Reasoning and Problem Solving
Step 9: Angles in Polygons

National Curriculum Objectives:

Mathematics Year 6 (6G2a) Compare and classify geometric shapes based on their properties and sizes
Mathematics Year 6: (6G4a) Find unknown angles in any triangles, quadrilaterals and regular polygons
Mathematics Year 6: (6G4b) Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

Differentiation:

Questions 1, 4 and 7 (Reasoning)
Developing Identify if a given answer is true or false, using understanding of how a quadrilateral can be split into triangles to work out the sum of the interior angles.
Expected Identify if a given answer is true or false, using understanding of how a polygon can be split into triangles to work out the sum of the interior angles.
Greater Depth Identify if a given answer is true or false, using understanding of how a polygon can be split into triangles to work out the sum of the interior angles. Explore more than one possibility.

Questions 2, 5 and 8 (Problem solving)
Developing Recognise relationships between the number of sides of a polygon and the number of triangles it can be split into. Calculate the sum of the interior angles of more than one shape (triangles and quadrilaterals.)
Expected Recognise relationships between the number of sides of a polygon and the sum of the interior angles. Calculate the sum of the interior angles of more than one shape.
Greater Depth Recognise relationships between the number of sides of a polygon and individual interior angles. Use understanding of interior angles to find the sum of angles in more than one shape.

Questions 3, 6 and 9 (Reasoning)
Developing Prove how many triangles a polygon can be split into (quadrilateral or pentagon.)
Expected Prove that the sum of the interior angles of a given polygon will always be the same.
Greater Depth Prove that the sum of the exterior angles of any given polygon will always be the same and that vertically opposite angles will always be equal.

More Year 6 Properties of Shapes resources.

Did you like this resource? Don't forget to review it on our website.

Angles in Polygons

Angles in Polygons

1a. The sum of the angles in a square is equal to the sum of the angles in 3 triangles, which is 540˚.

I think this is false because a square can only be split into 2 triangles, so the sum of the angles would be 360˚.

Sarah

Is Sarah correct? Explain your answer.

D

PS

1b. The sum of the angles in a shape is 360˚. The shape will always be a square.

I think this is true because the interior angles in a square total 360˚.

Craig

Is Craig correct? Explain your answer.

D

PS

2a. Look at the table below.

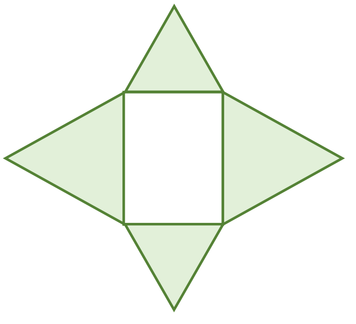
Number of sides	Number of triangles
4	2
5	3
7	5

Use this table to work out how many triangles a hexagon can be split into.

D

PS

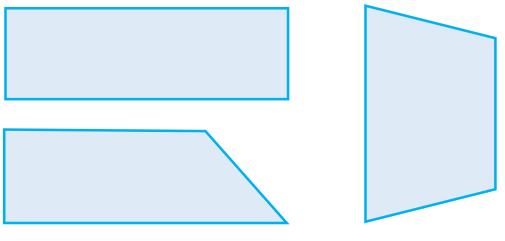
2b. The sum of interior angles of a triangle is 180˚ and the sum of the interior angles of a quadrilateral is 360˚. What would the total sum of the interior angles be for the 5 polygons you can see below?



D

PS

3a. A quadrilateral can only ever be split into two triangles, so the sum of the interior angles of any quadrilateral will always equal 360˚.

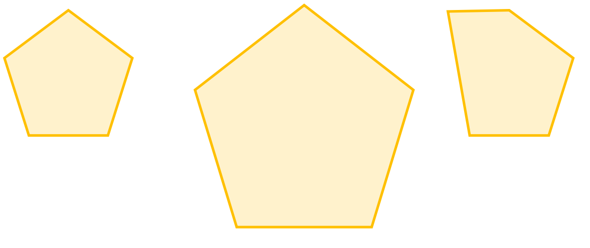


Convince me that it is true

D

R

3b. A pentagon can only ever be split into three triangles, so the sum of the interior angles of any pentagon will always equal 540˚.



Convince me that it is true

D

R

Angles in Polygons

4a. The sum of the angles in a pentagon is equal to the sum of the angles in 5 triangles, which is 900°.

I think this is true because a pentagon has 5 sides and 5 angles so it must have 5 triangles.

Kyle

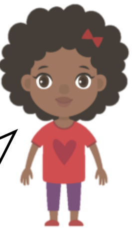
Is Kyle correct? Explain your answer.

E

PS

4b. The sum of the angles in a shape is greater than 540° but less than 900°. The shape can only be a hexagon.

I think this is false because the sum of a pentagon's interior angles is 540°, so the shape could also be a pentagon.



Kara

Is Kara correct? Explain your answer.

E

PS

5a. Look at the table below.

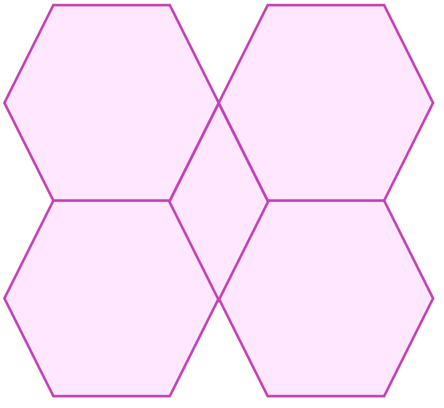
Number of sides	Number of triangles	Sum of interior angles
8	6	1080°
9	7	1260°
10	8	1440°

Use this table to work out the sum of the interior angles in a dodecagon.

E

PS

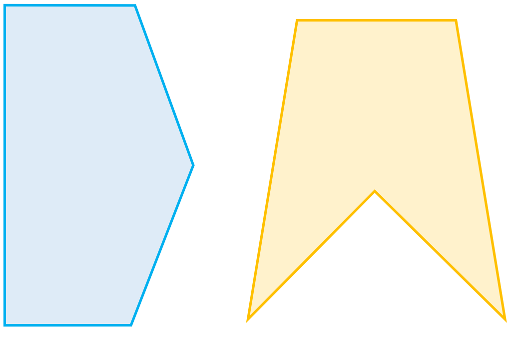
5b. What would the total sum of the interior angles be for the 5 polygons you can see?



E

PS

6a. The sum of the interior angles of any pentagon will always equal 540°.

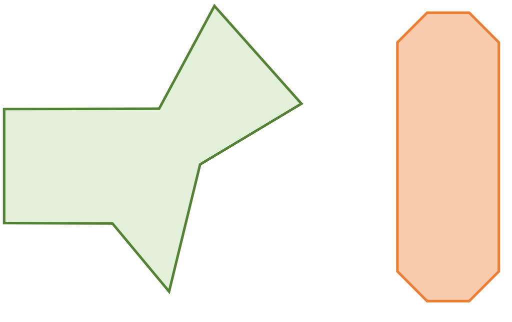


Convince me that it is true.

E

R

6b. The sum of the interior angles of any octagon will always equal 1080°.



Convince me that it is true.

E

R

Angles in Polygons

7a. There are four possible shapes which have interior angles totalling between 300° and 1000°.

I think this is true but I'm not sure why.

Michaela

Is Michaela correct? Help her explain by presenting the information in a table.

GD PS

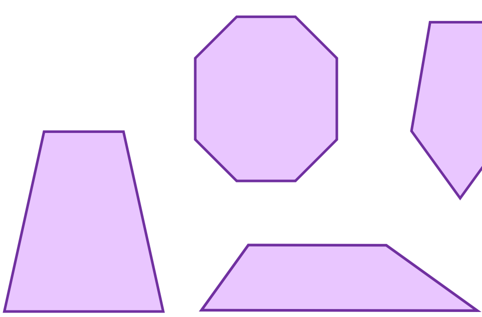
8a. Look at the table below.

Number of sides	Number of triangles	Size of interior angle
4	2	90°
5	3	108°
6	4	120°
8	6	135°

Use this table to work out the size of one interior angle in a dodecagon.

GD PS

9a. The sum of the exterior angles of any polygon will always equal 360°.



Convince me that this is true.

GD R

Angles in Polygons

7b. There are two possible shapes which have interior angles totalling between 1000° and 1500°.

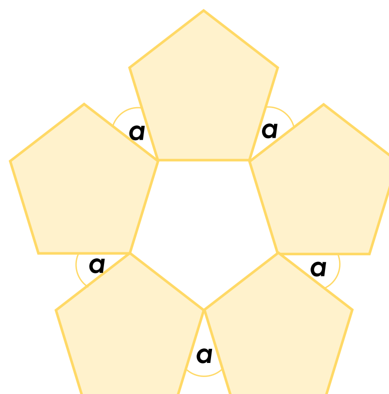
I think this is true but I'm not sure why.

Zak

Is Zak correct? Help him explain by presenting the information in a table.

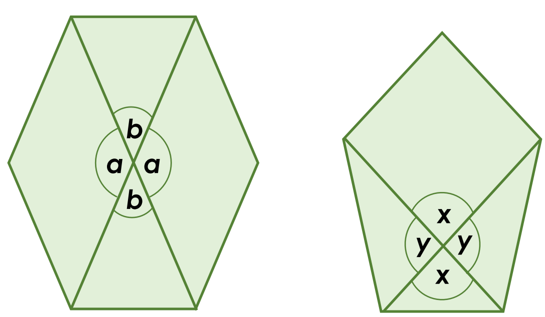
GD PS

8b. Use your knowledge of interior angles to work out the total sum of all the angles labelled *a*.



GD PS

9b. Vertically opposite angles will always be equal.



Convince me that this is true.

GD R

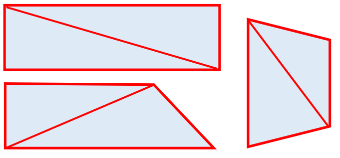
Reasoning and Problem Solving
Angles in Polygons

Developing

1a. Sarah is correct. A square can only be split into 2 triangles. The sum of the angles in each triangle is 180˚. 180˚ x 2 = 360˚.

2a. The table shows that the number of triangles is 2 less than the number of sides. Therefore a hexagon could be split into 4 triangles, because 6 – 2 = 4.

3a.



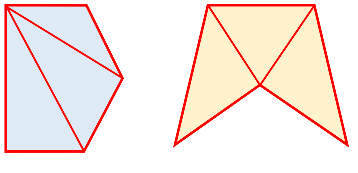
Children may demonstrate using a variety of quadrilaterals.

Expected

4a. Kyle is incorrect. A pentagon can only be split into 3 triangles. The sum of the interior angles in a pentagon will be 540˚, not 900˚.

5a. The table shows that the number of triangles a shape can be split into is 2 less than the number of sides. 12 – 2 = 10. A dodecagon can be split into 10 triangles. 10 x 180˚ = 1800˚. The sum of the interior angles in a dodecagon is 1800˚.

6a.



180˚ x 3 = 540˚.
Children may demonstrate using a variety of regular and irregular pentagons.

Greater Depth

7a. Michaela is correct. There are 4 possible shapes which have interior angles totalling between 300˚ and 100˚. Children may present their answer in a table which could look like this:

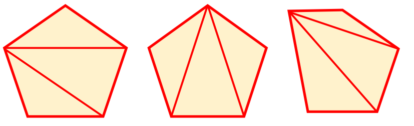
Reasoning and Problem Solving
Angles in Polygons

Developing

1b. Craig is incorrect. Even though the sum of the interior angles of a square is 360˚, this also applies to any other quadrilateral.

2b. There are 4 triangles and 1 quadrilateral. 180˚ x 4 = 720˚. 720˚ + 360˚ = 1080˚. The sum of all of the interior angles would be 1080˚.

3b.



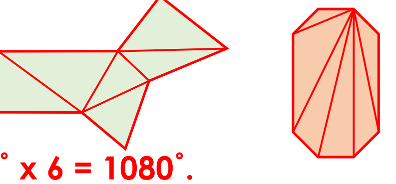
Children may demonstrate using a variety of pentagons.

Expected

4b. Kara is incorrect. The statement asks for interior angles with sums which are greater than 540˚. The sum of an pentagon's interior angles is equal to 540˚.

5b. There are 4 hexagons and one quadrilateral. The sum of the interior angles for a hexagon is 4 x 180˚ = 720˚. The sum of the interior angles in a quadrilateral is 360˚.
(4 x 720˚) + 360˚ = 3240˚.

6b.



180˚ x 6 = 1080˚.
Children may demonstrate using a variety of regular and irregular octagons.

Greater Depth

7b. Zak is incorrect. There are 3 possible shapes which have interior angles totalling between 1000˚ and 1500˚. Children may present their answer in a table which could look like this:

Reasoning and Problem Solving
Angles in Polygons

Number of Sides	Number of triangles	Sum of interior angles
4	2	360˚
5	3	540˚
6	4	720˚
7	5	900˚

8a. Children should look at the relationship between the number of sides and triangles and use this to calculate the sum of the interior angles of a dodecagon. Sum of angles in a dodecagon: 10 x 180˚ = 1800˚. Interior angle of a dodecagon: 1800˚ ÷12 = 150˚.

9a. Children will demonstrate their reasoning and proof through diagrams and use of calculations or a protractor. They may make the connection that the exterior angles follow a route around the outside of the shape and that all of the way around the shape is a full turn, which equals 360˚.

Reasoning and Problem Solving
Angles in Polygons

Number of Sides	Number of triangles	Sum of interior angles
8	6	1080˚
9	7	1260˚
10	8	1440˚

8b. An interior angle of a regular pentagon are 108˚. There are 3 of these angles joined at a point. 108˚ x 3 = 324˚. Angle *a* = 360˚ – 324˚ = 36˚. Angle *a* x 5 = 36˚ x 5 = 180˚.

9b. Children will demonstrate their reasoning and proof through diagrams and use of calculations or a protractor.