

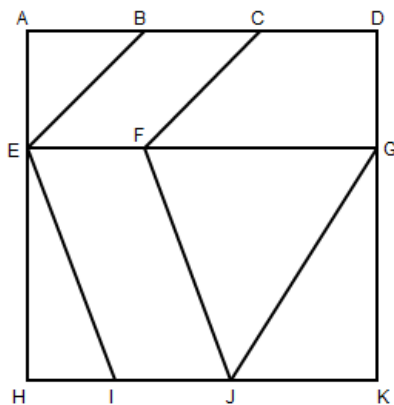
AREA OF 2D SHAPES

Can you find the side lengths of the different shapes?

Justify your answers.

The area of JGK is 20 cm^2 .

Can you find the area of every other shape?



- ADHK is a square, length 12 cm
- $AB = BC = CD = AE$
- BE is parallel to CF
- EI is parallel to FJ
- GE is parallel to AD

HELP

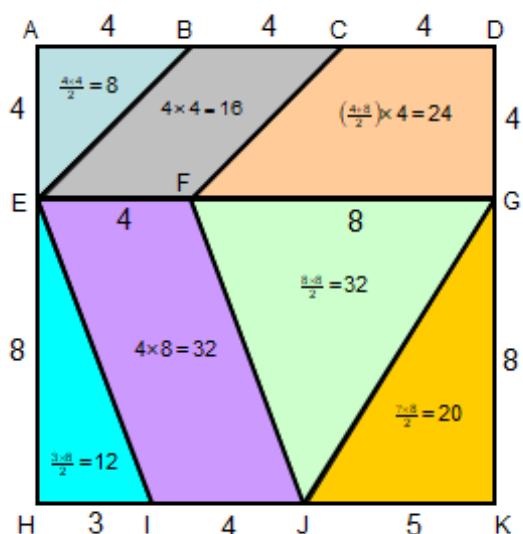
1. Use the information given in the bullet points in the question to get you started.
2. Fill in as many side lengths as you can, using the information given.
3. Identify the shapes within the square from the information given.
4. You should know how to calculate the area of each of these individual shapes.
5. If you have forgotten consult your textbook or check on the internet.
6. Make sure you have used all of the information you have been given in the question.

NEXT

When you have found a missing length, justify how you did this using the properties of the shape. It is not enough just to give the missing length. You must say how you know this is the missing length using the properties of the shape.

NOTES FOR TEACHERS

SOLUTION



AD = 12 cm and AB = BC = CD = AE

Therefore AB, BC, CD and AE equal 4 cm.

AD = AH since ADHK is a square, length 12 cm

AH = AE + EH therefore EH equals 8 cm, since AE equals 4 cm

AD = EG and are parallel and AE = DG and are parallel

Therefore ADEG is a rectangle. DG = 4 cm since AE is 4 cm.

EH = GK

EH = 8 cm therefore GK = 8 cm since ADHK is a square.

BE is parallel to CF and BC is parallel to EF.

Therefore BCEF is a parallelogram.

Since BC = 4 cm then EF = 4 cm.

FG = 8 cm, properties of rectangle ADGE.

EI is parallel to FJ (given) and EF is parallel to IJ (properties of rectangle EGHK).

Therefore IJ = 4 cm (properties of parallelogram).

The area of JGK is 20 cm².

Therefore JK = 5 cm ($\frac{1}{2}(\text{base}) \times \text{perpendicular height}$)

Area of triangle = $\frac{1}{2}(\text{base} \times \text{perpendicular height})$

Therefore area of triangle ABE = 8 cm²,

area of triangle EHI = 12 cm², area of triangle FGJ = 32 cm² and area of JGK = 20 cm² (Given)

Area of parallelogram = base \times perpendicular height

Therefore area of parallelogram BCEF = 16 cm² and area of parallelogram EFIJ = 32 cm²

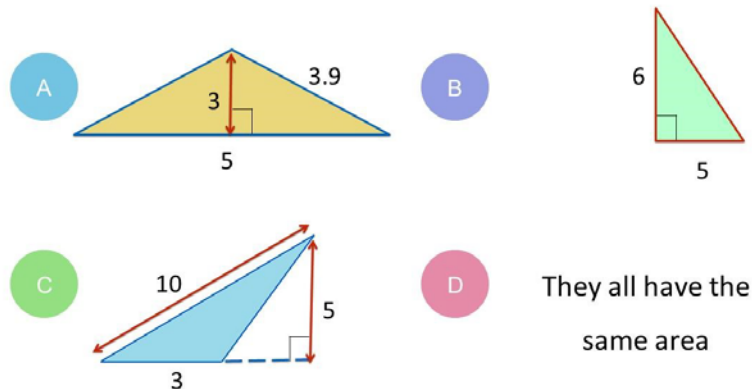
Area of trapezium = $(\frac{1}{2} (a + b) \times \text{perpendicular height})$ where a and b are parallel sides.

Therefore area of trapezium CDFG = 24 cm²

Diagnostic Assessment This should take about 5–10 minutes.

- 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”.
- 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.
- 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.
- 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.** It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.
- If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

Which of the following triangles does **not** have the same area as the others?



$$\begin{aligned}\text{Area of triangle A} &= \frac{1}{2} \times \text{base} \times \text{perpendicular height} \\ &= \frac{1}{2} \times 5 \times 3 \\ &= 7,5 \text{ cm}^2\end{aligned}$$

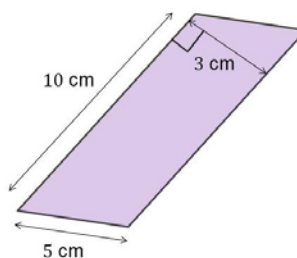
$$\begin{aligned}\text{Area of triangle B} &= \frac{1}{2} \times \text{base} \times \text{perpendicular height} \\ &= \frac{1}{2} \times 5 \times 6 \\ &= 15 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of triangle C} &= \frac{1}{2} \times \text{base} \times \text{perpendicular height} \\ &= \frac{1}{2} \times 3 \times 5 \\ &= 7,5 \text{ cm}^2\end{aligned}$$

Answer Triangle B does not have the same area as the others.

Possible misconceptions; using the length of the side opposite the right angle instead of the perpendicular height.

What is the area of the parallelogram?



- ☐ A 150 cm²
☐ B 50 cm²
☐ C 30 cm²
☐ D 15 cm²

$$\begin{aligned}\text{Area of parallelogram} &= \text{base} \times \text{perpendicular height} \\ &= 10 \times 3 \\ &= 30 \text{ cm}^2\end{aligned}$$

C is the correct answer.

Possible misconceptions

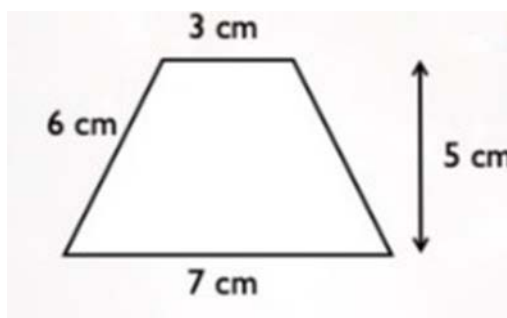
Answer A; multiplying the three lengths together.

Does not understand how to calculate the area of a parallelogram.

Answer B; multiplying by 5 cm instead of the perpendicular height

Answer D; Doesn't understand what is meant by the base of the parallelogram.

What is the area of the trapezium below?



- a) 60 cm² b) 21 cm² c) 630 cm² d) 25 cm²

$$\begin{aligned}\text{Area of trapezium} &= \frac{1}{2}(a + b) \times \text{perpendicular height} \\ &= \frac{1}{2}(3 + 7) \times 5 \\ &= 25 \text{ cm}^2\end{aligned}$$

D is the correct answer.

Possible misconceptions

Answer A; multiplying by 6cm instead of 5 cm.

Doesn't understand what is meant by perpendicular height.

Answer B; has multiplied the two parallel sides.

Does not understand how to calculate the area of a trapezium

Answer C; has multiplied the lengths of the four sides.

Does not understand how to calculate the area of a trapezium.

<https://diagnosticquestions.com>

Why do this activity?

In doing this activity students will have an opportunity to use the properties of 2D shapes to find the missing lengths.

It also consolidates their knowledge of finding the area of a variety of 2D shapes to solve the problem.

They first have to use the properties of 2D shapes to fill in the missing lengths. They must justify their answers.

They must then use their prior knowledge on how to calculate the area of a triangle, parallelogram and trapezium to proceed with the question.

Finally they must read the question carefully to find the missing length JK.

Learning Objectives

- Recognition of two-dimensional shapes
- Calculating unknown lengths using information given
- Calculate the area of triangles, parallelograms and trapezium.
- Use the information given in the question to find the missing length.

Generic Competences

To think critically/mathematically
To reason logically
To work independently and be capable of lifelong learning
To collaborate/work in a team
To analyse, reason and communicate effectively
To communicate exchange, criticise, and present information and ideas
To apply knowledge and skills
To solve and interpret problems in a variety of situations
To search for, evaluate, select, organise, analyse, and interpret information.

Suggestions for teaching

Use the key questions below to help the learners attempt the question in a logical way. However give the learners time to think about the problem and come up with some suggestions themselves.
Take the lead from the learners and use the key questions to guide them in the correct direction.
Use the key questions as a method of checking the progress of the weaker learners.
Identify the areas of weakness and use more straight-forward examples to revise the key concepts.

Key questions

What two-dimensional shapes can you identify in the diagram?
Can you establish the missing lengths?
How will you justify your answers?
How do we calculate the area of a triangle, parallelogram and trapezium?
What information is provided in the question to get the length JK.

Follow up

<https://aiminghigh.aimssec.ac.za/wp-content/uploads/2019/08/Properties-of-Parallelograms.pdf>
https://aiminghigh.aimssec.ac.za/wp-content/uploads/2016/12/Quadrilaterals_Guidance.pdf
<https://aiminghigh.aimssec.ac.za/wp-content/uploads/2016/11/Teacher-Notes-RATTY.pdf>

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