

Lesson 6

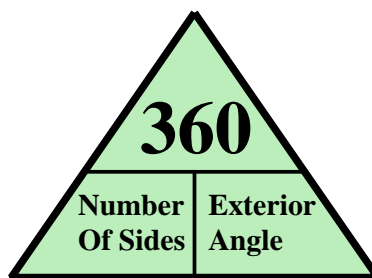
GCSE Mathematics Angles & Polygons

6.1 Discoveries

Here is the completed table that summarizes the previous lesson's investigations;

Question	N° of sides	Polygon Name	Each Interior	Each Exterior	Sum Interior	Sum Exterior
1	3	Equilateral Δ	60°	120°	180°	360°
2	4	Square	90°	90°	360°	360°
3	5	Pentagon	108°	72°	540°	360°
Example	8	Octagon	135°	45°	1080°	360°
4	10	Decagon	144°	36°	1440°	360°

The table suggests various properties that all regular polygons will have in common. The most efficient way to remember the various relationships is via the following formula triangle;



The three formulae contained within the triangle are;

$$\text{Number Of Sides} \times \text{Exterior Angle} = 360$$

$$\text{Number Of Sides} = \frac{360}{\text{Exterior Angle}}$$

$$\text{Exterior Angle} = \frac{360}{\text{Number Of Sides}}$$

Also

$$\text{Interior Angle} + \text{Exterior Angle} = 180$$

6.2 Exercise

You may use a calculator
Marks Available : 50

Question 1

For a regular polygon;

$$\text{number of sides} = \frac{360}{\text{one exterior angle}}$$

Use this formula to answer the following question:

Each exterior angle of a regular polygon is 12°

How many sides has the polygon ?

[3 marks]

Question 2

For a regular polygon;

$$\text{one exterior angle} = \frac{360}{\text{number of sides}}$$

Use this formula to answer the following question:

What is the size of each exterior angle of a 15 sided regular polygon ?

[3 marks]

Question 3

(i) For a regular polygon what is the sum of one interior and one exterior angle?

[1 mark]

(ii) Each exterior angle of a regular polygon is 18° .

(a) How many sides has the polygon ?

[2 marks]

(b) What is the size of each interior angle ?

[1 mark]

(c) What is the sum of all the interior angles ?

[1 mark]

Question 4

A regular polygon has 45 sides.

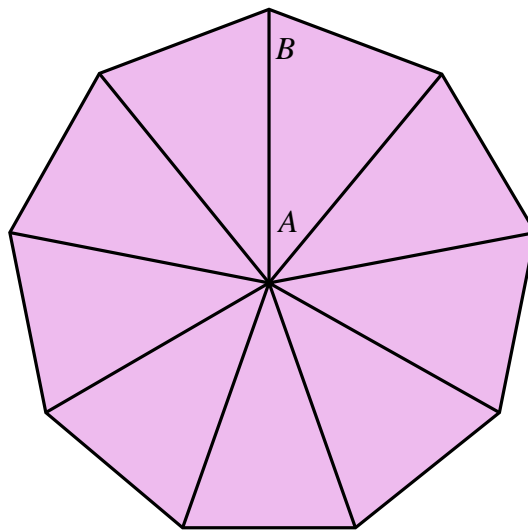
- (i) What is the size of each exterior angle ?

[2 marks]

- (ii) What is the size of each interior angle ?

[1 mark]

Question 5



A regular nonagon is shown with spokes radiating from the centre.

- (i) How many sides has a nonagon ?

[1 mark]

- (ii) What is the size of angle A ?

[1 mark]

- (iii) What is the size of angle B ?

[1 mark]

- (iv) On the diagram clearly mark

(a) an exterior angle

[1 mark]

(b) an interior angle

[1 mark]

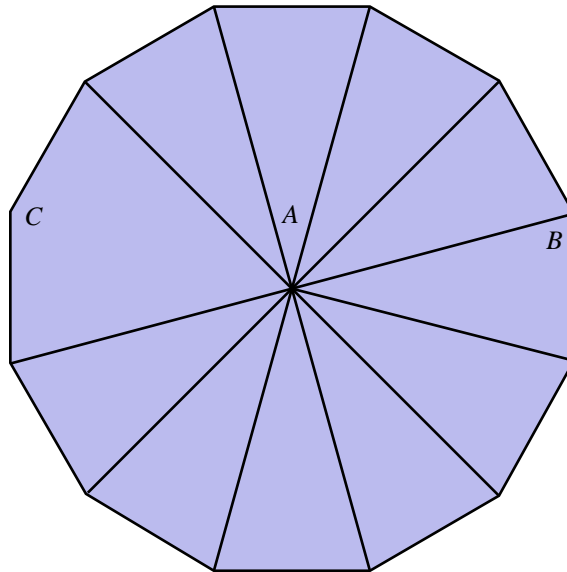
- (v) How many degrees is each of the nonagon's exterior angles ?

[1 mark]

- (vi) How many degrees is each of the nonagon's interior angles ?

[1 mark]

Question 6



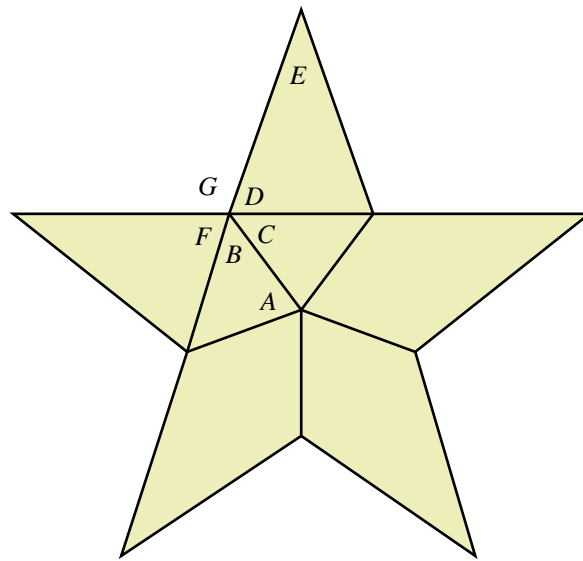
A regular dodecagon is shown with spokes radiating from the centre.

- (i) How many sides has a dodecagon ? [1 mark]
- (ii) What is the size of angle A ? [1 mark]
- (iii) What is the size of angle B ? [1 mark]
- (iv) What is the size of angle C ? [1 mark]

Question 7

- (i) Explain why a regular polygon can NOT have an external angle of 32° [2 marks]
- (ii) Can a regular polygon have an external angle of 18° ?
Give a reason for your answer. [2 marks]
- (iii) Which regular polygon has the largest possible external angle ? [1 mark]
- What is the size of that external angle ? [1 mark]

Question 8



The five pointed star is a regular pentagram.

In horror movies it's often used to keep werewolves away.

Some extra lines have been added to help you investigate the shape.

- (i) What is the size of angle A ? [1 mark]

- (ii) What is the size of angle B ? [1 mark]

- (iii) What is the size of angle C ? [1 mark]

- (iv) What is the size of angle D ? [1 mark]

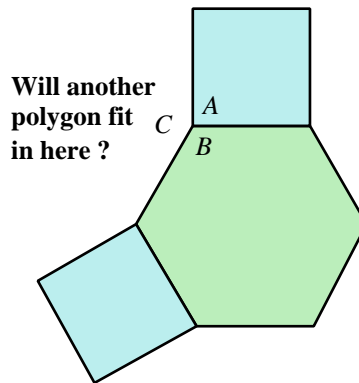
- (v) What is the size of angle E ? [1 mark]

- (vi) What is the size of angle F ? [1 mark]

- (vii) What is the size of angle G ? [1 mark]

- (viii) What is the sum of the interior angles of a regular pentagram ? [1 mark]

Question 9



William is doodling with regular polygons.

He sketches the diagram shown of two squares and a hexagon.

He wonders is another regular polygon will fit against those doodled so far.

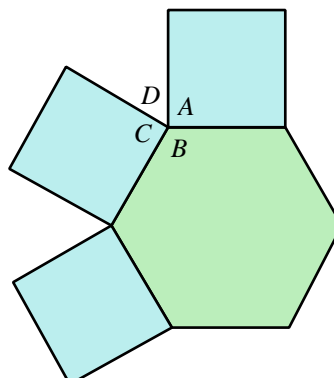
(i) What is the size of angle A ? [1 mark]

(ii) What is the size of angle B ? [1 mark]

(iii) What is the size of angle C ? [1 mark]

(iv) Does a regular polygon exist with interior angles of size C ?
Explain your answer. [2 marks]

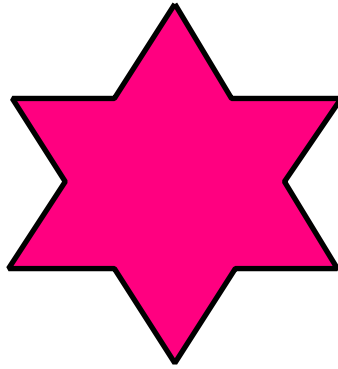
(v) Williams friend, Tony, suggests putting another square in as shown below.



Is Tony's suggestion a good one ?
Again, explain your answer.

[2 marks]

Question 10



The six pointed star is a regular hexagram.

- (i) In the space below use a pen or pencil, compass and straight edge to draw a large hexagram. If working on a computer upload a photograph of the hexagram drawn on paper with pencil, compass and straight edge.

[3 marks]

- (ii) What is the sum of the interior angles of a regular hexagram ?

[1 mark]

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk