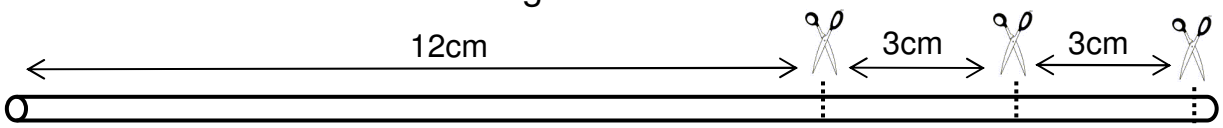
Exploring triangles

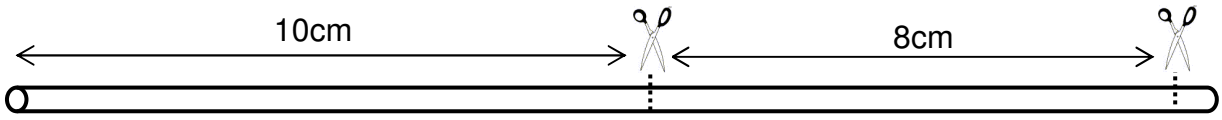
Resources required:

Each pair students will need:
1 container (eg. a rectangular plastic takeaway container)
5 long pipe cleaners (at least 30cm long)
8 plastic drinking straws (at least 18cm long and with no bend)
2 pairs of scissors.

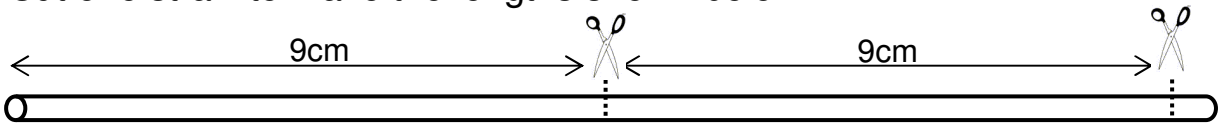
Cut one straw to make the lengths shown below.



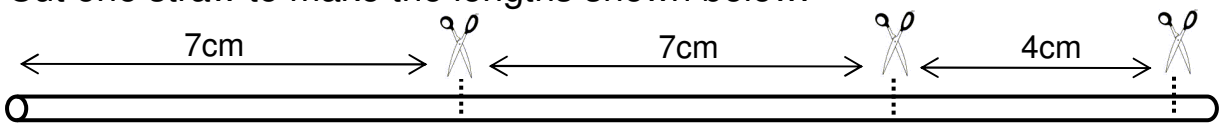
Cut each of three straws to make the lengths shown below.



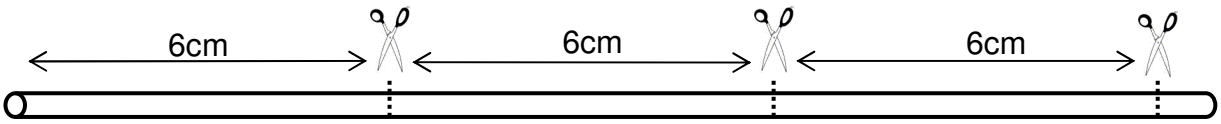
Cut one straw to make the lengths shown below.



Cut one straw to make the lengths shown below.



Cut each of two straws to make the lengths shown below.



Your group should now have:

one 12cm straw	two 7cm straws
three 10cm straws	six 6cm straws
two 9cm straws	one 4cm straw
three 8cm straws	two 3cm straws

Keep these lengths of straws in your container.
You will be using them and your pipe cleaners in other activities.

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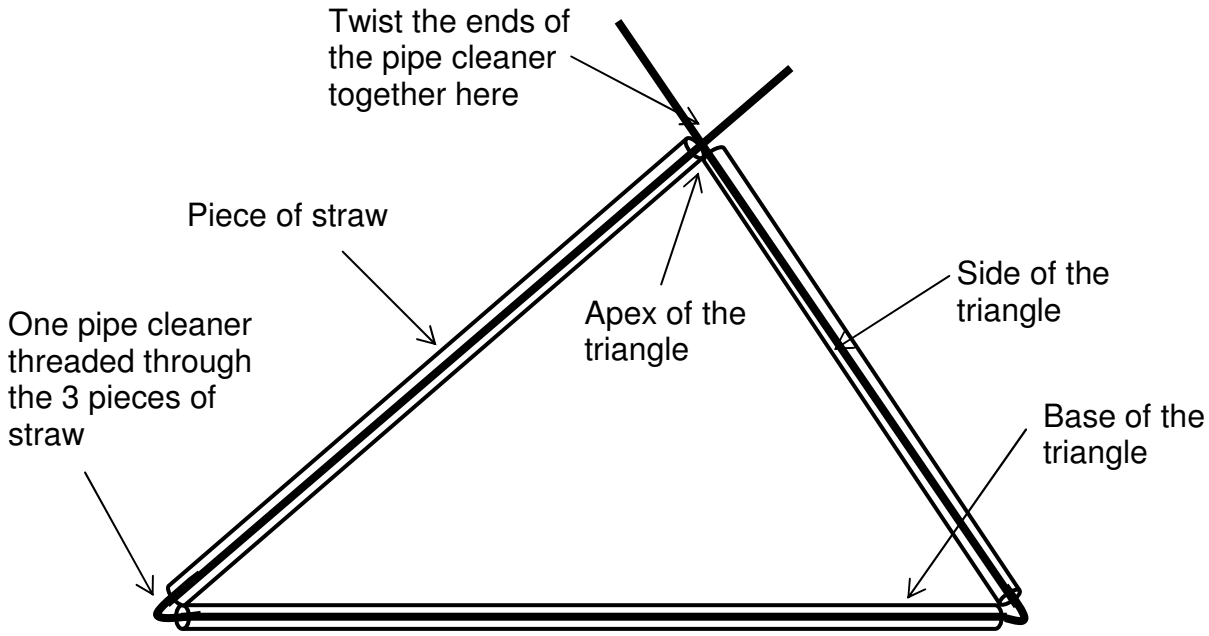
Thread any 3 pieces of straw onto one of your pipe cleaners.

Make a triangle by bending the pipe cleaner where the straw pieces meet each other.

Twist the ends of the pipe cleaner together as shown below.
The position of the twist should make the ends of the straw pieces just touch each other.
(Do not make the twist so tight that the straw pieces bend).



Thread 4 pieces of straw onto one of your pipe cleaners.
Make a quadrilateral by bending the pipe cleaner and twisting the ends together as before.

Thread 5 pieces of straw onto one of your pipe cleaners.
Make a pentagon by bending the pipe cleaner and twisting the ends together as before.

Try to change the angles of each of your polygons.
Do not bend the sides.

Can you change the shape of your pentagon? .....
Can you change the shape of your quadrilateral? .....
Can you change the shape of your triangle? .....

What is different about triangles?

.....

.....

.....

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Types of triangles

Resources required:
Each pair of students will need:
the container of straw pieces cut in Activity 2 - 4
5 long pipe cleaners (at least 30cm long)
a protractor.

Triangles are described by the relative lengths of their sides:

A **scalene triangle** - all sides are a different length
An **isosceles triangle** - at least 2 sides are equal in length
An **equilateral triangle** - all 3 sides are equal in length.

With a pipe cleaner and straw pieces, make each of the 5 triangles listed in the table and write down its type (scalene, isosceles or equilateral).

Use your protractor to measure each interior angle.
Write these measurements (to the nearest 5°) in the table.

Side (cm)	Base (cm)	Side (cm)	Type of triangle	Sizes of the 3 angles (degrees)
8	6	10		
6	9	6		
6	6	6		
4	10	10		

A **right-angled triangle** has one angle that is a right angle.

One of the triangles you made is also a right-angled triangle.
What are the lengths of its sides? .....

What are the lengths of the sides of the equilateral triangle? .....
What are the sizes of its angles? .....
Do all equilateral triangles have these angle sizes? .....
Why or why not? .....

.....

What can you say about the angles of an isosceles triangle? .....

.....

Are all equilateral triangles also isosceles triangles? .....
Are all isosceles triangles also equilateral triangles? .....
If an isosceles triangle is turned so that it has a different base, is it still an isosceles triangle? .....

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The sides and angles of a triangle

Resources required:
Each pair of students will need:
the container of straw pieces cut in Activity 2 - 4
5 long pipe cleaners (at least 30cm long)
a protractor.

An **acute-angled triangle** has all its angles less than 90°.
An **obtuse-angled triangle** has one angle between 90° and 180°.

Use a pipe cleaner and straw pieces to make each of the 5 triangles listed in the table below. Each triangle has a perimeter of 24cm.

Measure the angles of each triangle to decide whether it is an acute-angled triangle or an obtuse-angled triangle, then complete the table.

Base (cm)	Side (cm)	Side (cm)	Type of isosceles triangle
4	10	10	acute-angled
6	9	9	
8	8	8	
10	7	7	
12	6	6	

What happens to the size of the apex angle as the length of the base increases? .....

What is the largest apex angle you can make? .....

What is the longest base you can make if the perimeter of the triangle is 24cm? .....

State one example of three side lengths that add to 24cm and do not make a triangle.

.....cm, ...cm and .....cm

Explain why the length of a side of a triangle can never be more than the sum of the lengths of the other two sides.

.....

.....

.....

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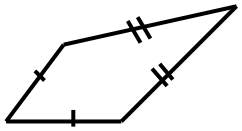
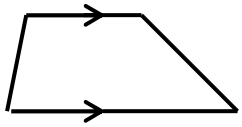
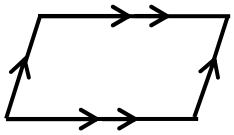
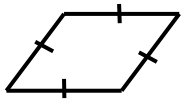
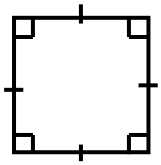
Special types of quadrilaterals

Resources required:
a set square per student.

A **quadrilateral** is a polygon with ..... angles and ..... sides.

Various types of quadrilaterals are defined:

- by whether they have opposite sides which are parallel, or
- by the relative lengths of their sides and/or
- by whether their angles are right angles.

Quadrilateral	Definition	Diagram
Kite	Two pairs of adjacent sides are equal	
Trapezium	At least one pair of opposite sides are parallel	
Parallelogram	Both pairs of opposite sides are parallel	
Rectangle	All angles are right angles	
Rhombus	All sides are equal	
Square	All angles are right angles and all sides are equal	

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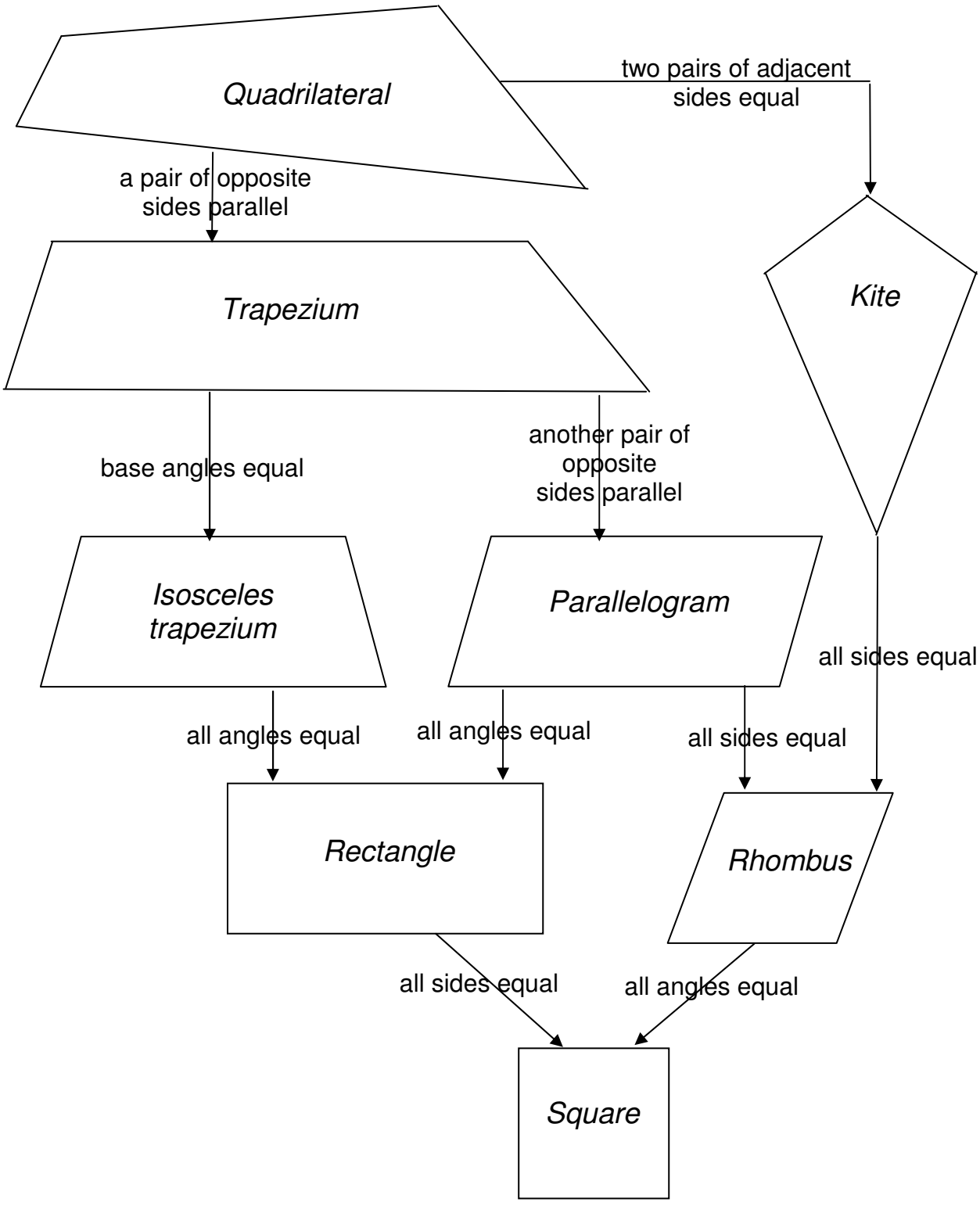
The diagram below is a **flow diagram**. Arrows are used to show how one type of quadrilateral flows to (i.e. leads to) the next.

The writing on each arrow tells you the additional property each type has.



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Use a set square to draw a square in the space below.

To draw perpendicular lines (ie. lines at right angles to each other):
1) Place the edge of your ruler along one line.
2) Find the two edges of your set square that make a right angle.
3) Place one edge of the right angle against the ruler.
4) Draw along the other edge of the right angle.

Look at the definition of a rectangle at the beginning of this activity.
Is a square a rectangle? .....
Why or why not?.....

.....

Look at the flow diagram on the previous page. With the downward flow of the arrows, the quadrilaterals become more specialised.

If two quadrilaterals in the diagram are linked by one or more arrows, the quadrilateral below is a special type of the one above it eg. an isosceles trapezium is a special type of trapezium.

With a partner, decide whether the following statements are true or false.

a) A parallelogram is a special type of trapezium .....

b) A square is a special type of rhombus .....

c) A rhombus is a special type of rectangle .....

d) A parallelogram is a special type of rectangle .....

e) A rhombus is a special type of kite .....

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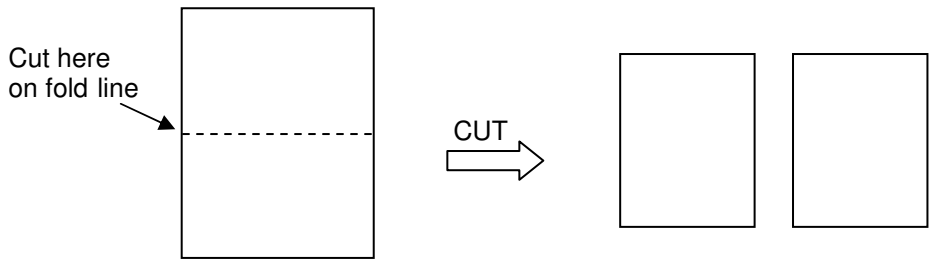
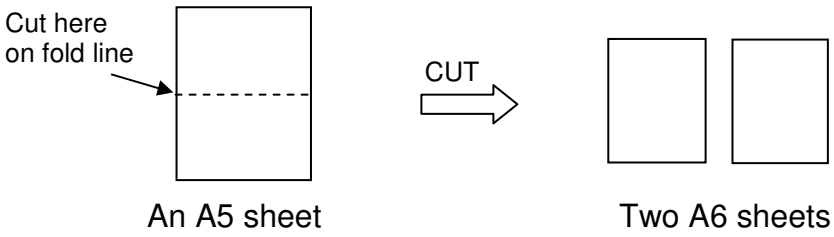
Investigating the shape of standard sheets of paper

Resources required:
2 sheets of A4 paper per student or per pair of students
a pair of scissors per student or per pair of students
a calculator per student or per pair of students.

Make two pieces of A5 paper by folding one piece of A4 paper in half and cutting it along the fold line as shown in the diagram below:



Now take one of the A5 sheets and cut it in half to make two A6 sheets.



Measure the width and length of the different sheets of paper to the nearest mm.
Complete the following table.

	A4 Paper	**A5 Paper**	**A6 Paper**
Length (cm)	29.7		
Width (cm)			
$\frac{\text{Length}}{\text{Width}}$			
$\frac{\text{Width}}{\text{Length}}$			

Are the A4, A5 and A6 sheets of paper similar to each other? .....
Why or why not? (Hint: remember corresponding angles and sides.)

.....

.....

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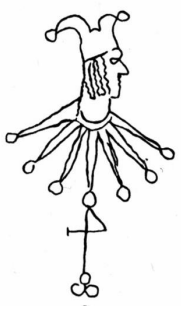
When comparing two sheets of paper to find out if they are similar, does it matter whether the ratio found for both sheets is length:width or width:length? .....



The most commonly used standard sheet of paper used to be foolscap.
This paper size became standard because it was used in the first printing press in the 15th century.
It was called "fool's cap" paper because the original paper of this size had the trademark of a court jester on it as a watermark.

Standard foolscap paper has a length of 33.7cm and a breadth of 20.6cm.

Imagine that you cut a foolscap paper in half in the same way that you cut the A4 paper in half.

- The <u>width</u> of the foolscap paper becomes the <u>length</u> of the "half foolscap paper".
- <u>Half the length</u> of the foolscap paper becomes the <u>width</u> of the "half foolscap paper".

This process is repeated to cut "half foolscap paper" into two pieces of "quarter foolscap paper".

Complete the following table.

	Foolscap paper	**Half foolscap paper**	**Quarter foolscap paper**
Length (cm)	33.7		
Width (cm)	20.6		
<u>Length</u> Width			

Are the foolscap, half foolscap and quarter foolscap sheets of paper all similar to each other? .....

Why or why not? .....

.....

.....

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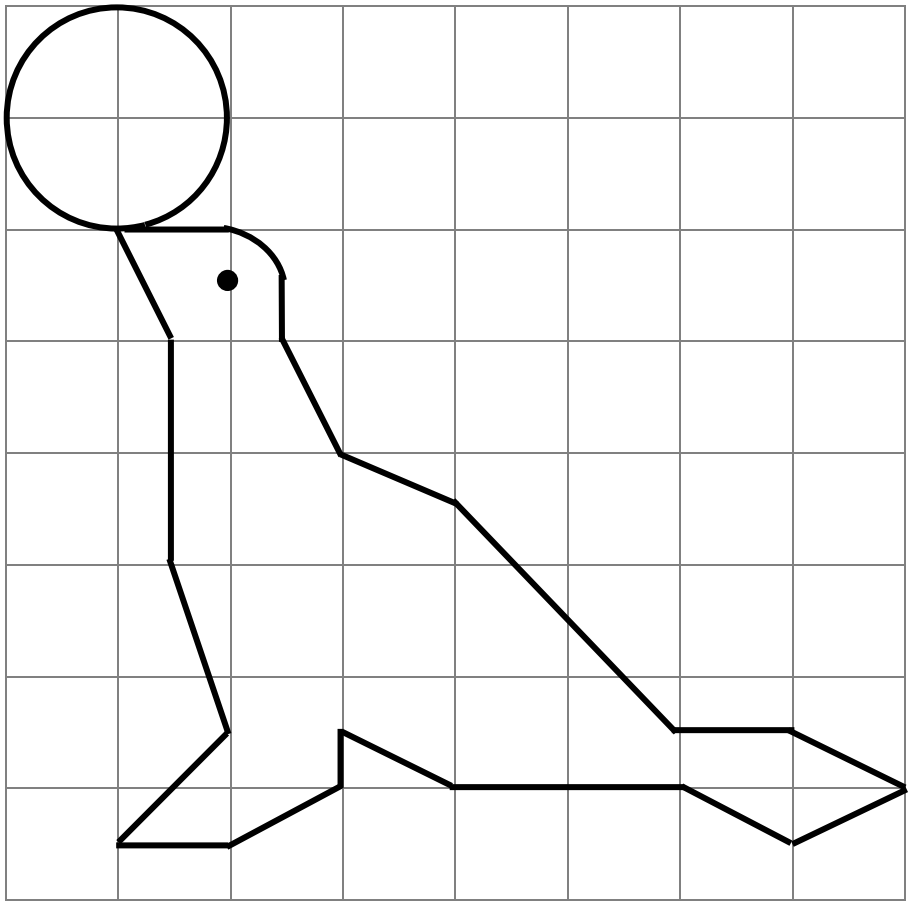
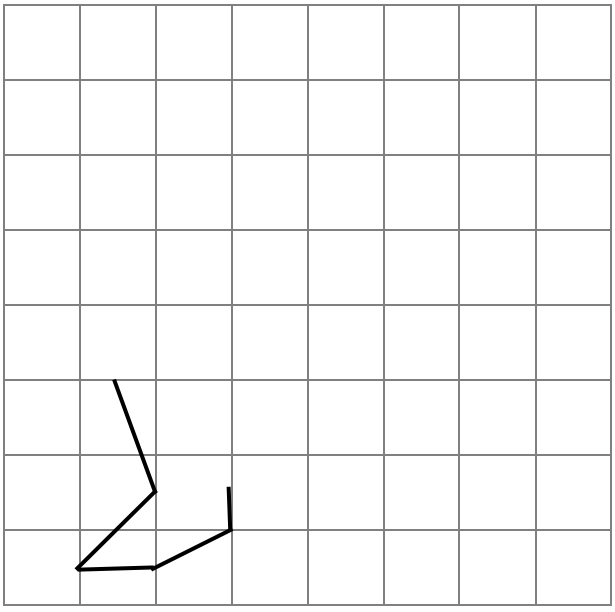
Enlargement and reduction using a grid

Resources required:
a protractor, a pair of compasses and a calculator per student.

With a pencil, copy this picture from the 1.5cm grid to the 1cm grid.
The flipper is already drawn for you on the 1cm grid.





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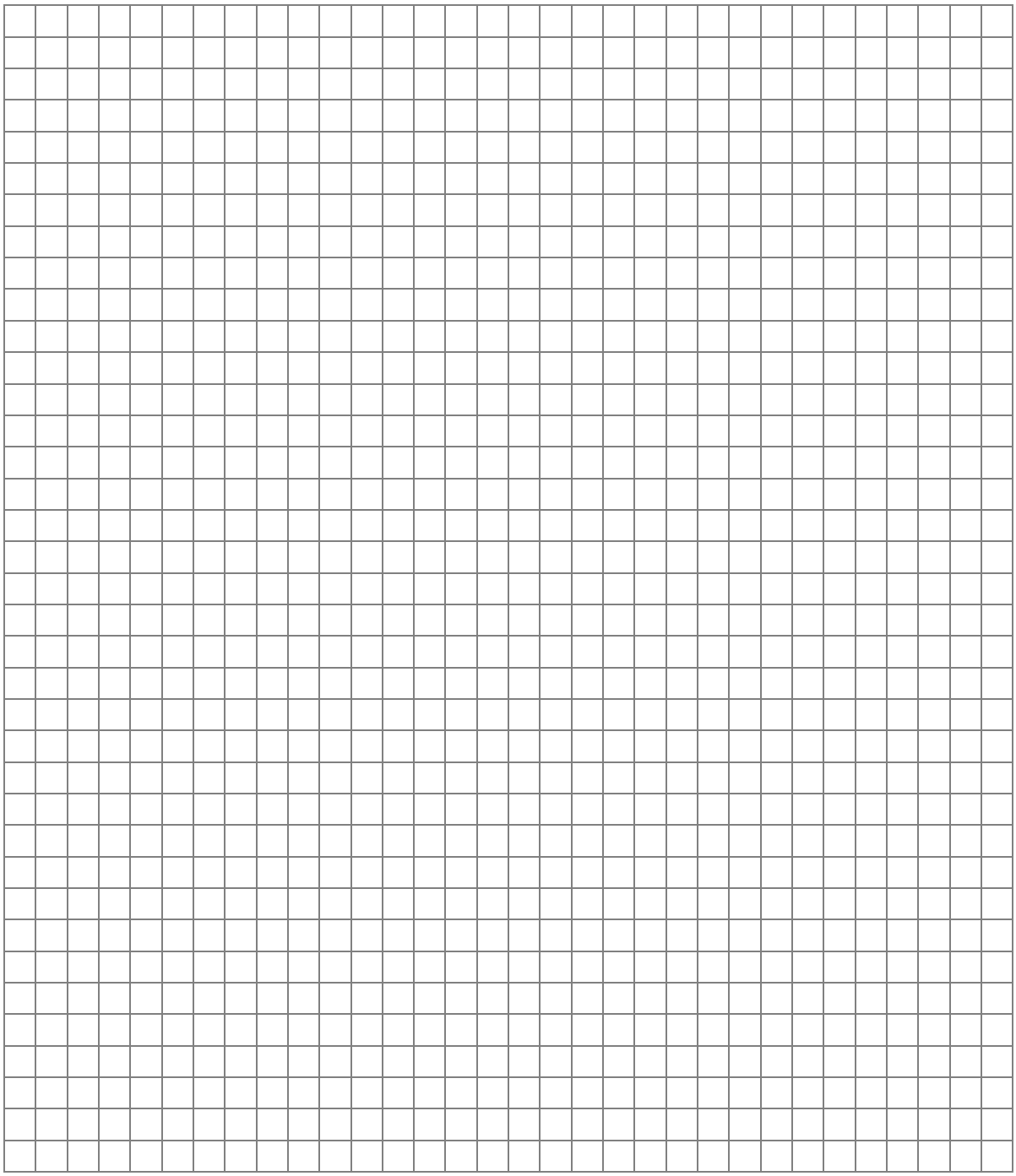
Make the largest possible copy of the performing seal (from the previous page) that fits within the grid below.

Use a pencil, a ruler and a pair of compasses to make your drawing.



If you wish, you may colour-in your picture.

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Compare the similarity of your pictures on the previous two pages by making the angle measurements listed below and filling in the table.

	in original picture	**in reduced picture**	**in enlarged picture**
Angle of the seal's nose			
Angle at the tip of the flipper			
Angle at the tip of the tail			

What can you say about angles in pictures when they are enlarged or reduced?.....

Compare the similarity of your pictures on the previous two pages by making the length measurements listed below and filling in the table.

	in original picture	**in reduced picture**	**in enlarged picture**
Length from the tip of the nose to the tip of the flipper			
Length from the tip of the nose to the tip of the tail			
Radius of the ball			

How would you determine the scale factor for a pair of circles?.....

.....

In the space below, calculate the scale factors you used to reduce the original picture and enlarge the original picture.
Use lengths in the table above to make your calculations.

The reduction factor

The enlargement factor

Would the scale factors be the same, no matter what part of the picture you decided to measure and compare?.....

Why or why not?.....

.....

.....

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