Cups and straws

Reasoning in the classroom

Support materials for teachers

Year 5

Llywodraeth Cymru
Welsh Government

Year 5 Reasoning in the classroom – Cups and straws

These Year 5 activities focus on finding combinations and patterns. The first activity was included in the 2015 National Numeracy Tests (Reasoning). This is followed by one further activity.

Activity 1

Cups and straws

Learners find the combinations that can be made using different-coloured cups and straws.

Includes:
- Cups and straws question
- Markscheme

Activity 2

Strange Street

Learners explore patterns they create using a 6 × 6 grid.

Includes:
- Explain and question – instructions for teachers
- Whiteboard – Houses to rent
- Whiteboard – Which house?
- Whiteboard – 2 people moving in
- Resource sheet – Strange Street, six houses
- Resource sheet – Strange Street, seven houses

Reasoning skills required

Identify	Communicate	Review
Learners identify the steps needed to complete a task and reach a conclusion.	They use everyday and mathematical language to talk about their own ideas and choices.	They interpret information and construct diagrams in order to draw appropriate conclusions.

Procedural skills
- Patterns

Numerical language
- Different
- Patterns
- Decreases

Cups and straws

Activity 1 – Cups and straws

Outline

This Year 5 activity requires learners to work out the different combinations that can be obtained using four coloured cups and straws.

You will need

Q

Cups and straws question
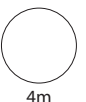One page for each learner

M

Markscheme

Cups: 4 colours

purple (P), yellow (Y), red (R), green (G)

Straws: 4 colours

purple (P), yellow (Y), red (R), green (G)

I want my straw and cup to be **different colours**.

Show all the ways the straw and cup can be different colours.

4m

Activity 1 – Cups and straws – Markscheme

Marks	Answer

4m	Shows **all 12 ways** with no duplication and no incorrect ways, e.g.
	
	 • PY PR PG
	   YP YR YG
	   RP RY RG
	   GP GY GR

Or 3m	The only error is to not reverse the colours, i.e. shows **only** the following 6 ways: PY PR PG YR YG RG Or Shows **at least 9** different correct ways, even if there are also duplications and/or incorrect ways
Or 2m	Shows **at least 7** different correct ways, even if there are also duplications and/or incorrect ways
Or 1m	Shows **at least 5** different correct ways, even if there are also duplications and/or incorrect ways

◀ **For PY accept YP (but not both), etc.**

Activity 1 – Cups and straws – Exemplars
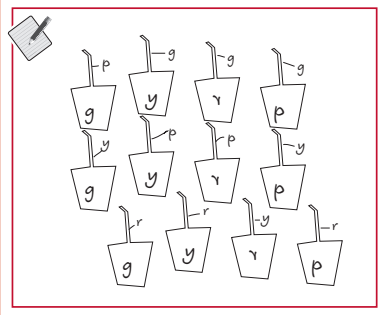
Correct; **4 marks**

- This learner works systematically, keeping the colour of the cup the same within each column. The back to front 'r' is unambiguous.

12 different correct ways, with some incorrect; **3 marks**

- The use of a table is an effective and efficient method, but this learner has forgotten that the straw must be a different colour from the cup.

purple and yellow
purple and green
red and purple
green and red
green and yellow
yellow and red

Colours not reversed, no other errors; **3 marks**

The green straw could go in the red cup and the red straw could go in the green cup, the yellow straw could go into the purple cup an the purple straw could go into the yellow cup the green straw could could go into the purple cup, the purple straw could go into the green cup, the red straw could go into the yellow cup and the yellow straw could go into the red cup

8 correct ways; **2 marks**

- This learner needs support to work more efficiently – writing sentences is time-consuming and the pairings are difficult to identify. However, the system of reversing colours, e.g. GR then RG, allows this learner to find some but not all of the 12 possible outcomes.

P and Y   r and G   G and Y
r and G   Y and p   p and Y

4 correct ways; **0 marks**

- Both RG and PY are duplicated.

Strange Street

Activity 2 – Strange Street

Outline

This Year 5 activity explores patterns created by learners using a 6 × 6 grid. The first part of the activity is physical so requires a (relatively) large area such as a playground, gym or hall.

You will need

WB   **Whiteboard – Houses to rent**

WB   **Whiteboard – Which house?**

WB   **Whiteboard – 2 people moving in**

R   **Resource sheet – Strange Street, six houses**
One page for each pair/small group

R   **Resource sheet – Strange Street, seven houses**
One page for each pair/small group

6 × 6 grid (This should be marked out in a large space.)
Each square sufficiently large for one learner to stand in

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

Activity 2 – Strange Street

Explain

Show **Houses to rent** on the whiteboard. Explain that the person who owns these six new houses on Strange Street is very fussy. She insists that as people move in, they must always move into a house next door to someone else. They cannot move into any house that leaves an empty house between them and their neighbour or neighbours.

Show **Which house?** on the whiteboard. If the first person to move into Strange Street moves into number 2, which house can the next person move into? *(1 or 3)* If, instead, the first person moves into house number 4 *(bottom diagram)*, which houses can the second person **not** move into? *(1, 2 or 6)*

Show learners the 6 × 6 large grid that you have marked out and explain that each row represents the same six houses in Strange Street. Choose a volunteer – they are the first person to move into Strange Street. Ask them to choose a 'house' *(e.g. number 3)* and 'move in' *(stand in the appropriate square on the first row of the grid)*. Choose another volunteer and ask where else the first person could have moved into *(e.g. number 1)*, then 'move in' the second volunteer using the second row. Continue until all six rows are completed *(i.e. until someone is standing in each of the six possible houses/squares across each of the six rows)*. Agree together that there are six choices, then ask the volunteers to return to their seats.

Now say that two people are going to move into Strange Street at the same time – the rules still apply so they must move into houses next to each other. Ask volunteers to show where they could live, and as they demonstrate draw red dots to record their positions using **2 people moving in** on the whiteboard, as shown in the example opposite.

●	●	3	4	5	6
1	2	3	●	●	6
1	●	●	4	5	6
1	2	●	●	5	6
1	2	3	4	●	●
1	2	3	4	5	6

Once learners have checked that there are no further ways for the two people to move in, ask if there is a way of arranging the people/red dots to make it easier to see that all possible ways have been found. Support them if necessary to stand in staggered rows, then erase the existing red dots on the whiteboard and replace as shown in the second example. Agree together that there are five different ways for two people to move in at the same time.

●	●	3	4	5	6
1	●	●	4	5	6
1	2	●	●	5	6
1	2	3	●	●	6
1	2	3	4	●	●
1	2	3	4	5	6

Now give each pair/small group a copy of **Strange Street, six houses**. Use the questions below to support their learning, encouraging them to predict and check, and reminding them to use the grids to show their evidence!

Strange Street, seven houses offers further opportunities to 'pattern-spot', i.e. as the number of people moving in at the same time increases, the number of different ways they can do that decreases by one.

Question

- How are you recording different ways on the grid? Do you have a system? Why does that help?

- What pattern can you see in your table? Can you predict what the next row will be? How?

- What can you tell me about the numbers in the two columns? *(As the number of people increases by one, so the number of different ways decreases by one. Also, each pair adds to seven.)*

- What pattern do you think you might get when you work with seven houses? Why? *(As previously, as the number of people increases by one, so the number of different ways decreases by one. This time, each pair adds to eight.)*

Extension

- Suppose there were 10 houses, and four people are moving in at the same time. How many different ways can they do this? *(7 ways)* Or 14 houses, with six people moving in at the same time? *(9 ways)* Can you explain how to find these answers? *(Add 1 to the number of houses and take away the number of people moving in.)*

New houses to rent!

Rules for living in Strange Street

1. The 1st person to rent can live in any of the houses.

2. New people renting must always live next door to someone else.

3. No empty houses between people!

2 people moving in . . .

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

Strange Street – six houses

Number of people moving in at the same time	Number of different ways they can do this
1	6
2	5
3	
4	
5	
6	

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
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1	2	3	4	5	6
1	2	3	4	5	6
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1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

Strange Street – seven houses

Number of people moving in at the same time	Number of different ways they can do this
1	7
2	6
3	
4	
5	
6	
7	

1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

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1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
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1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7