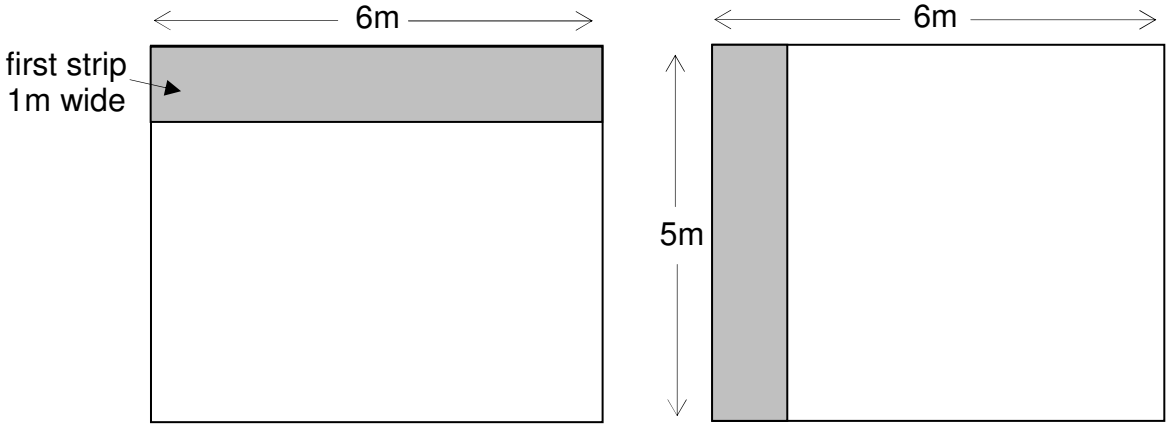
Area of a rectangle

Resources required:
3 coloured pencils per student.

These two men are laying turf in strips that are one metre wide.

The men need to turf two identical lawns with strips of turf 1m wide. Each lawn is 6m long and 5m wide (as shown in the diagram below). 1cm on the diagram is equivalent to 1m in real life.

They turf the first lawn by laying strips 6m long.
Draw these strips on the diagram. How many are needed? .....
What length of turf is needed altogether for this lawn? .....



They turf the second lawn by laying strips 5m long.
Draw these strips on the diagram. How many are needed? .....
What length of turf is needed altogether for this lawn? .....

Why is the same length of turf required no matter which way they decide to lay it? .....

If a rectangle is **b** units long and **h** units wide, what is its area (**A**)?

Area of a rectangle **A** = ...

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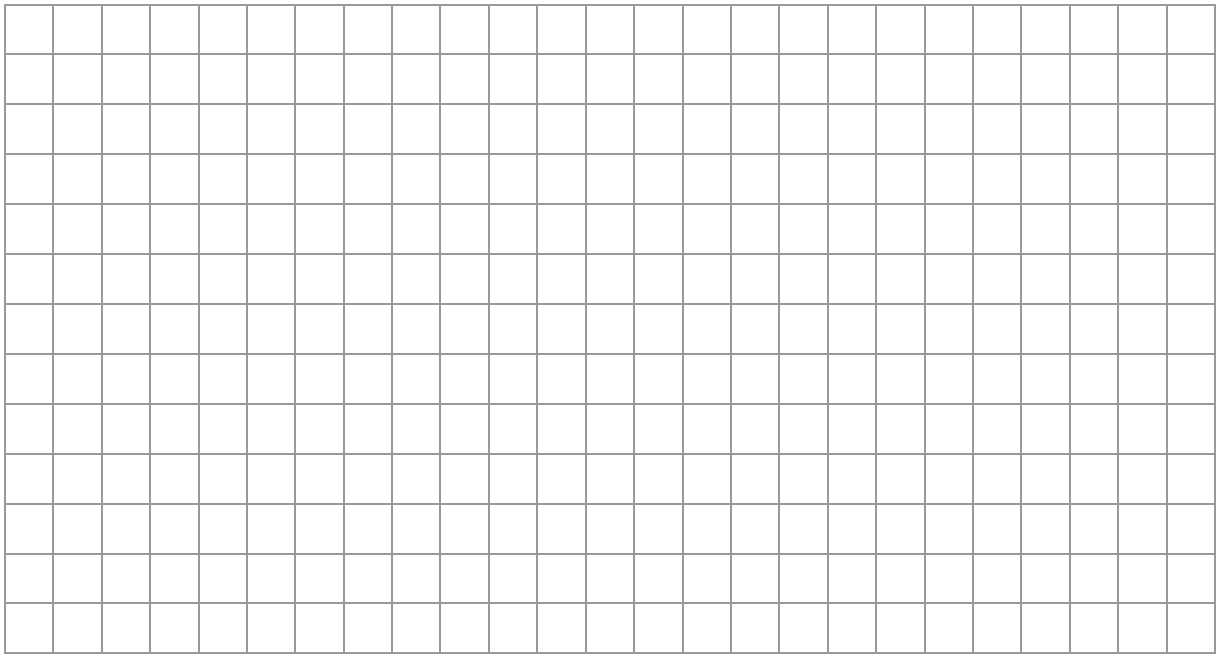
Why do the length and width of a rectangle need to be in the same units to calculate its area? .....

.....

The grid below has squares with sides 1 unit long.
With a pencil, draw along grid lines to make 6 rectangles that each have an area of 12 square units.
Give each rectangle a different base length.



Do all rectangles with the same area have the same perimeter? .....

If two of your rectangles have the same shape, colour them with the same colour.
Colour rectangles with different shapes, different colours.

List all the different side lengths of your rectangles.

.....

These side lengths should all be factors of 12. Why? .....

.....

If you know the area of a rectangle (**A**) and its length (**b**), how can you work out its width (**h**)? .....

If you know the area of a rectangle (**A**) and its width (**h**), how can you work out its length (**b**)? .....

If a rectangle has an area of 36 square units and one side is 9 units long,

- what is the length of the perpendicular side? .....
- what is the perimeter of the rectangle? .....

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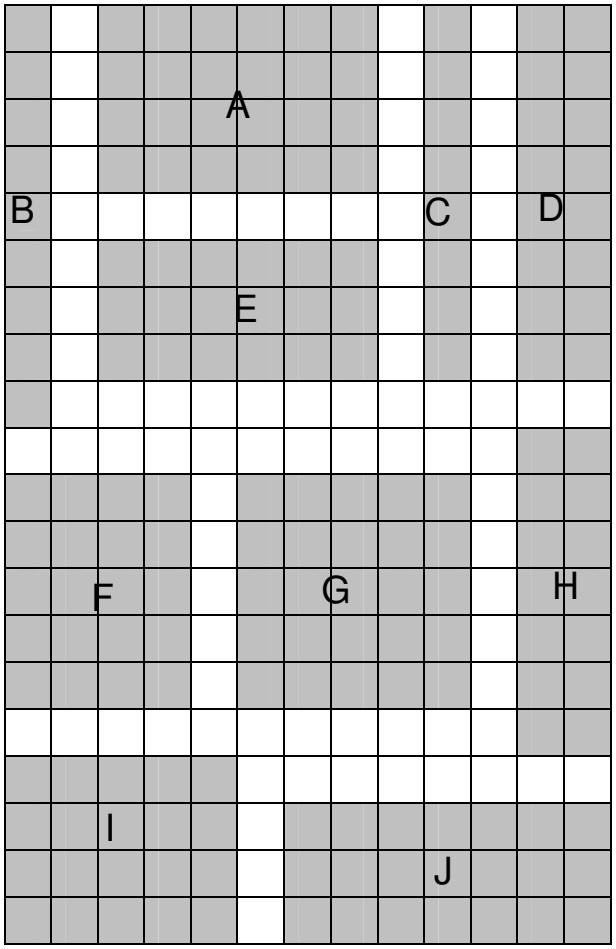
Perimeter of a rectangle

The grid below has squares with sides 1 unit long.
10 rectangles (A to J) are shaded on the grid and listed in the table.
For each rectangle, write the length of its base (**b**) and its height (**h**).
Add the base and height (**b** + **h**), then calculate the perimeter (**P**) of each rectangle.



Rectangle	b	h	b + h	P
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				

Do all rectangles with the same perimeter have the same area? .....

Which rectangles on the grid have the same perimeter and the same area? .....

These rectangles are congruent (ie. they have the same shape and size).

If you know the perimeter (**P**) of a rectangle, how can you work out the sum of its base and height (**b + h**)? .....

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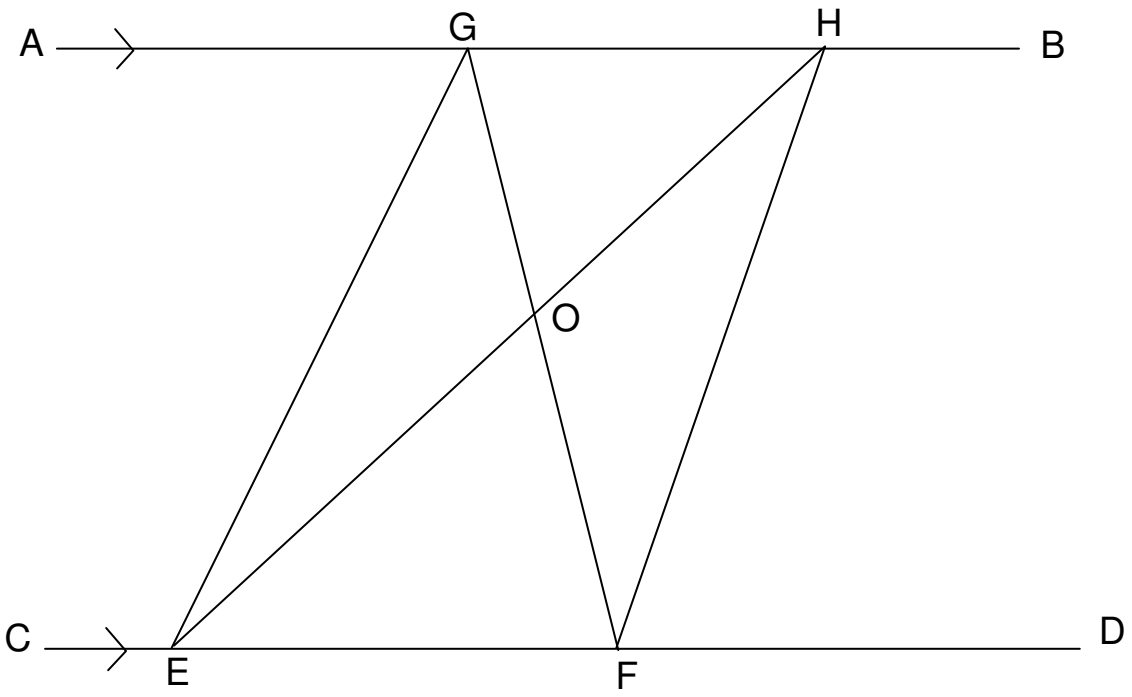
The same area

Resources required:
2 coloured pencils per student - one yellow and one blue
a set square per student.

In the drawing below, AB || CD (ie. AB is parallel to CD).
Draw an altitude of ΔEFG through G.
Draw an altitude of ΔEFH through H.



ΔEFG and ΔEFH have a base in common.
Name this base .....

Without measuring, how do you know that ΔEFG has the same area as ΔEFH? .....

.....

Lightly colour ΔEFG blue and ΔEFH yellow.
The triangles overlap.
Name the area coloured both blue and yellow: .....

Why is the area of ΔEOG the same as the area of ΔFHO? .....

.....

.....

On the same diagram above, draw a ΔGIH that has the same area as ΔGFH.
(Hint: Choose I to be a point on the line CD.)

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Dividing a triangle

Resources required:
a calculator per student.

On the base BC, draw a triangle ABC.

B C

The **midpoint** of a line is the point at the middle of the line.
Find the midpoint of the base BC and name it A'.
Draw the line AA'.
AA' is the median of ΔABC.

Median means "middle". A **median** of a triangle is a line joining a vertex with the midpoint of the opposite side.

Why is area of ΔABA' the same as the area of ΔAA'C? .....

.....

Draw the other two medians of ΔABC and label them BB' and CC'.
What did you find out about the medians of a triangle? .....

.....

Join the points A', B' and C' to make ΔA'B'C'.
Does ΔA'B'C' appear to have the same shape as ΔABC? .....

Measure lengths to calculate the following ratios (to the nearest integer):

$$\frac{\text{perimeter of } \Delta ABC}{\text{perimeter of } \Delta A'B'C'} = \frac{\qquad}{\qquad} = \text{.....}$$

$$\frac{\text{area of } \Delta ABC}{\text{area of } \Delta A'B'C'} = \frac{\qquad}{\qquad} = \text{.....}$$

How many times longer is the perimeter of ΔABC? .....
How many times larger is the area of ΔABC? .....

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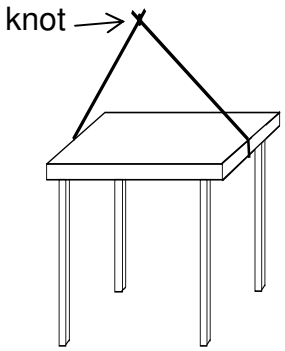
The maximum area

Resources required

Each pair of students needs:
a piece of string about 2.5 times the width of a desk
a protractor
a calculator.



Tie a piece of string around the width of your desk as shown, with the knot at the top.

The aim of this activity is to find the maximum area of a triangle that has the desk as its base, the knot as its apex, and string for the remaining two sides.

Person 1

Hold the knot above the desk to make a triangle with string and desktop.
Move the knot from side to side above the desk, keeping the triangle perpendicular to the desk (as seen from your seat).
Try to find the maximum height of the triangle (measured by Person 2).
Copy the measurements recorded by Person 2 into your table below.

Person 2

Measure the height of triangles made by your partner.
When you have found the triangle with the greatest height, record its measurements (to the nearest centimetre) in the table below.

Measurement	Reading (cm)
Perpendicular height (from the knot to the desk)	
Left hand side (string from the desk to the knot)	
Right hand side (string from the desk to the knot)	
Base (width of the desk)	

As you moved the knot, did the perimeter of the triangle change? .....

Why does the triangle with the greatest height have the greatest area?

.....

.....

Calculate the area of this triangle.

.....

.....

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What did you notice about the side lengths of the triangle with the greatest area? .....

What type of triangle is it? .....

A triangle has a perimeter of 18cm. If its base is 8cm, what side lengths will give this triangle the greatest area? .....
Write your answer in the top row of the table below.

Perimeter (cm)	Base (cm)	Side (cm)	Side (cm)
18	8		
18	6		
18	4		

Calculate the side lengths that give the maximum area when the base is 6cm, and then when the base is 4cm. Write your answers in the table.

Draw these triangles on the bases below, using a pair of compasses opened to the required side length to mark the apex.
Label the sides with their lengths.

8 cm

4 cm

6 cm

Measure and label the altitude of each triangle.
Find the triangle with the maximum area.
What length are the sides of this triangle? ....., ... and .....
What type of triangle is it? .....

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Finding the volume of a playing card

Resources required

Each pair of students needs:
a pack of playing cards
a calculator.

Take your cards out of their box.
How many cards are there? .....

Square up the deck.

With a ruler, measure the length and width of the cards and the perpendicular height of the deck.
To make calculations easier, approximate the shape of a card to a rectangle.

Make your measurements to the nearest mm.

Length: .....
Width: .....
Perpendicular height: .....

Calculate the volume of the deck.

Calculate the volume of one card.

Make your deck slant to one side.
Has the volume of the deck changed? .....
How do you know? .....
.....

Has the perpendicular height of the deck changed? .....

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