## Properties of Shapes: Regular and Irregular Polygons

## Aim

Distinguish between regular and irregular polygons based on reasoning about equal sides and angles.

To reason about regular and irregular polygons.

## Success Criteria

I can recognise polygons as closed shapes with 3 or more straight sides.

I can sort polygons based on if they are regular or irregular.

I can reason about the properties of shapes.

## Key/New Words

Regular polygons, irregular polygons, sides, angles, equal, equilateral, right angled triangle, isosceles, scalene.

| Resources |
| :--- |
| Lesson Pack |
| Rulers |
| Protractors |
| Preparation <br> Differentiated Regular and Irregular Shape <br> Diving into Mastery Activity Sheets - as <br> required <br> Snap Cards - one pack per pair |

Resources
Lesson Pack
Rulers
Protractors

## Preparation

Differentiated Regular and Irregular Shape Reasoning Activity Sheets - one per child
Diving into Mastery Activity Sheets - as required

Snap Cards - one pack per pair

## Prior Learning

It will be beneficial if children are confident with measuring angles accurately using a protractor, as covered in the Measuring Angles in Degrees lesson.

## Learning Sequence

|  | Remember It: Using the corresponding slide on the Lesson Presentation, the children will carry out a talkbased activity based on describing 2 D shapes. This will enable children to recap prior learning about shapes and use key vocabulary. Children will discuss the names, types of angles, the measurements of interior angles, lines of symmetry, parallel lines and perpendicular lines. | $\bigcirc$ |
| :---: | :---: | :---: |
|  | Sorting 2D Shapes: Using the corresponding slides on the Lesson Presentation, the children will consider how a selection of 2 D shapes have been sorted. They will discover that the shapes have been sorted into 'polygons' and 'not polygons'. The children will then learn how to define a polygon and what the properties of polygons and non polygons are. Can the children recognise polygons as closed shapes with 3 straight sides? | $\bigcirc$ |
|  | Polygons: Using the corresponding slides on the Lesson Presentation, the children consider how the polygons have been sorted into a table. The children will be encouraged to suggest the headings that could label both columns of the table. The children will then be shown that the shapes have been sorted into regular and irregular polygons, before sharing what they notice about the contrasting types of polygons. It is important that children understand that regular polygons have sides of equal length and irregular polygons have sides of differing lengths. Can the children sort polygons based on if they are regular or irregular? | $\bigcirc$ |
|  | Snap: Using the corresponding slides on the Lesson Presentation, the children will play a game of snap in pairs. The objective is to find pairs of matching shapes. Children may only win these cards if they correctly state if the shapes are regular or irregular polygons. This game is intended to support children with spotting regular and irregular polygons. It is suggested that children are provided with rulers for this game so that they can measure the sides of the shapes to prove that they are regular polygons. Can the children measure shapes accurately to prove if they are regular or irregular polygons? | $\bigcirc$ |
|  | Properties of Regular Polygons: Using the corresponding slides on the Lesson Presentation, the children are introduced to the second important property that regular polygons have - equal angles. An animation will demonstrate how the interior angles can be measured to prove that the shapes are regular polygons. It is essential that the children understand that regular polygons have sides and angles that are equal. Can the children sort polygons based on if they are regular or irregular? Can the children measure shapes accurately to prove if they are regular or irregular polygons? |  |
| 0,0 | Reasoning: Using the corresponding slides on the Lesson Presentation, the children will discuss a reasoning question about triangles. This addresses a common misconception that many children may have which is believing that all triangles are regular polygons. This is because many children visualise an equilateral triangle when considering triangles. This part of the presentation recaps the three other types of triangles so that children can become aware that it is only the equilateral triangle which is a regular polygon. |  |


| $\bigcirc$ | Regular and Irregular Shape Reasoning Activity Sheets: Using the differentiated Regular and Irregular Shape Reasoning Activity Sheets, the children complete tasks that provide them with opportunities to answer a range of reasoning questions. <br> To support children working towards expected level, children <br> will complete two <br> sorting activities. The <br> first activity involves <br> sorting shapes based <br> on if they are polygons <br> or not polygons. <br> The second sorting activity involves <br> sorting polygons based on if they are regular or irregular. It is suggested that this is carried out as a group activity with adult support so that the children can give mathematical reasons for sorting each shape card. <br> Children working at expected level will complete a range of reasoning questions. They will spot polygons, before proving that they can recognise regular and irregular polygons. Children will then describe the differences between regular and irregular polygons before deepening their understanding by answering two further reasoning questions. <br> To challenge children working at greater depth, the children will sort shapes based on if they are regular polygons or not. Children will then accurately draw two regular and two irregular polygons before solving a visual shape problem. | $\square$ |
| :---: | :---: | :---: |
| $\square$ | Diving into Mastery: Schools using a mastery approach may prefer to use the following as an alternative activity. These sheets might not necessarily be used in a linear way. Some children might begin at the 'Deeper' section and in fact, others may 'dive straight in' to the 'Deepest' section if they have already mastered the skill and are applying this to show their depth of understanding. <br> Children complete fluency questions related to regular and irregular polygons. <br> Children answer reasoning questions related to regular and irregular polygons. <br> Children work individually or collaboratively on problem-solving questions related to regular and irregular polygons. | $\square$ |

## Exploreit

Drawit: Provide children with opportunities to draw regular and irregular polygons on dotty paper to further enhance understanding.
Sortit: Using concrete representations of 2D shapes, children sort the shapes based on if they are regular and irregular polygons.
Learnit: Children will find this superb Knowledge Organiser a useful tool to support their understanding of shape properties.

## DISCLAIMER

We hope you find the information on our website and resources useful.

## Displaying the Presentation

To ensure this presentation displays correctly: If you are a Mac user, the presentation may open in 'slide master' mode - to see all the content, click 'close slide master' and the presentation should display correctly. If you are using Google Drive, the presentation won't display correctly if you open it in Google Slides. If you have opened it in Google Slides, you will need to download it again from the Twinkl website and this time open it from your computer.

## Animations

This resource has been designed with animations to make it as fun and engaging as possible. To view the content in the correct formatting, please view the PowerPoint in 'slide show mode'. This takes you from desktop to presentation mode. If you view the slides out of 'slide show mode', you may find that some of the text and images overlap each other and/or are difficult to read.
To enter slide show mode, go to the slide show menu tab and select either from beginning or from current slide.


Maths

## Properties of Shapes

## Regular and Trreguhar Shape Remsoning



## Aim

- To reason about regular and irregular polygons.


## Success Criteria

- I can recognise polygons as closed shapes with 3 or more straight sides.
- I can sort polygons based on if they are regular or irregular.
- I can reason about the properties of shapes.

Work with a partner to describe the 2D shape using the questions provided. How many questions can you answer in one minute?

| What is the name of |
| :---: |
| the shape? |



Which angles can we identify the measurements of?


How many lines of symmetry does the shape have?

Does the shape have any perpendicular or parallel lines?

## Sorting 2D Shapes

I have sorted some shapes into two separate groups.

Polygons

## Not Polygons



## Polygons

Discuss with a partner. How can we define what a polygon is?

- Polygons are 2D shapes.
- Polygons are closed shapes.
- Polygons have 3 or more straight sides.



## Polygons

This is how I sorted the polygons into two groups. ?


## Polygons



One property of a regular polygon is that they have sides which are equal lengths.

One property of an irregular polygon is that they have sides which are different lengths.

Play the game 'Snap' with your shape cards. Matching cards can only be won if you say whether the shape is regular or irregular.


All of these polygons have sides that are equal lengths but only the ones circled are regular polygons!
Hazel

Regular polygons have a second important property. Have a close look inside the shapes that Hazel has circled.

What do you notice?

The interior angles of the circled shapes are equal. We can check by measuring with a protractor!
t are equal.




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Tanisha is investigating regular and irregular polygons.

I think all triangles are regular polygons!


Is Tanisha correct? Explain your answer.

## Tanisha has drawn an equilateral triangle.

Equilateral triangles are the only triangles that have equal length sides and angles. It is the only type of triangle that is a regular polygon!


## Equilateral

Right Angle
Isosceles
Scalene


## Diving into Mastery

Dive in by completing your own activity!


## Aim

- To reason about regular and irregular polygons.


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- I can recognise polygons as closed shapes with 3 or more straight sides.
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## Next Steps

| T | Teacher | I | Independent |
| :--- | :--- | :--- | :--- |
| PPA | Planning, Preparation and Assessment | AL | Adult Led |
| S | Supply | GP | Guided Practice |


| Aim: To reason about regular and irregular polygons. |  |  |  | Date: |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Delivered By: |  |  | Support: |  |  |
| Success Criteria | Me | Friend | Teacher | T | PPA | S | I | AL | GP |
| I can recognise polygons as closed shapes with 3 or more straight sides. |  |  |  | Notes/Evidence |  |  |  |  |  |
| I can sort polygons based on if they are regular or irregular. |  |  |  |  |  |  |  |  |  |
| I can reason about the properties of shapes. |  |  |  |  |  |  |  |  |  |
| Next Steps |  |  |  |  |  |  |  |  |  |


| T | Teacher | I | Independent |
| :--- | :--- | :--- | :--- |
| PPA | Planning, Preparation and Assessment | AL | Adult Led |
| S | Supply | GP | Guided Practice |

1) 

a)

|  | Regular Polygon | Irregular Polygon |
| :---: | :---: | :---: |
| Quadrilateral | D | B C |
| Not a Quadrilateral | A | E |

b) Parallelogram or kite or rhombus.
c) Equilateral triangle.
2) Irregular hexagon must have at least one unequal side and angle when compared to the other sides and angles.

The regular quadrilateral must be a square.

1) This shape is a square, so it is a regular polygon.

2) 

a) Niall is incorrect. The rhombus does have sides that are the same length but the angles are not equal. The rhombus is an irregular polygon.
b) A rhombus must have four sides of the same length. A square is a type of rhombus and is therefore an example of a regular rhombus.
3)

| Hexagons are regular polygons. | Sometimes |
| :---: | :---: |
| A pentagon with equal length <br> sides will have equal angles. | Always |
| Circles and semicircles are <br> classed as irregular polygons. | Never |

1) 

a) All sides and angles must be equal.
b) This depends on the shape drawn. The sum of the interior angles are: equilateral triangle $-180^{\circ}$ square $-360^{\circ}$ regular pentagon-540 ${ }^{\circ}$ regular hexagon-720 ${ }^{\circ}$.
2)
a) The shape drawn must have at least one unequal side and angle when compared to the other sides and angles.
b) The answer should be the same as for q1b, depending on the shape drawn.
3) The children should explore pentagons, octagons, triangles and generalise that the sum of interior angles will be the same value whether the polygon is regular or irregular.
1)
a) Sort these 2D shapes into the diagram. Put the letters A-E in the correct places.
A


|  | Regular Polygon | Irregular Polygon |
| :---: | :--- | :--- |
| Quadrilateral |  |  |
| Not a Quadrilateral |  |  |
|  |  |  |

b) Write the name of a different 2 D shape that is an example of an irregular quadrilateral.
c)

What type of triangle must be placed in the 'regular' and 'not a quadrilateral' section?
2) Draw an irregular hexagon and a regular quadrilateral.

1) Margot makes some irregular polygons on a geoboard.

$\qquad$
$\qquad$
$\qquad$
$\qquad$
Which of these is not an example of an irregular polygon? $\qquad$
Explain how you know. $\qquad$
$\qquad$
2) 

a) Niall is investigating polygons.


Do you agree with Niall? Give reasons for your answer.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
b) Is a rhombus always an irregular polygon? Explain your answer.
$\qquad$
$\qquad$
3) Write always, sometimes or never next to the statements in the table. Give reasons for your answers in the last column.

|  | Always, Sometimes <br> or Never | Reason |
| :---: | :--- | :--- |
| Hexagons are regular polygons. |  |  |
| A pentagon with equal length <br> sides will have equal angles. |  |  |
| Circles and semicircles are <br> classed as irregular polygons. |  |  |

a) Draw a regular polygon. Remember to use a protractor and ruler to check that your shape is regular.
b) What is the sum of the interior angles?
2)
a) Now draw an irregular polygon with the same number of sides as the shape you drew above.
b) What is the sum of the interior angles?
$\qquad$

What do you notice?
$\qquad$
3) Is the same true for other regular and irregular polygons. Use the dotty paper to investigate.
a) Sort these 2D shapes into the diagram. Put the letters A-E in the correct places.
1)
a) Sort these 2D shapes into the diagram. Put the letters A-E in the correct places.


C


|  | Regular <br> Polygon | Irregular <br> Polygon |
| :---: | :---: | :---: |
| Quadrilateral |  |  |
| Not a <br> Quadrilateral |  |  |

b) Write the name of a different $2 D$ shape that is an example of an irregular quadrilateral.
c) What type of triangle must be placed in the 'regular' and 'not a quadrilateral' section?
2) Draw an irregular hexagon and a regular quadrilateral.
$\qquad$
$\qquad$
$\qquad$ $\cdot$

.


$\cdot$
.
. .
$\qquad$

1) Margot makes some irregular polygons on a geoboard.
2) Margot makes some irregular polygons on a geoboard.


Which of these is not an example of an irregular polygon?
Explain how you know.
2)
a) Niall is investigating equilaterals.


This rhombus is a regular polygon because all the sides are the same length.


Do you agree with Niall? Give reasons for your answer.
b) Is a rhombus always an irregular polygon? Explain your answer.
3) Write always, sometimes or never next to the statements in the table. Give reasons for your answers in the last column.

| Hexagons are regular polygons. |  |
| :---: | :--- |
| A pentagon with equal length <br> sides will have equal angles. |  |
| Circles and semicircles are <br> classed as irregular polygons. |  |

a) Draw a regular polygon. Remember to use a protractor and ruler to check that your shape is regular.
b) What is the sum of the interior angles?
2)
a) Now draw an irregular polygon with the same number of sides as the shape you drew above
$\qquad$
-••

- • • • • • • • • • • •
b) What is the sum of the interior angles?

What do you notice?
3) Is the same true for other regular and irregular polygons. Use the dotty paper to investigate.
1)
a) Draw a regular polygon. Remember to use a protractor and ruler to check that your shape is regular.
b) What is the sum of the interior angles?
2)
a) Now draw an irregular polygon with the same number of sides as the shape you drew above
. . . . . . . . . . .
b) What is the sum of the interior angles?

What do you notice?
3) Is the same true for other regular and irregular polygons. Use the dotty paper to investigate.

## Regular and Irregular Shape Reasoning

To reason about regular and irregular polygons.

1) One shape in each set is a polygon. Find the polygon in each set and circle it.

|  |  | $\square$ |
| :---: | :---: | :---: |
|  |  | $\square$ |
|  |  |  |

2) How do you know that these shapes are polygons?
3) One polygon in each horizontal set is a regular polygon. Find the regular polygon in each set and circle it.

4) What is the difference between irregular and regular polygons?
$\square$
5) Zoe is investigating if polygons are irregular or regular.


Is Zoe correct? Give reasons for your answer.
6) Write always, sometimes or never next to the statements in the table.

| Four sided shapes with straight <br> sides are regular polygons. |  |
| :---: | :--- |
| Open shapes are polygons. |  |
| Irregular polygons have angles <br> of different sizes. |  |

## Regular and Irregular Shape Reasoning Answers

1) One shape in each set is a polygon. Find the polygon in each set and circle it.

2) How do you know that these shapes are polygons?

They are polygons because they are closed shapes that have 3 sides or more.
3) One polygon in each horizontal set is a regular polygon. Find the regular polygon in each set and circle it.

4) What is the difference between irregular and regular polygons?

Regular polygons have sides and angles that are equal. Irregular polygons can have sides and angles of different measurements.
5) Zoe is investigating if polygons are irregular or regular.


Is Zoe correct? Give reasons for your answer.
Zoe is incorrect. Rectangles are not regular polygons because the sides are different lengths. To be classed as a regular polygon, the sides need to be equal lengths.
6) Write always, sometimes or never next to the statements in the table.

| Four sided shapes with straight <br> sides are regular polygons. | Sometimes |
| :---: | :---: |
| Open shapes are polygons. | Never |
| Irregular polygons have angles <br> of different sizes. | Always |

## Regular and Irregular Shape Reasoning

To reason about regular and irregular polygons.

1) Sort the shapes into the diagram. Write each letter in the correct quadrant.


|  | Regular Polygon | Irregular Polygon |
| :---: | :---: | :---: |
| Has an even <br> number of sides |  |  |
| Has an odd <br> number of sides |  |  |

2) Tick the polygons that are placed in the correct sorting hoops below. Use a protractor and a ruler to check your answers.

Irregular Polygons


Regular Polygons

3)
a) Accurately draw two irregular polygons and two regular polygons.

b) Write a definition for irregular and regular polygons.
4) How many regular polygons can you see in the shape picture?


## Regular and Irregular Shape Reasoning Answers

To reason about regular and irregular polygons.

1) Sort the shapes into the diagram. Write each letter in the correct quadrant.

2) Tick the polygons that are placed in the correct sorting hoops below. Use a protractor and a ruler to check your answers.

Irregular Polygons


Regular Polygons

3)
a) Accurately draw two irregular polygons and two regular polygons.

Drawings will differ. Check to see that children have drawn regular polygons with equal sides and angles.
b) Write a definition for irregular and regular polygons.

Children should mention that regular polygons are 2D shapes which have sides and angles that are equal. They may say that polygons are closed shapes that have at least three straight sides. Children may provide examples of irregular and regular polygons.
4) How many regular polygons can you see in the shape picture?


6 squares
1 regular octagon

## Regular and Irregular Shape Reasoning

To reason about regular and irregular polygons.

## Adult guided task 1:

- Cut out all of the shapes and lay them face down on the table.
- Children take turns to turn over a shape card.
- As a group, discuss if the shape is a polygon or not.
- As a group, children decide if the shape goes in the 'polygon' or 'not polygon' circle.
- Use the talk prompts below to support the children with discussing the shapes.




## Polygons

Not Polygons


## Regular and Irregular Shape Reasoning

To reason about regular and irregular polygons.

## Adult guided task 2:

- Cut out all of the shapes and lay them face down on the table.
- Children take turns to turn over a shape card.
- As a group, discuss if the shape is a regular or irregular polygon.
- Remind children that regular polygons have sides and angles that are equal.
- As a group, children decide if the shape goes in the 'regular polygon' or 'irregular polygon' circle.
- Instruct children to use rulers and protractors to prove if a polygon is regular or irregular.
- Use the talk prompts below to support the children with discussing the shapes.


Can you tell by looking at the polygon if it is regular or irregular?


## Irregular Polygons

## Regular Polygons



## Regular and Irregular Shape Reasoning Answers



## Regular and Irregular Shape Reasoning Answers

Irregular Polygons
Regular Polygons






Properties of Shapes | Regular and Irregular Polygons

| To reason about regular and irregular polygons. |  |  |
| :--- | :--- | :--- |
| I can recognise polygons as closed shapes with 3 <br> or more straight sides. |  |  |
| I can sort polygons based on if they are regular <br> or irregular. |  |  |
| I can reason about the properties of shapes. |  |  |

Properties of Shapes \| Regular and Irregular Polygons

| To reason about regular and irregular polygons. |  |  |
| :--- | :--- | :--- |
| I can recognise polygons as closed shapes with 3 <br> or more straight sides. |  |  |
| I can sort polygons based on if they are regular <br> or irregular. |  |  |
| I can reason about the properties of shapes. |  |  |

Properties of Shapes | Regular and Irregular Polygons

| To reason about regular and irregular polygons. |  |  |
| :--- | :--- | :--- |
| I can recognise polygons as closed shapes with 3 <br> or more straight sides. |  |  |
| I can sort polygons based on if they are regular <br> or irregular. |  |  |
| I can reason about the properties of shapes. |  |  |

Properties of Shapes | Regular and Irregular Polygons

| To reason about regular and irregular polygons. |  |  |
| :--- | :--- | :--- |
| I can recognise polygons as closed shapes with 3 <br> or more straight sides. |  |  |
| I can sort polygons based on if they are regular <br> or irregular. |  |  |
| I can reason about the properties of shapes. |  |  |

Properties of Shapes \| Regular and Irregular Polygons

| To reason about regular and irregular polygons. |  |  |
| :--- | :--- | :--- |
| I can recognise polygons as closed shapes with 3 <br> or more straight sides. |  |  |
| I can sort polygons based on if they are regular <br> or irregular. |  |  |
| I can reason about the properties of shapes. |  |  |

