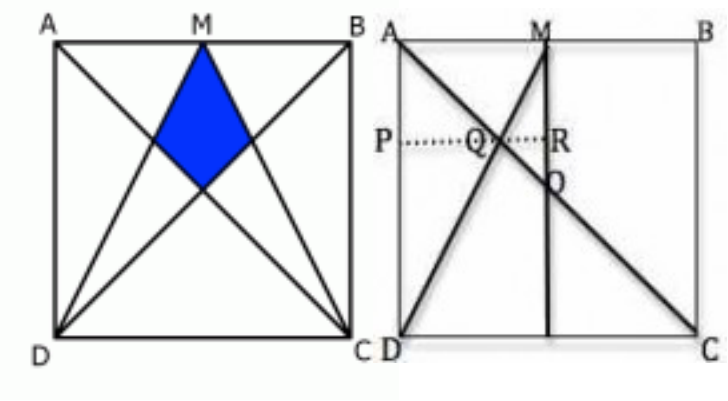
KITE IN A SQUARE

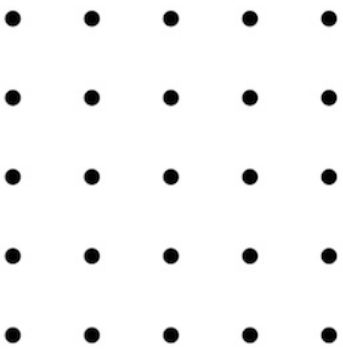


ABCD is a square with edge 1 unit. AM=MB and O is the centre of the square.

Find the area of the kite.

Can you do this by more than one different method?

HELP

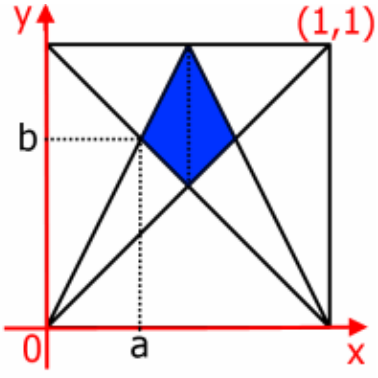


Start by drawing the square for yourself on dotty paper.

What do you notice about triangles ADQ and MQO?

What can you find out about the lengths PQ and QR?

NEXT



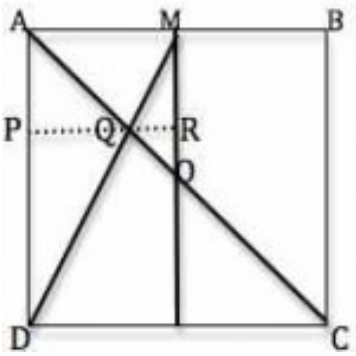
This diagram might suggest another method. Can you find the area of the kite by two different methods?

Can you find the areas of the other triangles in the diagram?

NOTES FOR TEACHERS

SOLUTION

BY SIMILAR TRIANGLES

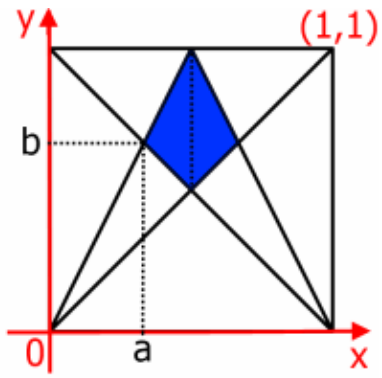


Triangles ADQ and QOM are similar because ∠ADQ=∠QMO (alternate angles AD//MO) and ∠DAQ=∠QOM (alternate angles AD//MO).

So PQ = 2QR, that is PQ = $\frac{1}{3}$ and QR = $\frac{1}{6}$.

Area ΔQOM = $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{6} = \frac{1}{24}$ and AREA of KITE = $\frac{1}{12}$.

BY COORDINATES



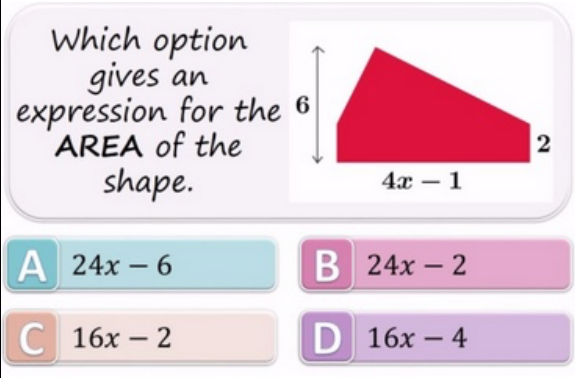
The point (a, b) is the intersection of the lines y = 2x and y = 1 – x so a = ⅓ and b = ⅔.

The kite is made up of two congruent triangles.
One triangle has vertices (½, ½); (½, 1), (⅓, ⅔)
perpendicular height $\frac{1}{6}$ and area $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{6} = \frac{1}{24}$

AREA of KITE = = $\frac{1}{12}$.

Diagnostic Assessment This should take about 5–10 minutes.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".



2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. It is important for learners to explain the reason for their answer as it helps them to clarify their own ideas and develop their communication skills.
4. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
5. **Ask the class 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 concept of area is needed for the lesson to follow, so explain the right answer or give a remedial task.
The correct answer is **D.** Area rectangle + Area triangle
= $2(4x - 1)$ + ½×$4(4x - 1)$ = $4(4x - 1) = 16x - 4$

A. This is the area of the 'box' enclosing the red shape.
B. and C. Students giving these answers seem to have multiplied the given dimensions randomly without any understanding of area.

https://diagnosticquestions.com

Why do this activity?

This activity is simpler than it looks and it gives learners the experience of using what they know about similar triangles to solve a problem involving area.

Learning objectives

In doing this activity students will have an opportunity to solve a geometric problem involving unknown sides and angles in triangles and quadrilaterals, using known properties of triangles and quadrilaterals, as well as properties of congruent and similar triangles.

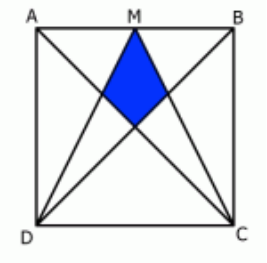
Generic competences

In doing this activity students will have an opportunity to:

- think mathematically, reason logically and give explanations and proofs;
- visualize - develop the skill of interpreting and creating visual images to represent concepts and situations;
- interpret and solve problems.

Suggestions for Teaching

Start with the Diagnostic Quiz and find out if your learners can work out the area of a compound shape by splitting it into a rectangle and a triangle and finding those areas.



Show the first image from the problem and ask learners what they notice about it. Discuss the symmetries in the figure. Then say to the class: "ABCD is a square with edge 1 unit. M is the midpoint of AB. Work out the area of the kite which is shaded in the diagram."

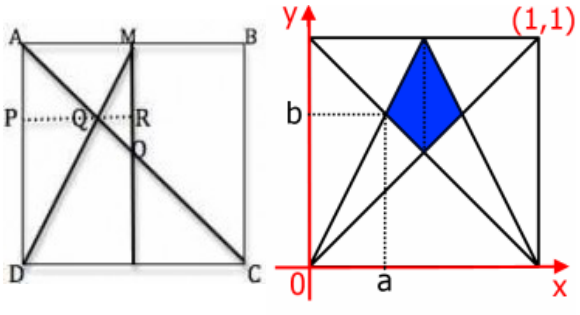
Give out the question on page 1 or write it up on the board.

You could use the **1 – 2 – 4 – More** strategy. Ask learners to work by themselves for about 5 – 10 minutes. Then ask them to work in twos (pairs) and compare their methods and answers. Did they get the same answer?

Give learners some time to have a go at the problem. While they are working, circulate and see the methods they are trying. Use the key questions to guide their thinking.

If learners struggle to get started you might give them the HELP slip. If some groups finish ahead of the others, give them the NEXT slip from page 1.

After some time ask pairs to form groups of 4 and to compare their methods and answers again.



Have a class discussion about the solution getting learners to explain their work.

If everyone has used the same method draw these 2 diagrams on the board and suggest that the diagrams give them a hint about a second method. Let them work on a second method. Which method do they prefer?

Key questions

For Similar Figures method:	For Coordinates method:
• which angles are the same? • which triangles are similar? • which triangles are congruent? • can you find the lengths PQ and QR? • what lengths do we know?	• what are the equations of the lines? • where do they intersect?

Follow-up ideas

Kissing Triangles https://aiminghigh.aimssec.ac.za/years-9-11-kissing-triangles/
Why the same https://aiminghigh.aimssec.ac.za/years-11-12-why-the-same/
Square Hole https://aiminghigh.aimssec.ac.za/years-11-12-square-hole/
Wedge on Wedge https://aiminghigh.aimssec.ac.za/years-10-11-wedge-on-wedge/

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. For resources for teaching A level mathematics see https://nrich.maths.org/12339
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **beyond** the school curriculum for Grade 12 SA.

	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**