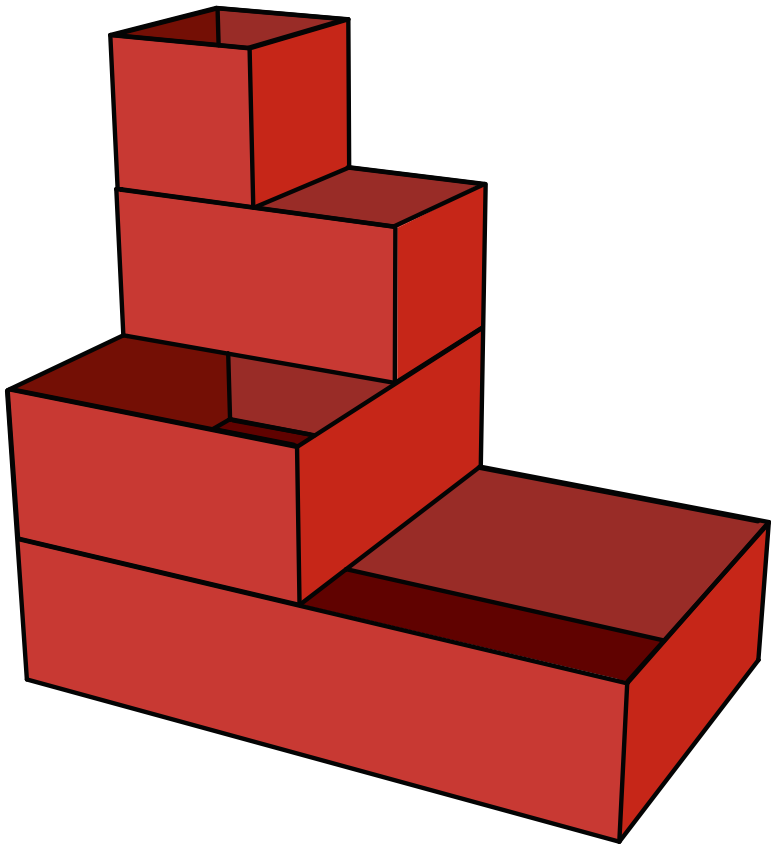
Reasoning in the classroom

Stacking boxes

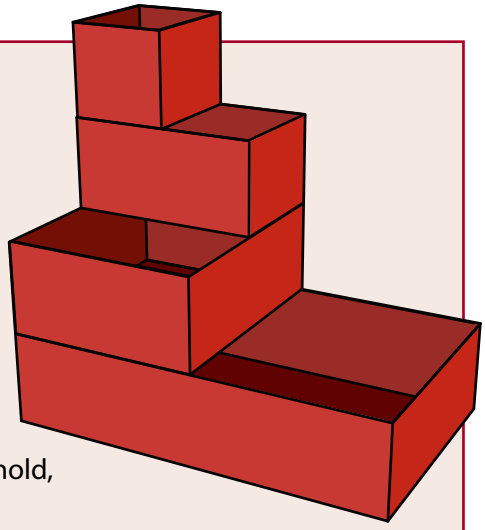


Support materials for teachers

Year 6

Llywodraeth Cymru
Welsh Government

Year 6 Reasoning in the classroom – Stacking boxes



These Year 6 activities encourage learners to use spatial reasoning to solve problems.

Activity 1

Stacking boxes
Learners reason how many boxes will fit on top of other boxes.

Includes:
- Stacking boxes question
- Markscheme

Activity 2

Boxes again
They think about how many dominoes the boxes will hold, then create a box that will hold twenty dominoes.

Includes:
- Explain and question – instructions for teachers
- Whiteboard – Stacking boxes

Activity 3

Paper sizes
They investigate the A series of paper sizes.

Includes:
- Explain and question – instructions for teachers
- Resource sheet – Paper sizes

Reasoning skills required

Identify	Communicate	Review
Learners bring together a wide range of mathematical skills to solve problems.	They discuss their work and produce reasoned arguments to show their thinking.	They review their work and consider whether their calculations are accurate.

Procedural skills

- Multiplication
- Ratio and proportion
- Decimals

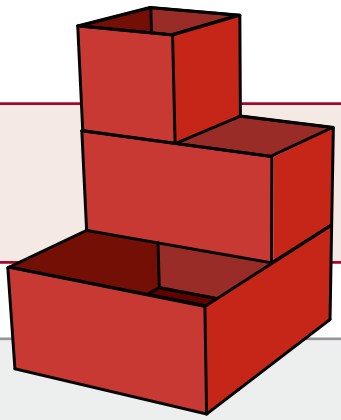
Numerical language

- Nets
- Dimensions
- Area

Activity 1

Stacking boxes

Activity 1 – Stacking boxes



Outline

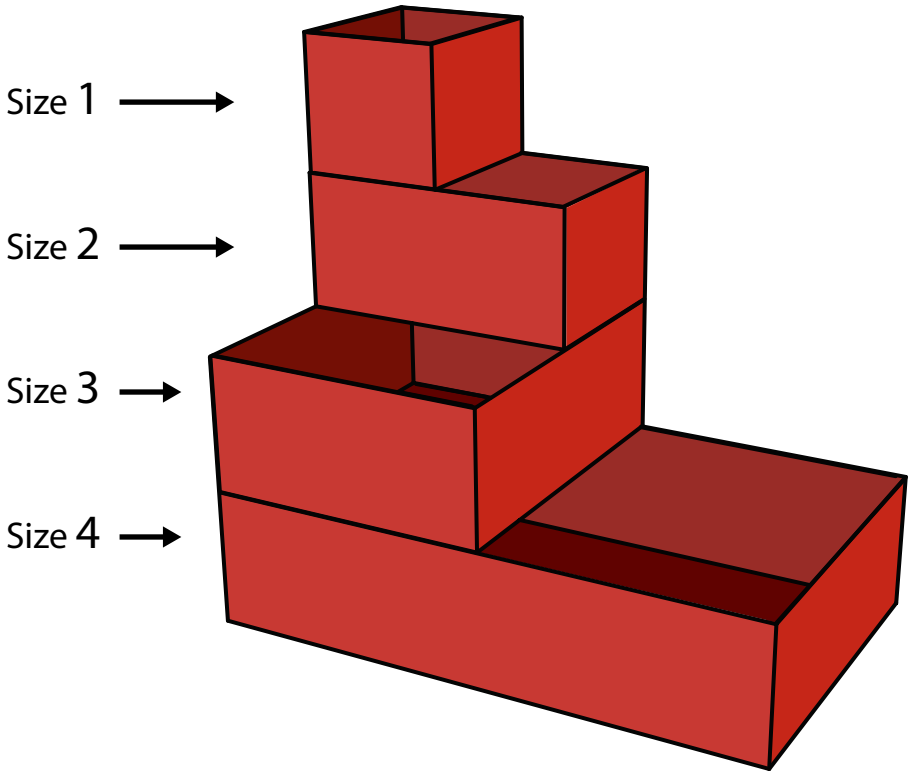
Learners use stacking boxes to solve a simple problem.

You will need

Stacking boxes question
One page for each learner

Markscheme

Here are four different-sized boxes:



Two size 1 boxes fit on top of a size 2 box.

Two size 2 boxes fit on top of a size 3 box, and so on.

Altogether, how many **size 1** boxes fit on top of a **size 4** box?

2m

Activity 1 – Stacking boxes – Markscheme

Marks	Answer
2m	**8**
1m	Continues to the next size, i.e. gives the answer **16** Or Shows **2 × 2 × 2** or **4 × 2**

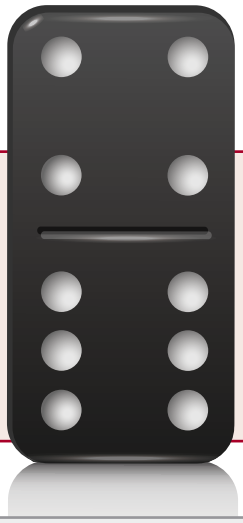
◀ **Correct method**

Note that as there is little variety in learner responses, there are no exemplars for this item.

Activity 2

Boxes again

Activity 2 – Boxes again



Outline

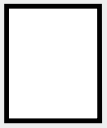
This activity is designed to carry on from **Activity 1 – Stacking boxes**.

Learners consider how many dominoes would just fit inside the boxes. Then they create a box that will just hold 20 dominoes – but they are only allowed one domino when planning and making their box.

You will need

Whiteboard – Stacking boxes

A set of dominoes



Card

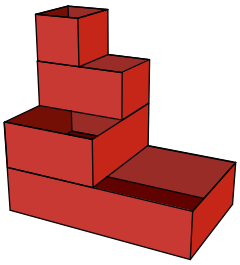
Scissors

Glue or tape

Activity 2 – Boxes again

Explain

Show the image, **Stacking boxes** on the whiteboard.



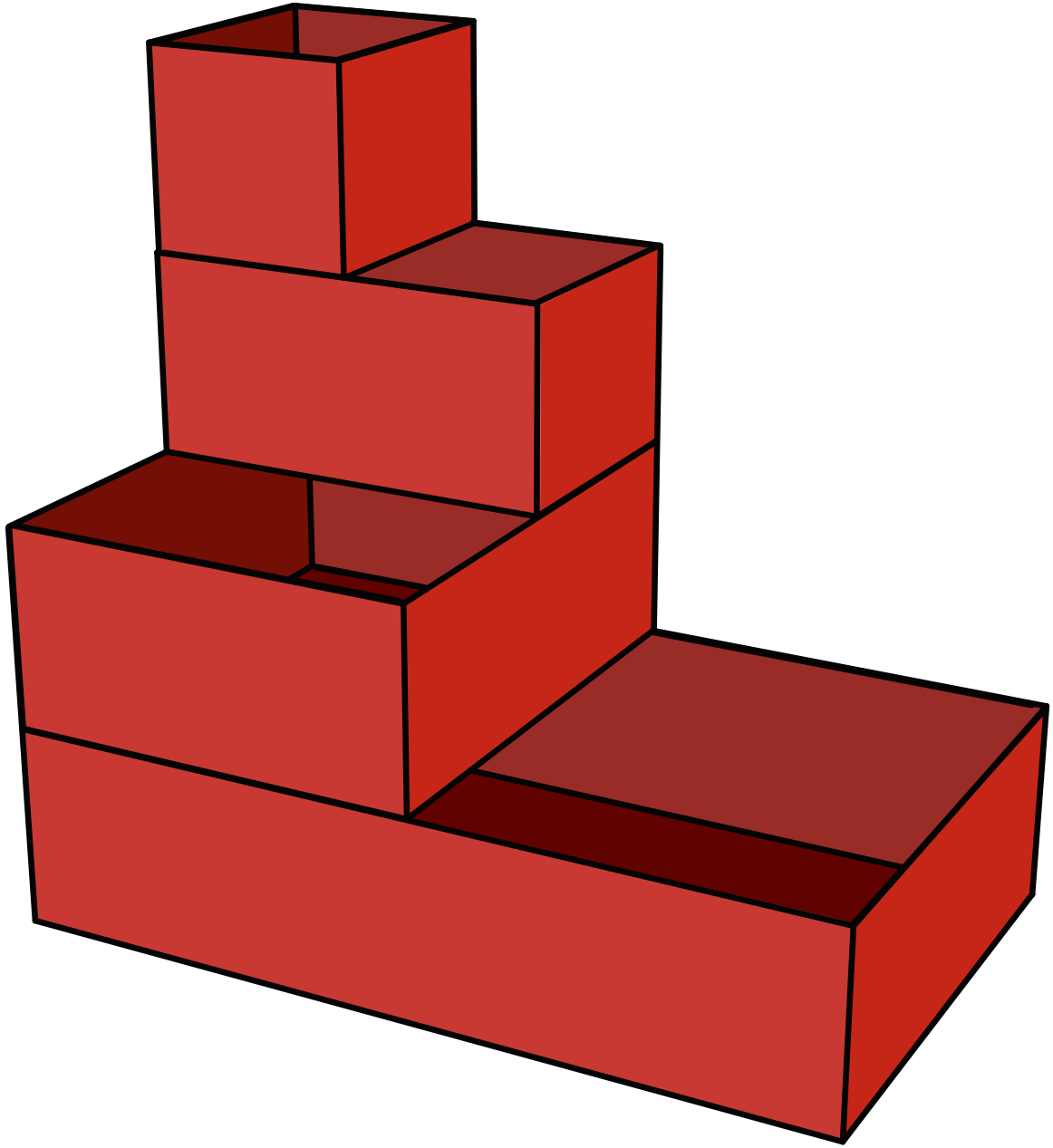
Tell learners that 20 dominoes will just fit inside the smallest box. Then discuss together how many dominoes will just fit inside the other boxes. *(40, 60 and 80 respectively)*

Give each group one domino then ask them to make a box that will hold exactly 20 dominoes, no more, no less. Say that you will test their box by placing 20 dominoes in it after they have finished making it!

Question

- There were 20, 40, 80 and 160 dominoes in the boxes. How is this sequence increasing? *(Doubling)* How many dominoes would fit in the 6th box? *(640)* How do you know?
- How are you working out the dimensions of your box? How will the 20 dominoes be arranged? How else could they have been arranged?
- Does your box have a lid or not? What is the net for your box?
- When manufacturers pack things in boxes, for example cereals, they don't pack so that only the correct amount of cereal can be fitted in, and no more. Why not?

WB



Activity 3

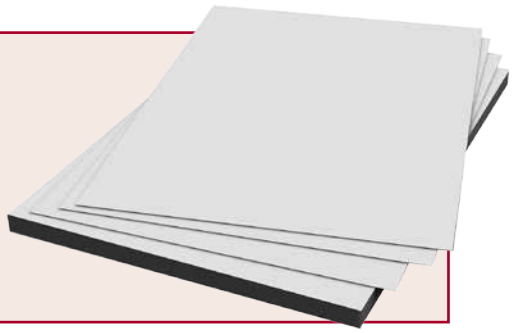
Paper sizes

Activity 3 – Paper sizes

Outline

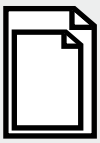
This activity is designed to carry on from **Activity 2 – Boxes again**, but can also follow on from **Activity 1 – Stacking boxes**.

Learners investigate the relationships between different-sized sheets of paper, e.g. A3 and A4.



You will need

Resource sheet – Paper sizes



Examples of papers, e.g. A3 and A4

Activity 3 – Paper sizes

Explain

Give each group a copy of the resource sheet **Paper sizes** and explain that A1 to A8 compares different-sized papers. A1 is the biggest of these, then A2, then A3 and so on. *(If possible, show examples of some of these papers, e.g. A3 and A4, full size.)*

Discuss together: how many A8 sheets fit together to make an A7 sheet? *(2)*

How many A8 sheets fit together to make an A6 sheet? *(4)*

Then ask learners to work out how many A8 sheets fit together to make an A1 sheet.
(128 because $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$)

Or

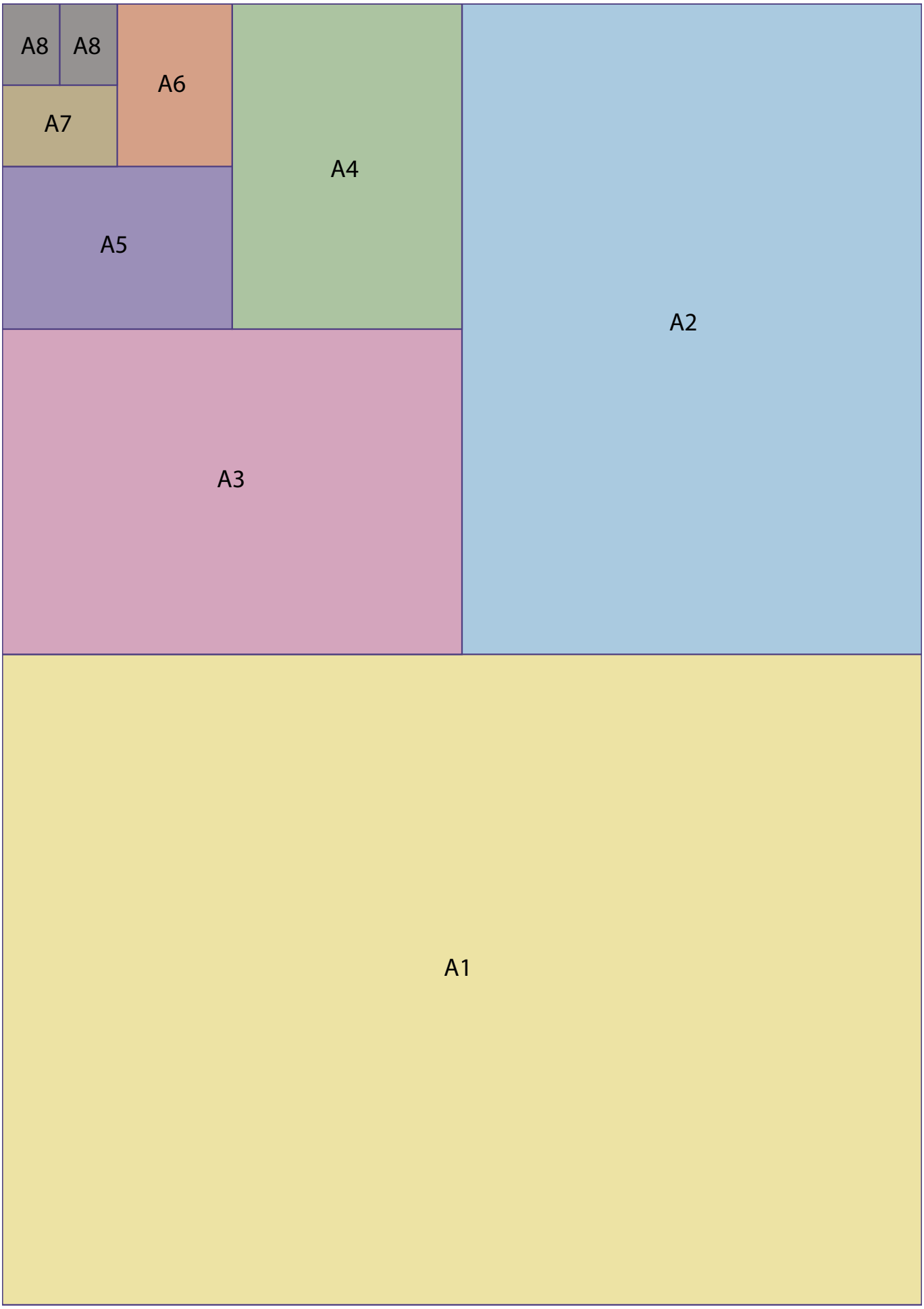
Learners cut the resource sheet to compare the different sizes.

Question

- Have you found a pattern when you are working out how many A8 sheets fit in the other sheets? How does your pattern help you to find out how many A8 sheets fit together to make an A1 sheet?
- There is another size of sheet called an A0 sheet. How big do you think an A0 sheet is? Why?
- Tell me what the ratio 1 : 2 means. Can you give me an example of papers that have areas in the ratio 1 : 2? What about in the ratio 2 : 1? What about the ratio 1 : 4?
- Which sheet has an area that is $\frac{1}{8}$ of the area of an A4 sheet? *(A7)* Which other pairs of sheets can you find where the area of one sheet is $\frac{1}{8}$ of the area of the other sheet? *(A4 to A1, A5 to A2, A6 to A3, A8 to A5, A9 to A6, A10 to A7)*
- The dimensions of an A4 sheet of paper are 29.7cm by 21.0cm. What are the dimensions of an A3 sheet of paper? What about the other sizes?

Extension

- Learners can investigate the C series of envelope sizes by using the information at, for example, www.sizes.com/materls/paperISOC.htm


A8
A8
A6
A7
A4
A5
A2
A3
A1