

# FREEDOM PAPER CITY MATHS

"In a world of transient communication and fleeting digital memories, paper offers texture and feeling, weight and sensation."

G.F. Smith

PAPER SHAPES  
(TRIANGLES, KITE & RHOMBUS) PAGE 3

QUADRILATERAL POSTER PAGE 17

PAPER MATHS PAGE 22

# PAPER CITY

Part of *Look Up*, this season, spaces in and around the Fruit Market will be transformed by this event, where leading artists and designers have been invited to play with the most fundamental creative material – paper.

Ten days celebrating colour and the freedom to play – installations by some of the most exciting creative minds from the worlds of contemporary art, design and architecture – using the specialist coloured paper, Colorplan, from Hull company G . F Smith.

We're inviting you to play with paper in your maths class, creating different shapes using our step-by-step guide before answering a series of paper maths problems.

The resources have been designed to be used either as a series of maths lessons or as a full morning's activity.



Photo © Andre J Fanthome

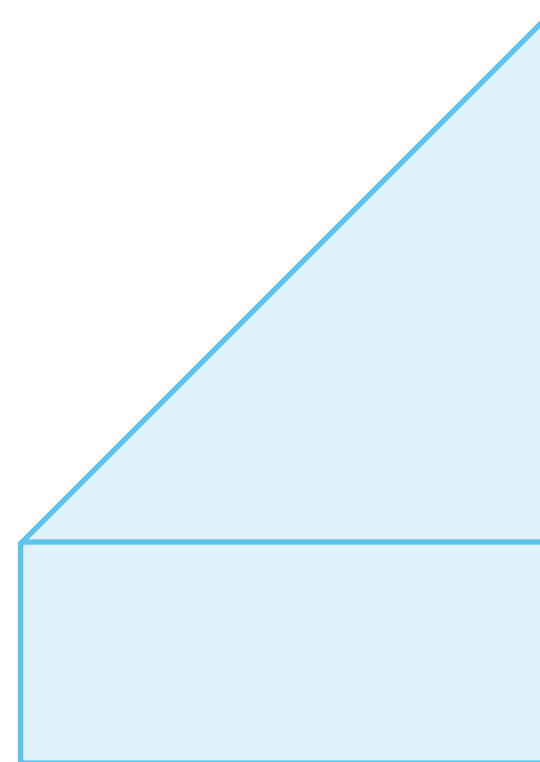
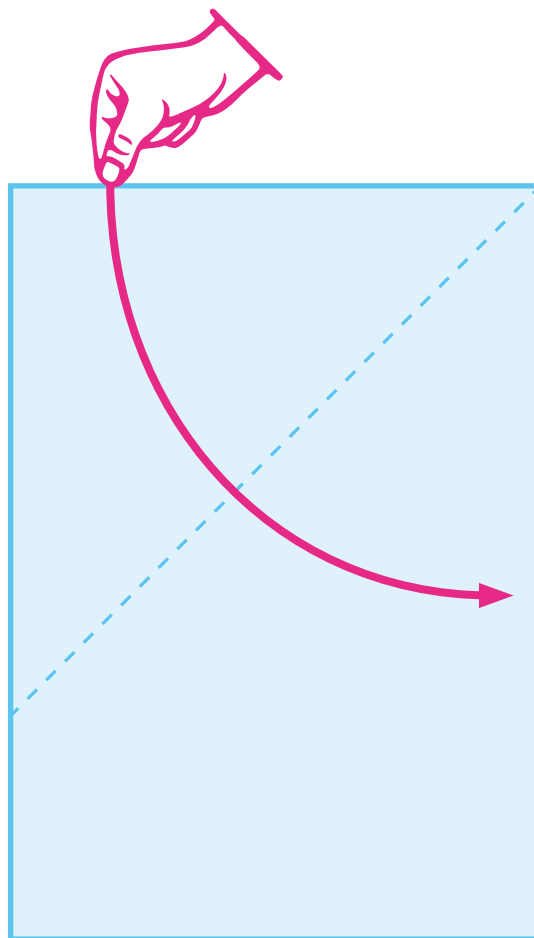
**WHAT YOU  
WILL NEED:**

**DIFFERENT  
COLOURED  
PAPER**

# ISOSCELES TRIANGLE

## STEP 1

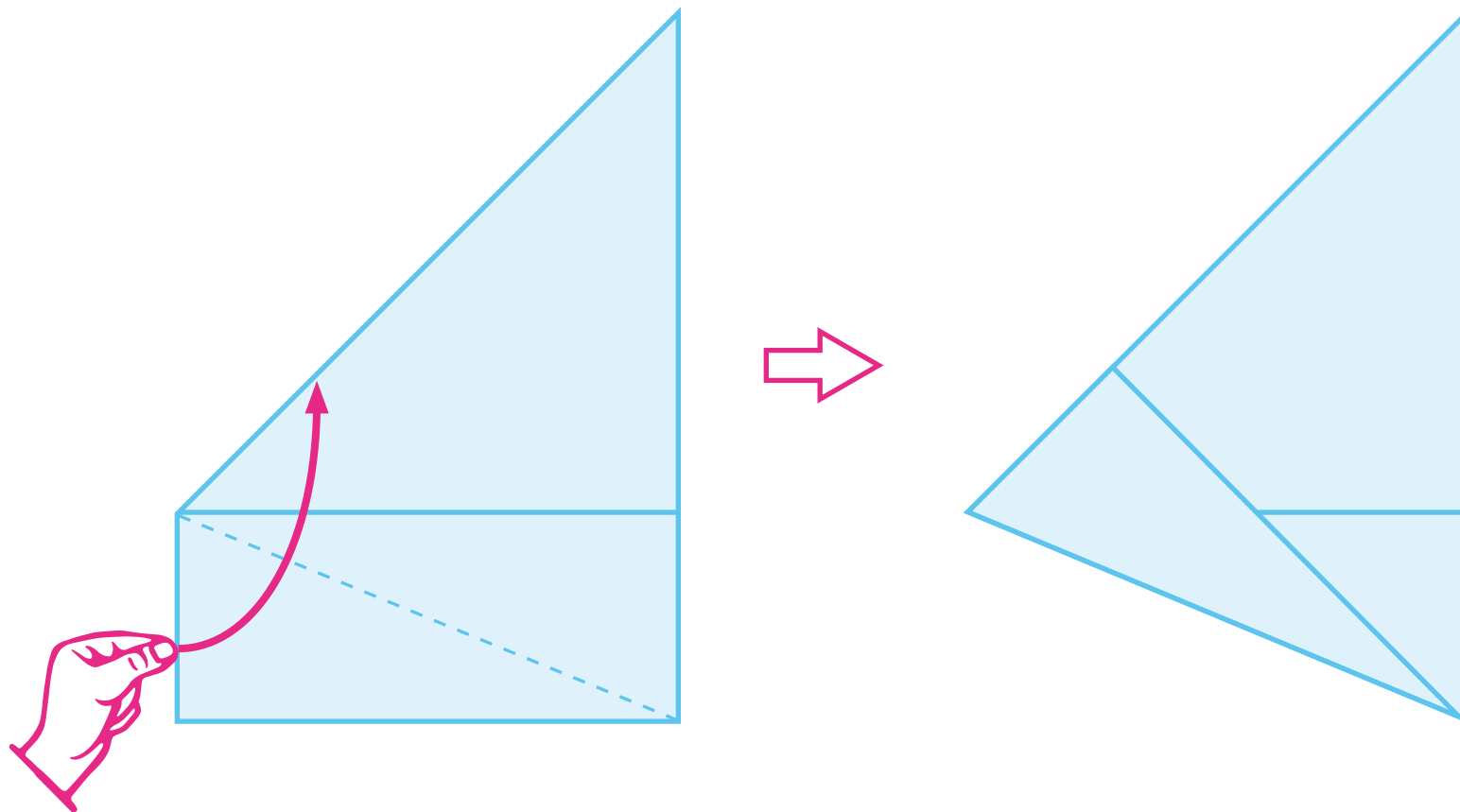
Fold the top left corner until the top edge lines up along the long edge



# ISOSCELES TRIANGLE

## STEP 2

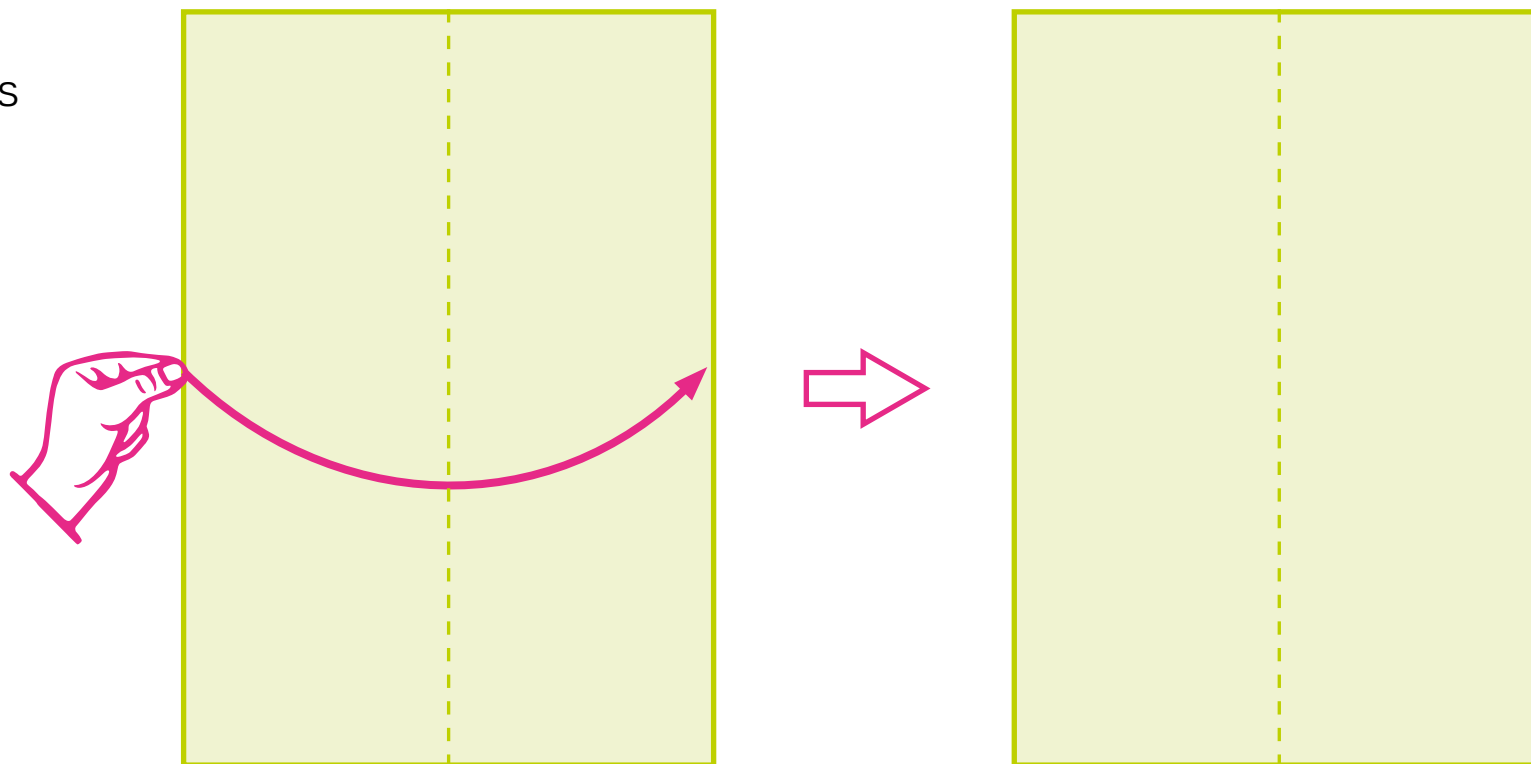
Fold the left edge of the rectangle to fit along the sloping edge



# EQUILATERAL TRIANGLE

## STEP 1

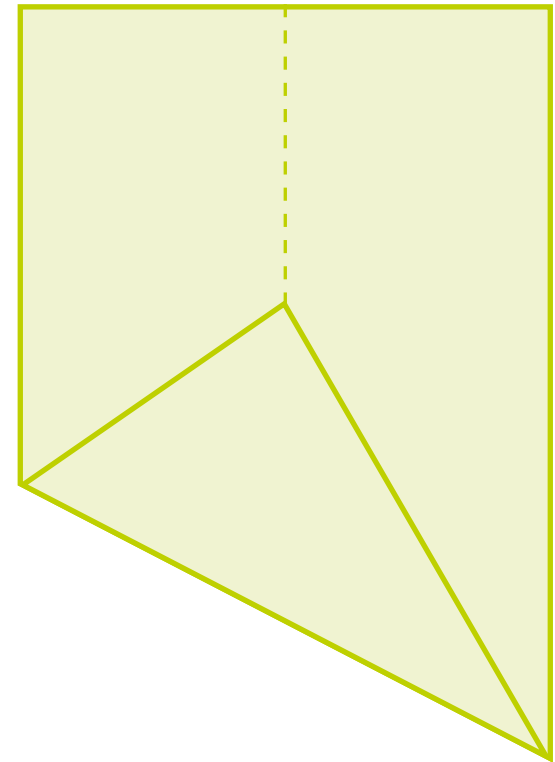
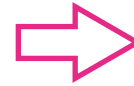
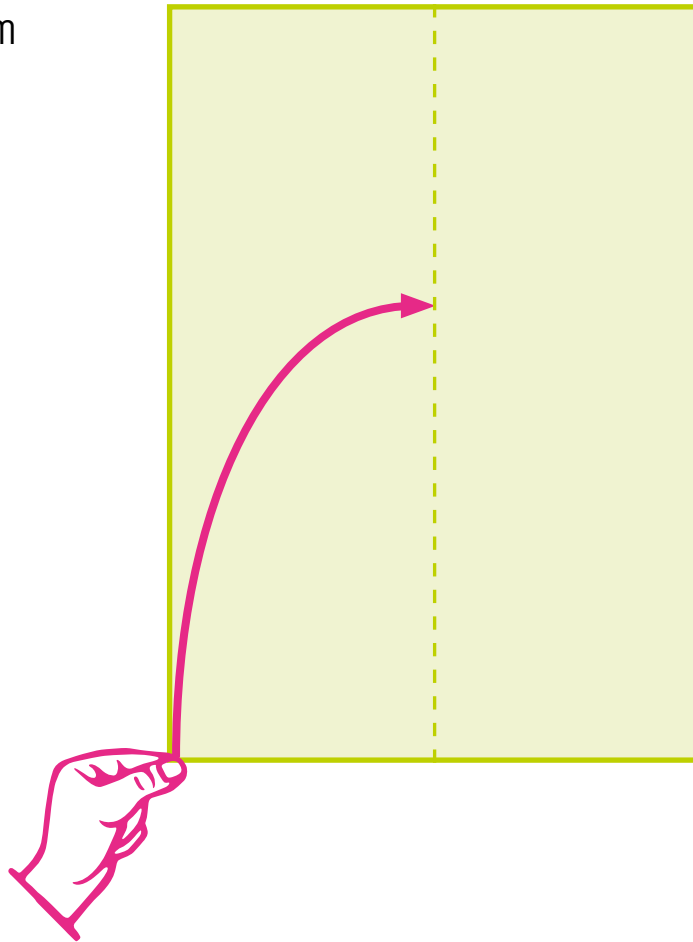
Fold the paper  
half lengthways  
and then open  
it out again



# EQUILATERAL TRIANGLE

## STEP 2

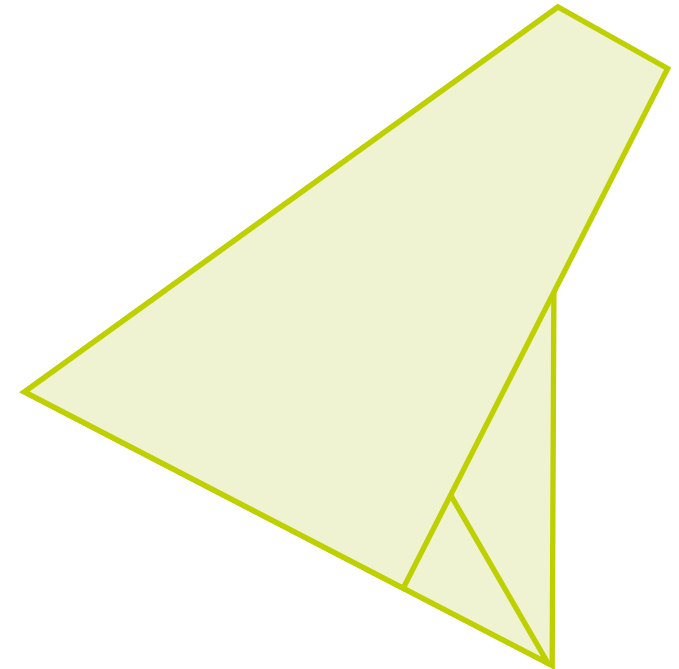
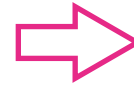
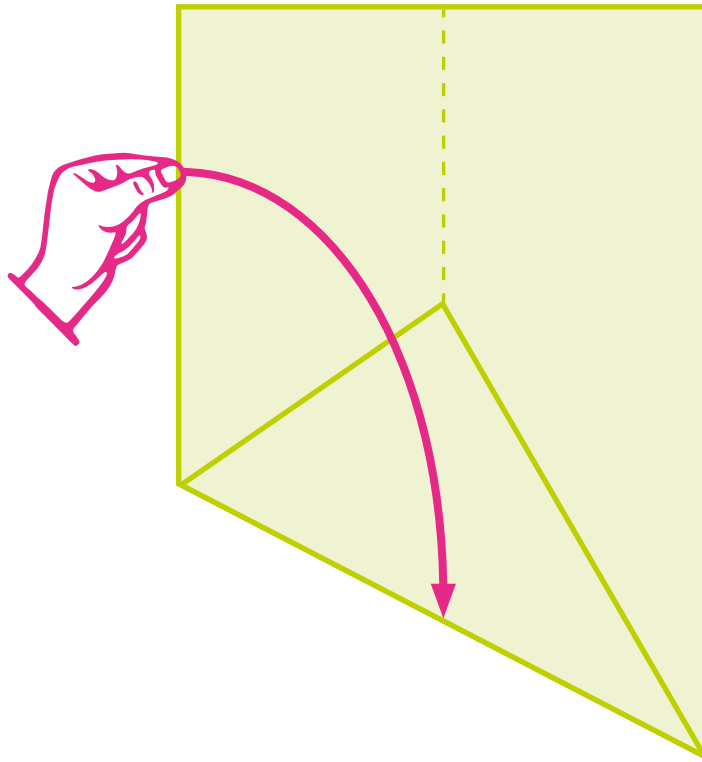
Hold the bottom right corner and fold the bottom left corner to the centre crease



# EQUILATERAL TRIANGLE

## STEP 3

Fold the upper part so that the left edge lies along the sloping edge

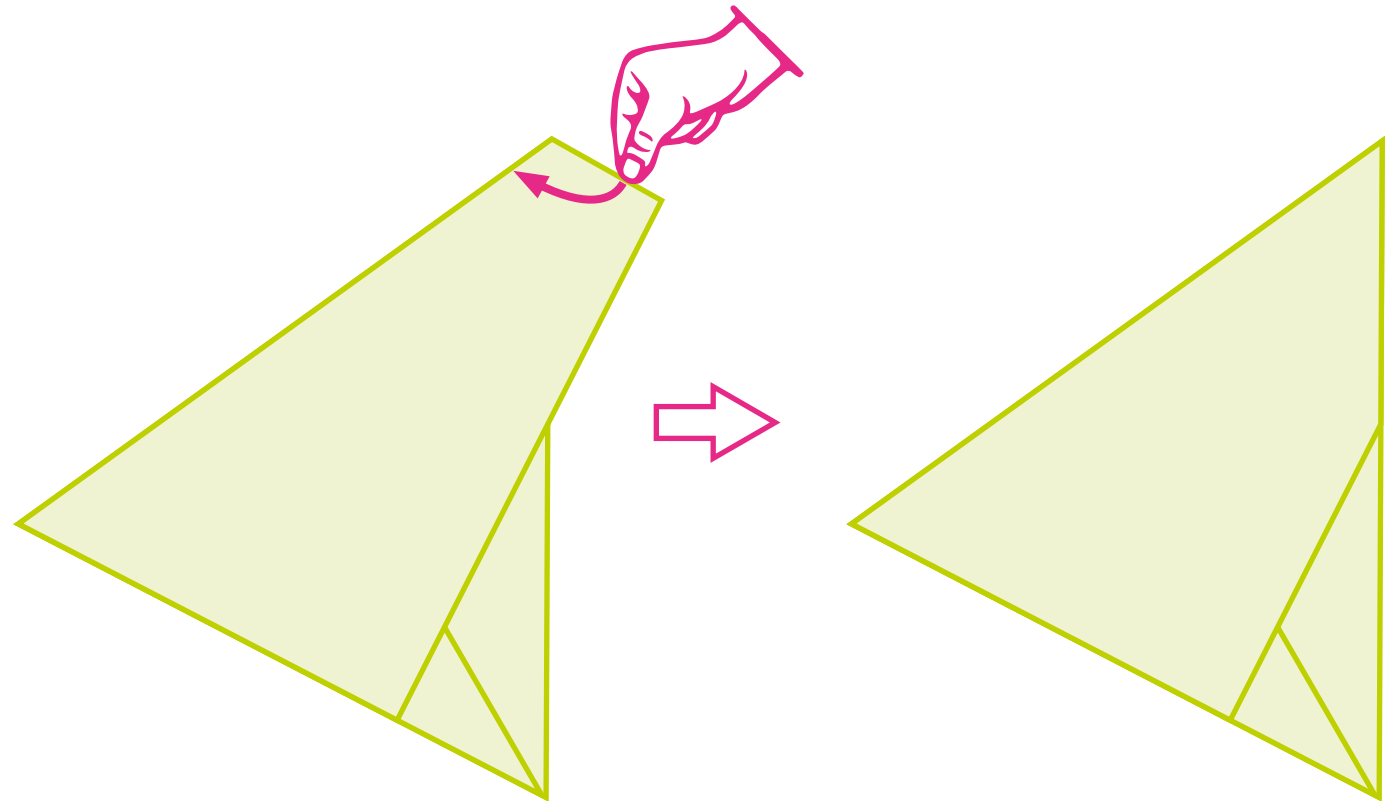




# EQUILATERAL TRIANGLE

## STEP 4

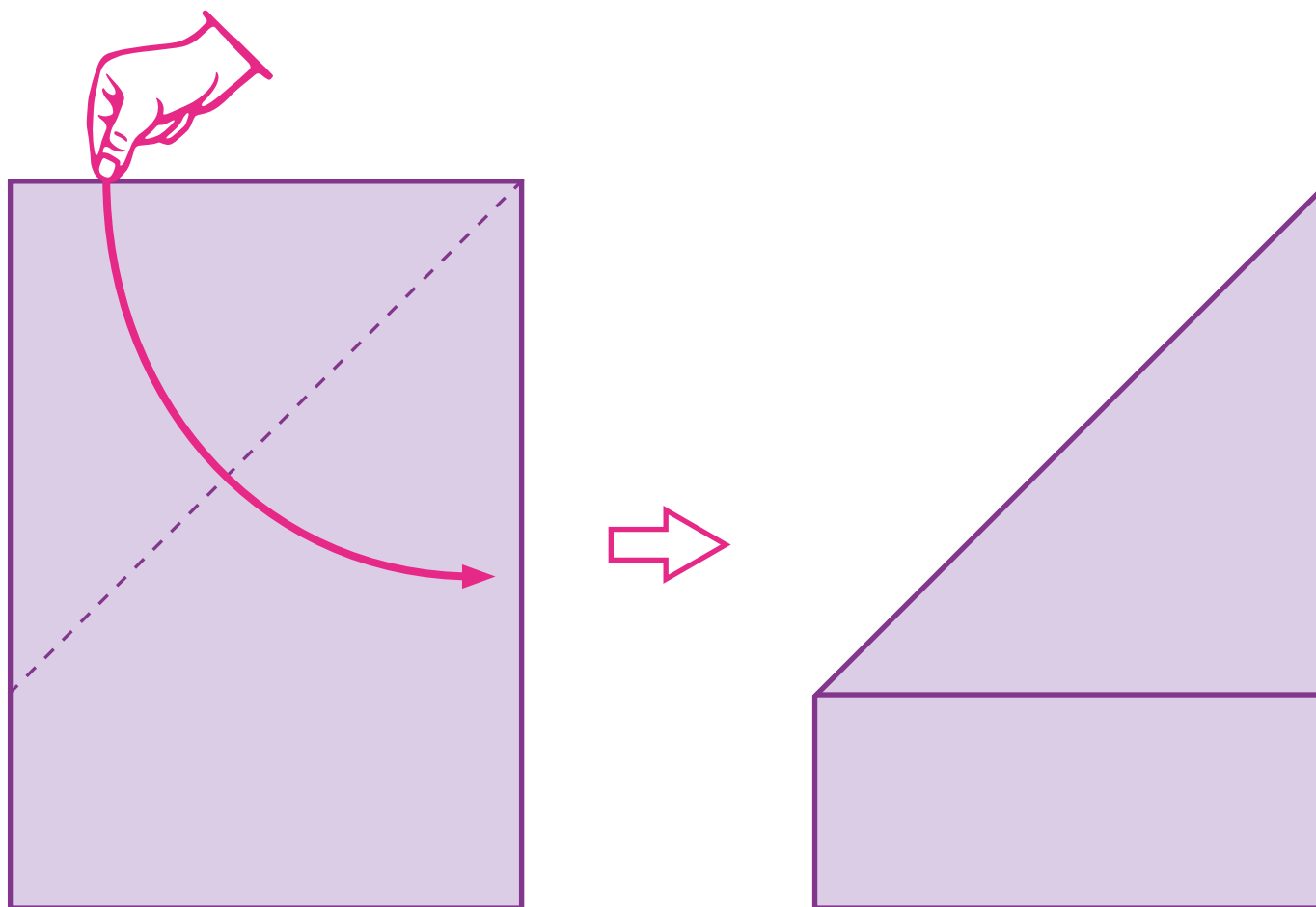
Fold the small triangle over to line up with the edge



# KITE

## STEP 1

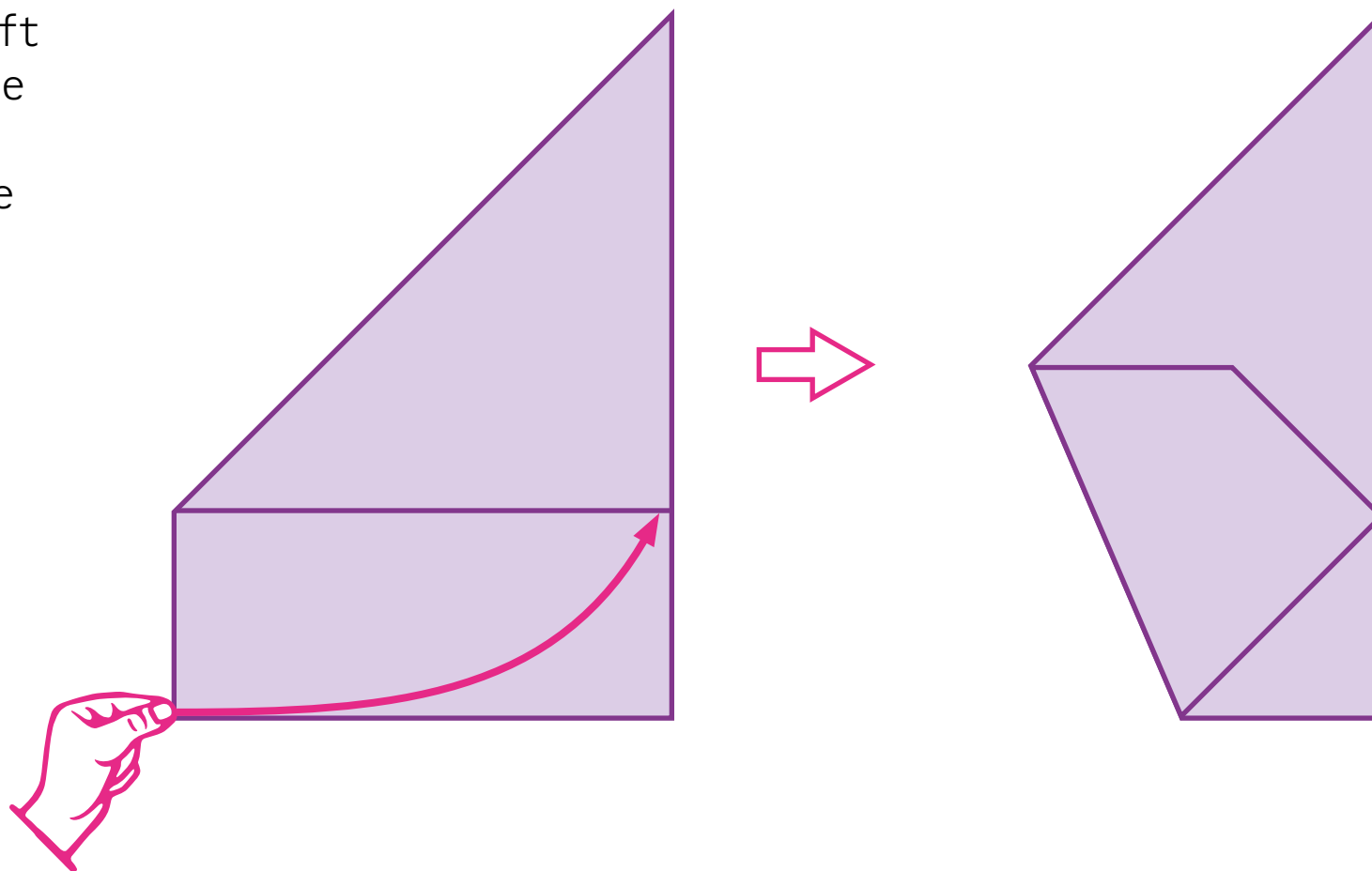
Fold the top left corner until the 'top' edge lines up along the right hand 'long' edge



# KITE

## STEP 2

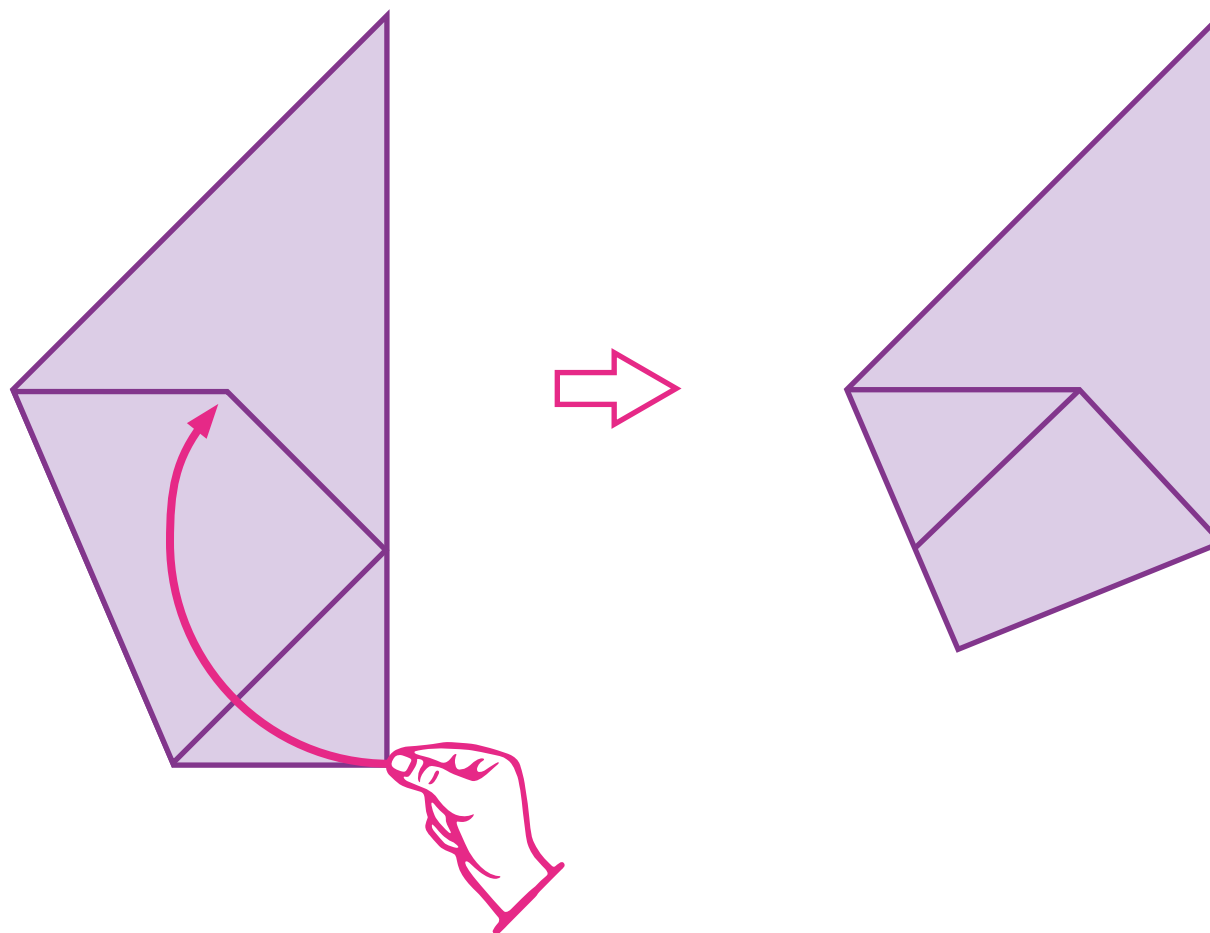
Fold bottom left corner onto the bottom of the triangle on the right edge



# KITE

## STEP 3

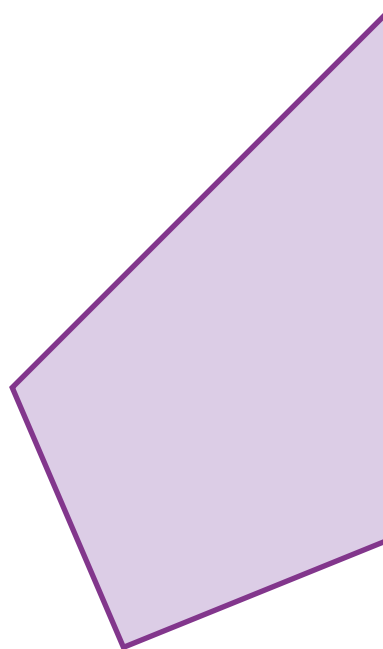
Fold lower right corner to the point shown, edges should line up.



# KITE

## STEP 4

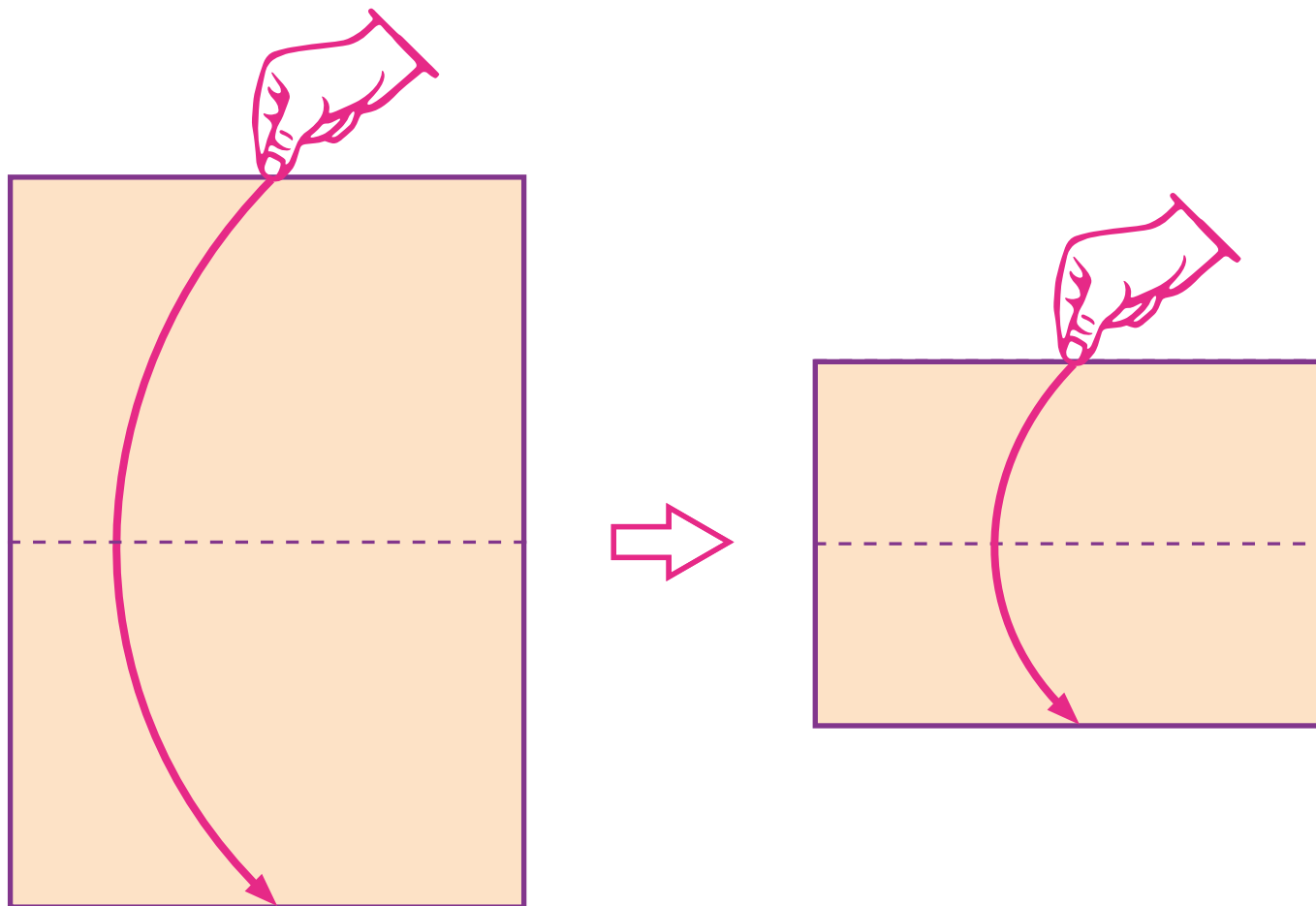
Flip over and  
turn around



# RHOMBUS

## STEP 1

Fold in half,  
then in half  
again, and  
unfold

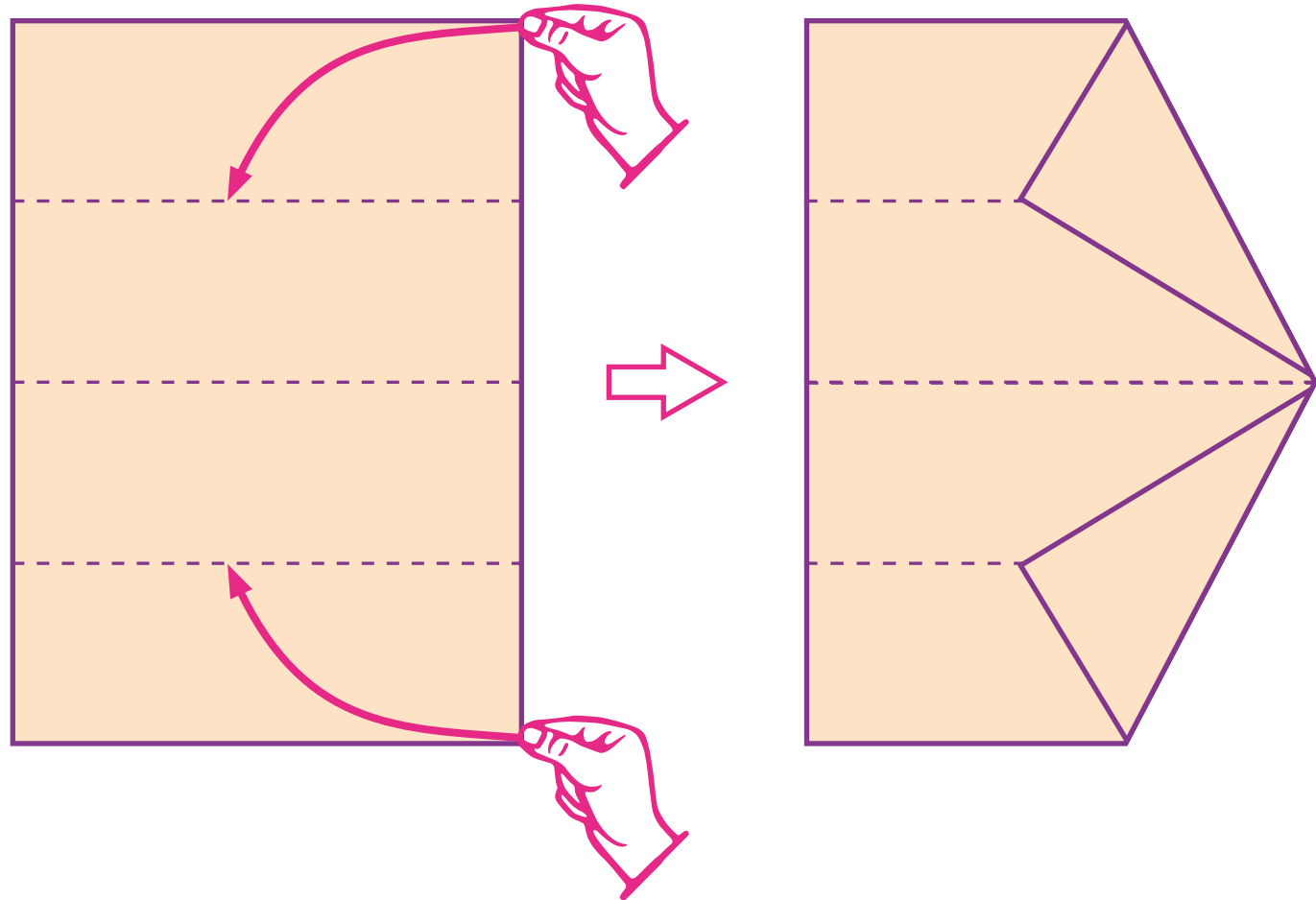


# RHOMBUS

## STEP 2

Hold middle right-hand point and fold the bottom right-hand corner to the quarter line (stretching to middle right-hand point)

Repeat for the top right-hand corner

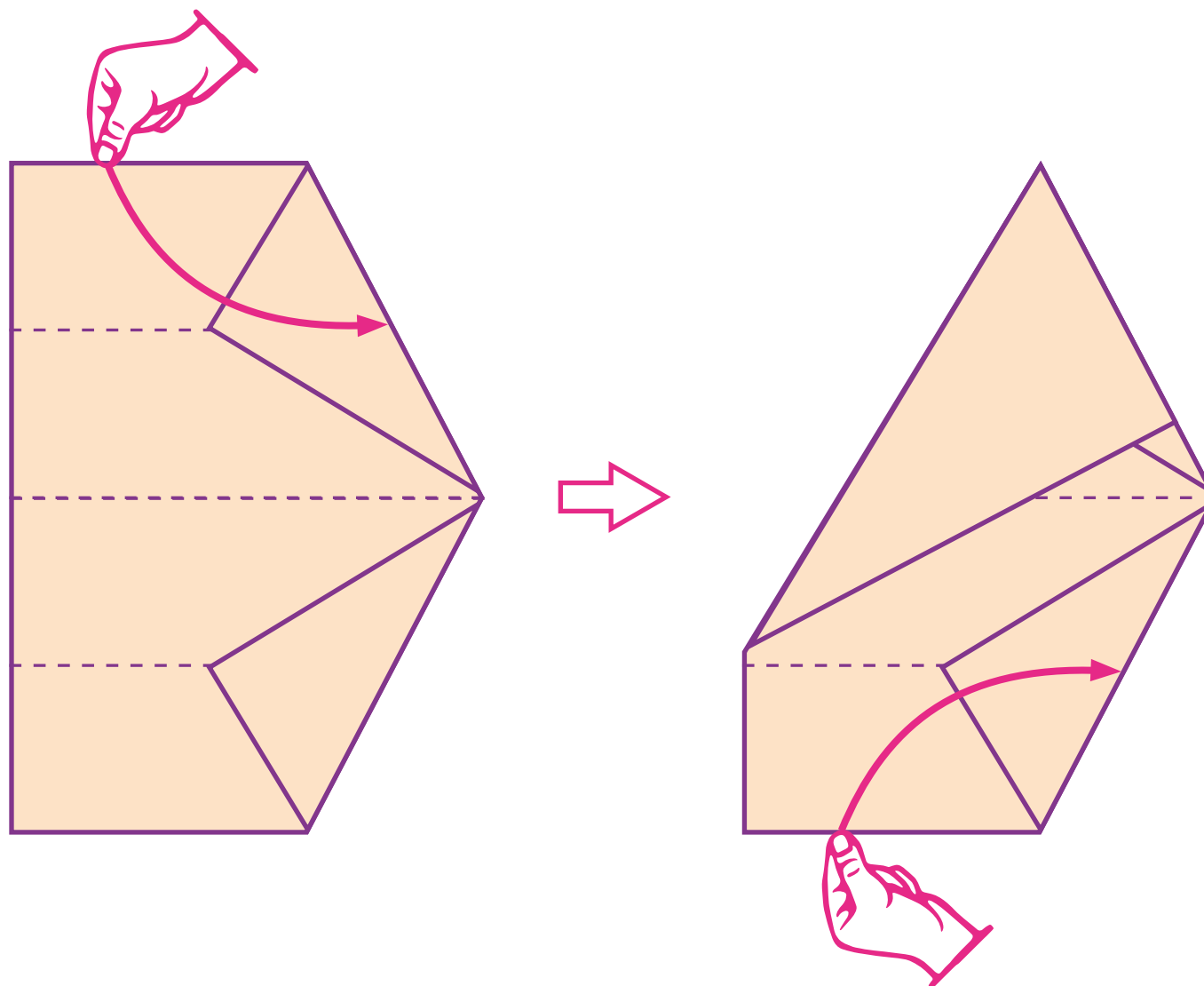


# RHOMBUS

## STEP 3

Fold over 'edge-to-edge'

(top first; then bottom)

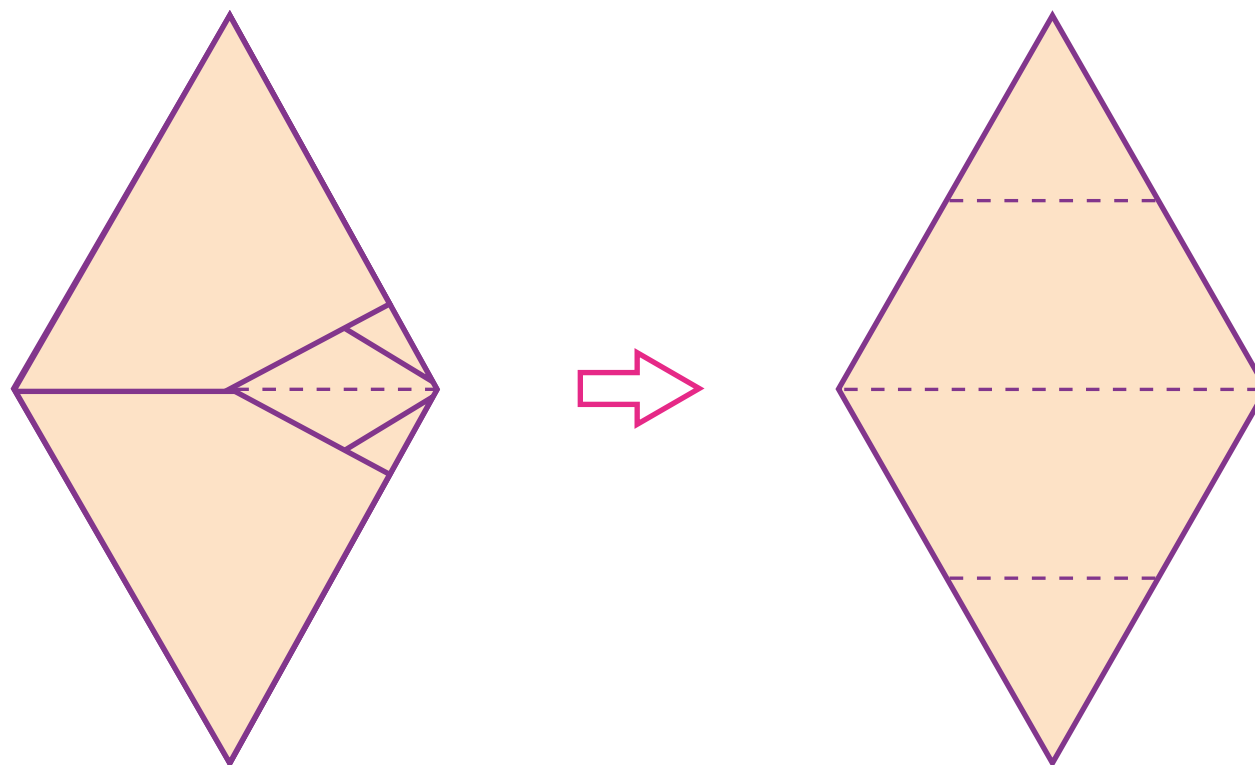




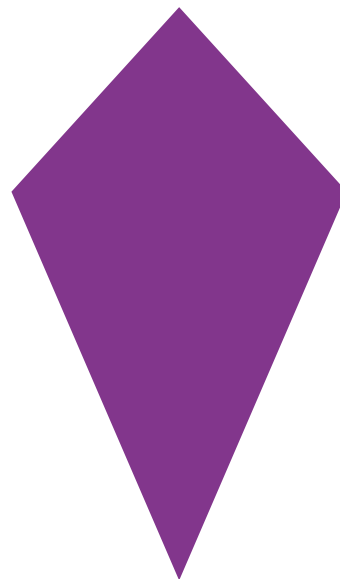
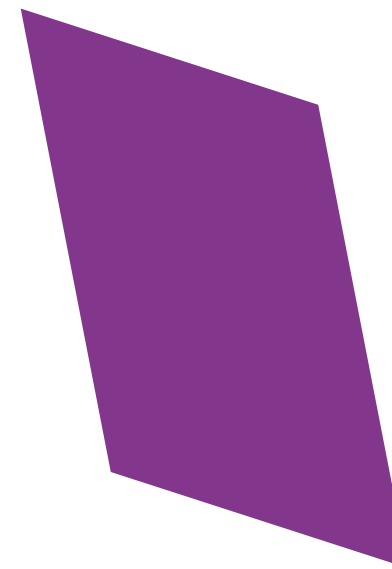
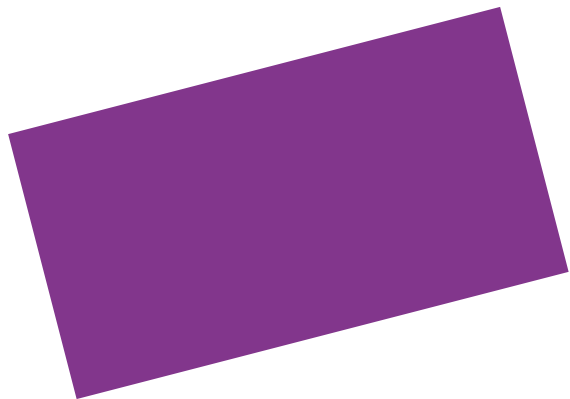
# RHOMBUS

## STEP 4

Flip over and  
turn around



# QUADRILATERAL POSTER



**Square**  
**Kite**

**Rectangle**  
**Parallelogram**

**Rhombus**  
**Trapezium**

# MATCH UP THE SHAPES WITH THE STATEMENTS



**Rectangle**



**Trapezium**



**Parallelogram**



**Square**



**Kite**



**Rhombus**

4 right angles

4 right angles

4 equal sides

4 lines of symmetry

diagonals bisect each other at right angles

diagonals bisect each other at right angles

diagonals are equal

diagonals are equal

opposite sides are parallel

opposite sides are parallel

opposite sides are parallel

angles add up to  $360^\circ$

angles add up to  $360^\circ$

angles add up to  $360^\circ$

angles add up to  $360^\circ$

rotational symmetry order 2

rotational symmetry order 4

opposite sides are parallel

opposite sides are equal

2 pairs of equal sides

2 pairs of equal sides

opposite sides are  
equal and parallel

2 pairs of equal sides

# WHAT CAN YOU MAKE WITH YOUR SHAPES?

How can you make different size shapes?

These have a special name, they're called similar shapes.

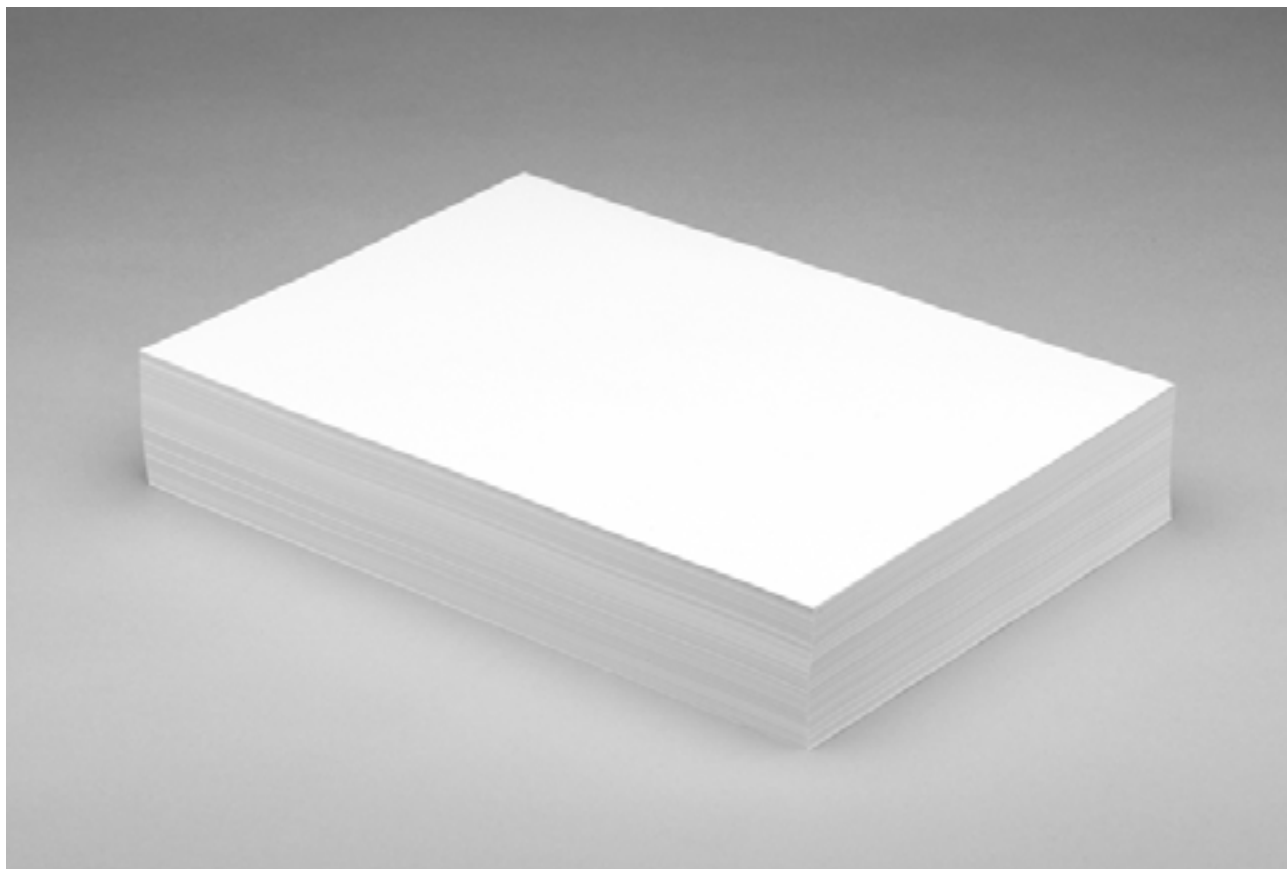
When shapes fit inside one another, this is called nesting.



# PAPER MATHS

I bought a ream of A4 paper today. A standard ream is 500 sheets.

Assuming the commonly-used density of  $80 \text{ g/m}^2$  (also written as "gsm") can you estimate the weight of the paper?



# THE WEIGHT OF A REAM OF PAPER

The estimation process goes something like this.

- 1.** A piece of A4 paper has dimensions roughly  $20\text{cm} \times 30\text{cm}$ , giving an area of  $600\text{cm}^2$ .
- 2.** One square metre is  $100\text{cm} \times 100\text{cm} = 10,000\text{cm}^2$ . The number of pieces of paper needed to cover  $1\text{m}^2$  is around  $10,000/600 \approx 17$  pieces
- 3.** Those 17 pieces weigh  $80\text{g}$ , since the paper density is  $80\text{g}/\text{m}^2$ .
- 4.** The total area of the ream of paper is  $500/17 \approx 30\text{m}^2$ .
- 5.** So the total weight of the ream of paper is  $30 \times 80 = 2,400\text{g} = 2.4\text{kg}$ .

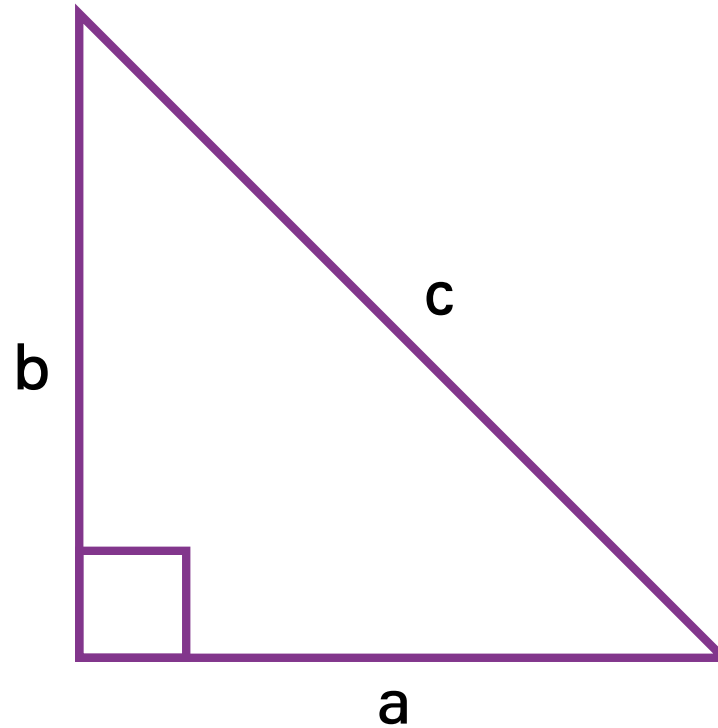


# PAPER SIZES

Paper sizes are based on the A0 size, which has an area of  $1\text{m}^2$ .

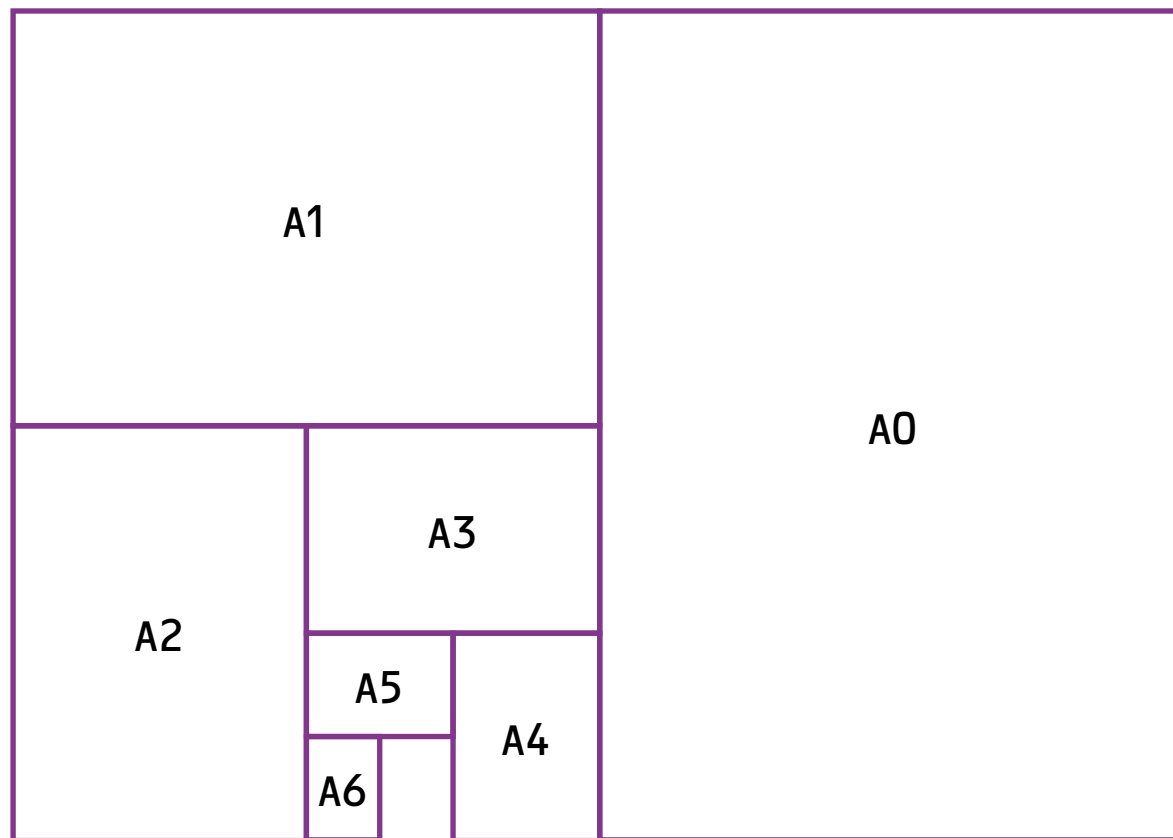
Its dimensions are  $841\text{cm} \times 1189\text{cm}$ , and its aspect ratio is  $1:\sqrt{2}$ . That is, the height divided by the width is  $\sqrt{2}$ . Why do you think this is?

Here's a clue....



# PAPER SIZES

To get the next size down, we just cut A0 in half giving A1 size, at  $0.5\text{m}^2$ .



# PAPER SIZES

This also has an aspect ratio of  $1:\sqrt{2}$  (in fact, all paper sizes have this ratio – this was deliberate so all paper sizes are a neat multiple of each other.) We keep going, halving each time, so we get A2, A3 and then A4, the standard size used in office printers. This size is exactly  $1/16$  of a square metre ( $10000/16 = 625\text{cm}^2$ , so our estimate of  $600\text{ cm}^2$  was not bad.)

## INVESTIGATION: PAPER USED

Estimate how much paper is used in your class each week, term and year.

---

How much paper do you think is used in the whole school?

---

How many reams is this?

---

And how much do you think it will cost?

## LEARN MORE:

*Paper City* is a free event which will take place from 30 Jun – 9 Jul in the Fruit Market and Humber Street Gallery.

Also revealed at the launch of *Paper City* is the World's Favourite Colour. What's yours? What is your class'?

[hull2017.co.uk/papercity](http://hull2017.co.uk/papercity)