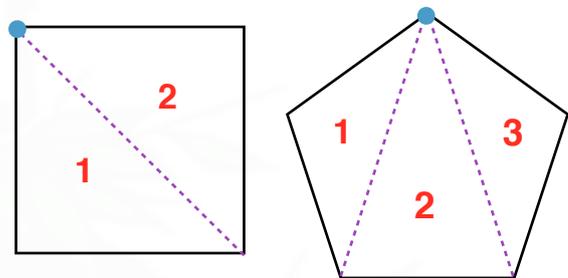
   For a square this creates **2 triangles**.
   For a pentagon this creates **3 triangles**.

   Copy and complete the table below. Draw the shapes and split into triangles if you need to.

Shape	Number of sides	Number of triangles	Sum of interior angles
Square	4	2	$2 \times 180° = 360°$
Pentagon	5	3	
Hexagon			
Octagon			
$n-$**sided polygon**			

E.g. 1 Using the formula "Sum of interior angles of an $n-$sided polygon $= 180°(n-2)$", state the
formula for the size of one interior angle of an $n-$sided regular polygon.

   Working: There are n equal angles in the $n-$sided regular polygon.
   The sum of the interior angles is $180°(n-2)$

   So size of one interior angle of an $n-$sided regular polygon is $\dfrac{180°(n-2)}{n}$.

E.g. 2 Find the sum of the interior angles of:
    (a)   a decagon   (b)   a $13-$sided polygon.

    Working: (a) $n = 13.$
$$\text{Sum of interior angles} = 180°(n-2)$$
$$= 180°(13-2)$$
$$= 1980°$$

              (b)   A decagon has 10 sides so $n = 10.$
$$\text{Sum of interior angles} = 180°(n-2)$$
$$= 180°(10-2)$$
$$= 1440°$$

E.g. 3 Find the size of one interior angle of:
    (a)   a regular $16-$sided polygon.   (b)   a regular $23-$sided polygon.

    Working: (a) $n = 16.$
$$\text{Size of one interior angles} = \frac{180°(n-2)}{n}$$
$$= \frac{180°(16-2)}{16}$$
$$= 157.5°$$

              (b) $n = 23.$
$$\text{Size of one interior angles} = \frac{180°(n-2)}{n}$$
$$= \frac{180°(23-2)}{23}$$
$$= 164.3°$$

E.g. 4 A nonagon has 8 interior angles each measuring $130°$. Find the size of the ninth angle.

    Working: Sum of interior angles of a nonagon $= 180°(9-2) = 1260°$
                    Sum of 8 interior angles $= 8 \times 130° = 1040°$
                    9th angle $= 1260° - 1040° = 220°$

    Video: **Angles in polygons**

    Solutions to Starter and E.g.s

Exercise
9-1 class textbook: p66 M3.3 Qu 4-12 even, 13, 14
A*-G class textbook: p59 M3.3 Qu 4-12 even, 13, 14
9-1 homework book: p21 M3.3 Qu 1-9
A*-G homework book: p16 M3.3 Qu 1-8