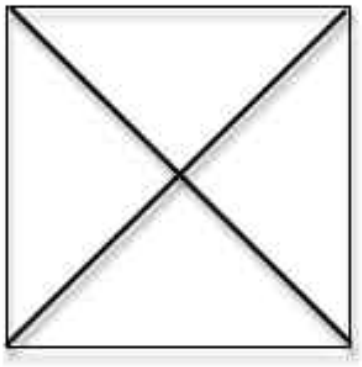
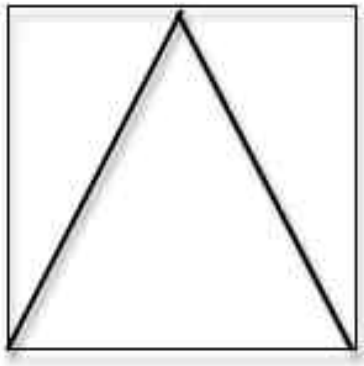
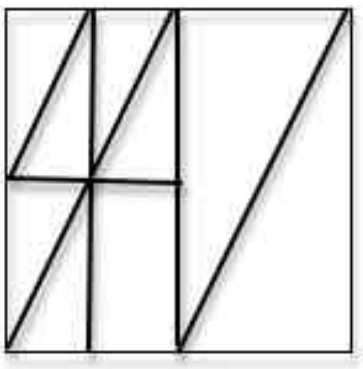
FRACTIONS IN A SQUARE

1 

2 

3 

Squares 1, 2 and 3 all have edges length 1 unit.

Some edges are divided into lengths of ½ and ¼.

The squares are split up into smaller shapes.

Draw the squares and cut them up. Squared paper is good for this.

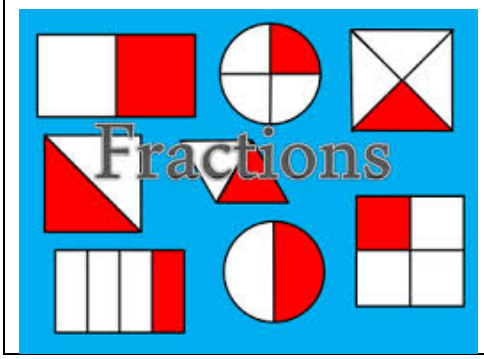
What fractions can you see?

What can you say about those shapes and their properties?

Which shapes are similar?

The squares have area 1 square unit. What are the areas of the bits inside the squares?

HELP



What fractions are shaded in these diagrams? What do you know about the shapes.

NEXT

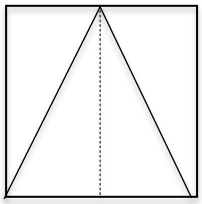
Draw squares and split them into halves in as many different ways as you can find. You could design some attractive ‘half and half’ patterns.

You could do the same for quarters. Squared paper is useful for this work.

GUIDE FOR PARENTS

SOLUTION

The area of **SQUARE 1** is one square unit. It is split into 4 triangles, each having area ¼.
The triangles are exactly the same shape and size (congruent) and have angles 90°, 45° and 45°.
The triangles are isosceles.
The square has rotational symmetry and 4 lines of reflection symmetry (mirror lines).



By drawing a line like the dotted line in the diagram (a line of reflective symmetry or mirror line) we see that **SQUARE 2** can be split into 4 triangles of the same shape and size. So square 2 is split into 3 triangles having areas ½ , ¼ and ¼ . The diagram has only one line of symmetry and no rotational symmetry. The smaller triangles are right angled and the larger triangle is isosceles.

SQUARE 3 is split into 8 triangles and one rectangle. The rectangle has area $^1/_8$ and the 6 smaller triangles have area $^1/_{16}$. The two larger triangles have area ¼.

The 6 small triangles are similar to the the 2 larger triangles with linear scale factor 2 and area scale factor 4. Learners might even see parallelograms and trapeziums in this diagram.

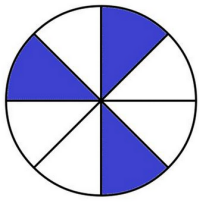
Diagnostic Assessment for 11year olds and older.
For younger learners just ask what fractions they see in the diagram.

This should take about 5 minutes.
Show your learners the diagram. For younger learners see the Suggestions for homelearning section.
For older learners ask the question below and say:

"Put up 1 finger if you choose answer A, 2 fingers for B, 3 fingers for C and 4 fingers for D".

1. Ask the learners to explain why they gave their answers and DO NOT say whether it is right or wrong but simply thank them for giving the answer.
2. Ask them **again** to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.

The white sections have a combined area of 1.5m²
What is the area of the blue sections?



A 0.9m² B 2.4m² C 0.3m² D 12m²

Common Misconceptions
Learners will often just guess so it is important to make them give a reason for their choice.

Correct answer A:
The disc is split into eighths.
Three eighths are blue and 5 eighths white.
There are 5 white sections and they make up an area of 1.5 m². Divide that area by 5 to find the area of one section, that is 0.3m².

The area of the 3 blue sections combined is 0.9m²
Learners who give the answer **C** have given the area of one section.
B. Here the learner has not understood the question and has given the area of the whole disc.
D. This answer is a completely different order of magnitude and shows a complete lack of understanding. Probably the learner worked out 8 × 1.5 https://diagnosticquestions.com

Why do this activity?

This activity challenges learners to think mathematically and to relate their ideas about number and fractions to ideas about shapes and area. In this way it shows links between different mathematical concepts. It is a good activity for group discussion and learners should be encouraged to see different aspects of these diagrams.

Learning objectives

In doing this activity students will have an opportunity to:

- practise visualizing fractions geometrically as parts of a whole;
- to relate tractions and areas to the geometry of triangles and symmetry.

Generic competences

In doing this activity students will have an opportunity to **visualize** and develop the skill of interpreting and creating visual images to represent concepts.

Suggestions for homelearning

Start with the Diagnostic Quiz but only use the full quiz about area for 10/11 year olds and above.
For younger learners use the same diagram and ask the questions:
What is the smallest fraction in this picture?
What fraction of the disc is coloured blue?
What fraction of the disc is white?

Use this activity as a basis for discussion. First get the learners to draw the shapes and cut them up or, for younger learners, give them the squares to cut up for themselves or, if necessary cut them up for them. The learners should take the squares one at a time, put the pieces together like a jigsaw, and compare the pieces to see similarities and differences between the bits. Ask the key questions about each square.

The ideas involved make this a valuable exercise. You don't need to mention words or concepts that have not yet been introduced as part of the curriculum. If the learners have not met words like 'congruent' or 'similar' before they might say 'those triangles are the same shape and size' instead of saying they are congruent. They may say 'they are the same shape but bigger or smaller' rather than saying they are similar. If they have not met the word 'isosceles' which means that the triangle has two equal edges and two equal angles, then you might ask 'how could you fold the triangle in half?'

Key Questions

Taking one square at a time:

- What do you see in the diagram?
- What can you say about the shapes?
- What are the areas?
- What other properties can you see?
- Anything else?

Follow up

Fractions by Halves https://aiminghigh.aimssec.ac.za/years-5-6-fractions-by-halves/

Fractions by Thirds https://aiminghigh.aimssec.ac.za/years-4-7-fractions-by-thirds/

Tangram Fractions https://aiminghigh.aimssec.ac.za/years-6-10-tangram-fractions/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa. New material will be added for Secondary 6. The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is beyond the school curriculum for Grade 12 SA.
For resources for teaching A level mathematics see https://nrich.maths.org/12339

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6