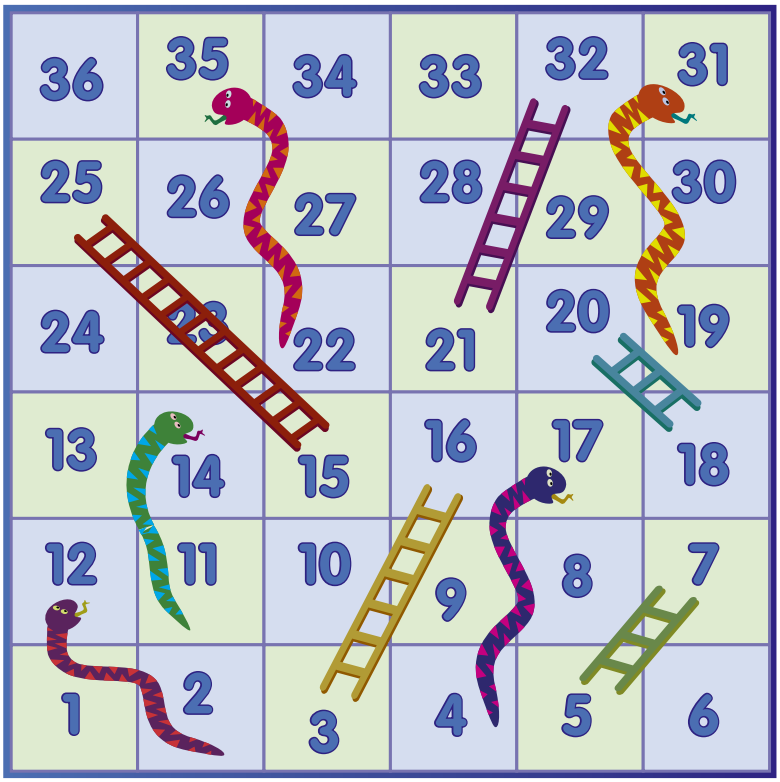
Reasoning in the classroom

Snakes and ladders



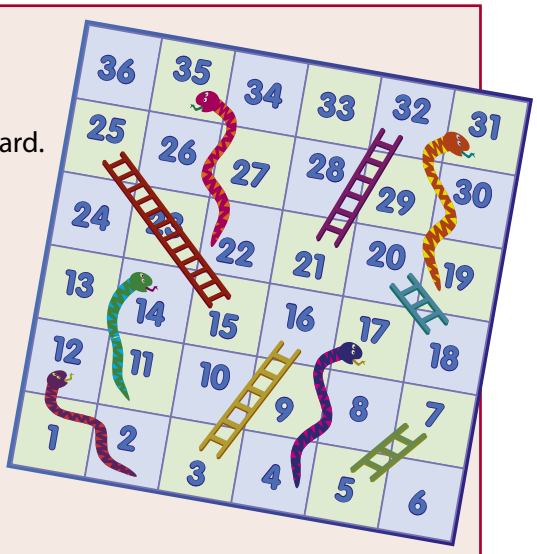
Support materials for teachers

Year 4

Llywodraeth Cymru
Welsh Government

Year 4 Reasoning in the classroom – Snakes and ladders

These activities encourage Year 4 learners to think strategically.



Activity 1

Snakes and ladders

Learners consider moves on a Snakes and ladders board.

Includes:

- Teachers' script
- PowerPoint presentation
- Snakes and ladders questions
- Markscheme

Activity 2

My game

They use their knowledge of multiplication tables to create their own game.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – My game

Activity 3

Nim–7

Learners play this game from the NRICH website, looking for winning strategies.

Includes:

- Explain and question – instructions for teachers

Reasoning skills required

Identify	Communicate	Review
Learners choose their own strategies.	They decide how to record outcomes.	They reflect on their conclusions.

Procedural skills

- **Multiplication and division, including multiplication tables**
- **Addition and subtraction**

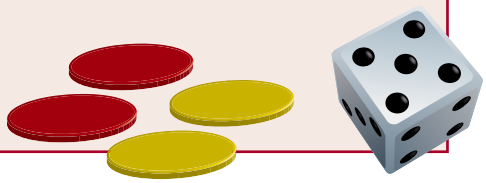
Activity 1

Snakes and ladders

Activity 1 – Snakes and ladders

Outline

Learners consider moves on a Snakes and ladders board, including the minimum number of moves needed to win.



You will need

Teachers' script

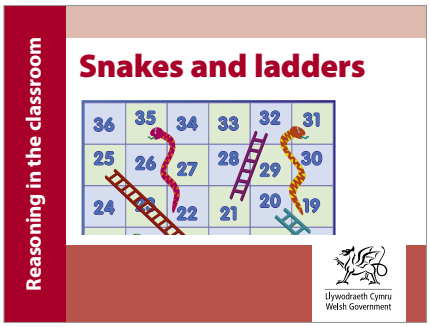
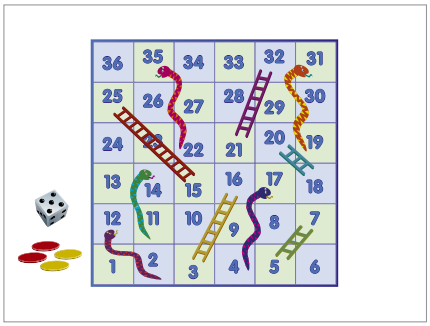
PowerPoint presentation

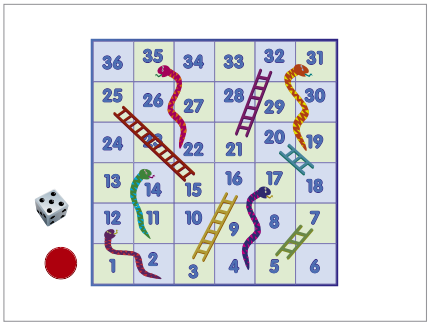
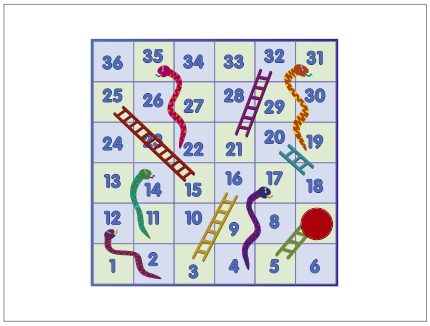
Snakes and ladders questions
Two pages for each learner, can be printed double-sided

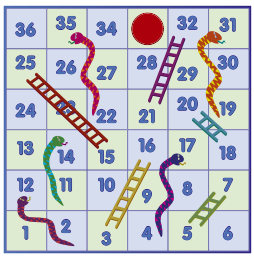
Markscheme

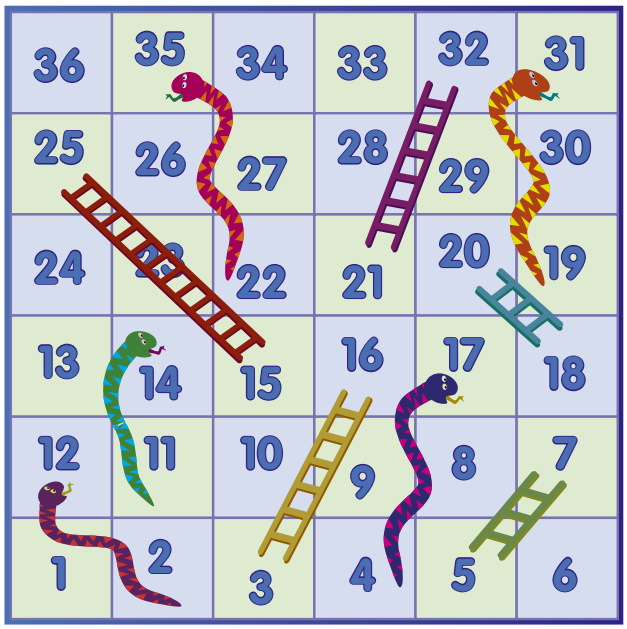
Presentation to be shown to learners before they work on Snakes and ladders

The text in the right-hand boxes (but not italics) should be read to learners. You can use your own words, or provide additional explanation of contexts, if necessary. However, if you are using this activity as an assessment item, no help must be given with the numeracy that is to be assessed.

Slide 1		*(Keep this slide on the screen until you are ready to start the presentation.)*
Slide 2		How many of you know the game Snakes and ladders? It is a game played by children all over the world.
Slide 3		There is one six-sided dice, numbered one to six. Each player takes it in turn to throw the dice. They move their counter along the board or up at the ends of the rows. *(Show the 'zig-zag' way of moving along the board.)* If you are lucky enough to land on the bottom of a ladder you climb right up to the square at the top of the ladder.

Slide 4		Laura starts a game. She throws the dice and gets a five. When she moves her red counter forward five squares what will happen?
Slide 5		That's right, she goes up the ladder to square number 7 *(Make sure learners understand how 'ladders' work.)* So now Laura is on square 7 When she throws the dice again, what number does she not want? Why? That's right, another throw of five would take her to square 12 and she would slide down the snake to square 2 *(Make sure learners understand how 'snakes' work.)* Would anything happen if she were on square 7 and threw a one, two or four? No, you can only slide down snakes from the top of the snake. Would anything happen if she were on square 7 and threw a two or three? No, you can only climb ladders from the square at the bottom.

Slide 6		Now it's later in the game and Laura is on square 33 What number does she **not** want to throw? Why? *(A throw of two would take her to square 35 and she would slide all the way down to square 22)* What numbers would she have to throw to finish the game? Yes, a three, four, five or six. As soon as she reaches or passes the final square – number 36 – she has finished the game. *(This is important for learners to understand.)* Now you are going to answer some questions about the game Snakes and ladders. Remember to show your working so that someone else can understand what you are doing and why. *(If you are using this item for assessment purposes, you may wish to limit the time available, e.g. 10 minutes.)*



Start here

I hope I land on square **15** as it has the longest ladder.

15 is good but the ladder on **3** is better!

Why does Matt say the ladder on square 3 is better?

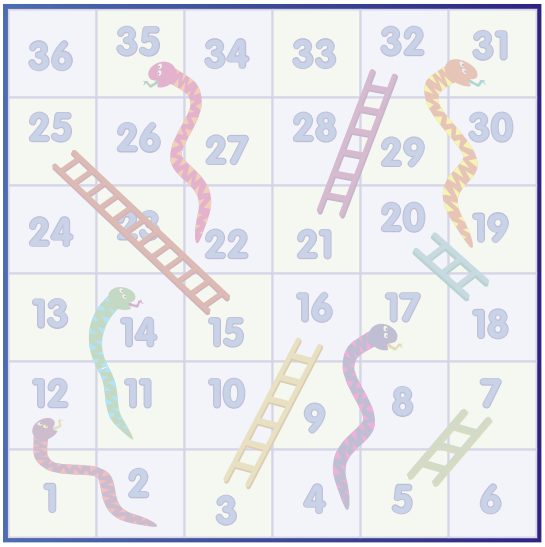
1m

I played the game.

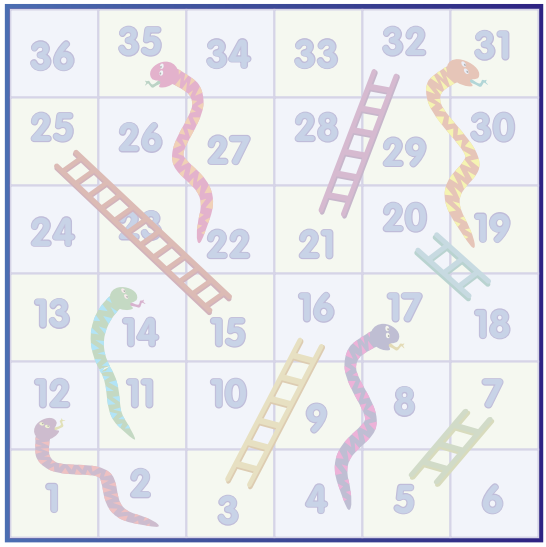
It took me **3** throws of the dice to win.

Show how you can win with 3 throws of the dice.

There are two boards in case you need to start again.



What numbers were thrown?

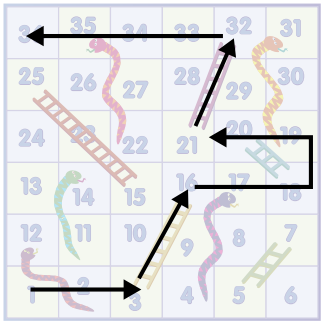
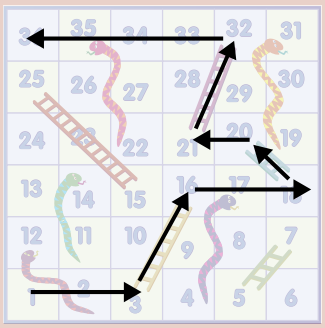


What numbers were thrown?

3m

1m

Activity 1 – Snakes and ladders – Markscheme

Q	Marks	Answer
i	1m	Justifies why the ladder on 3 is better by comparing the amounts increased, e.g. • It goes up 13 but the other goes up 10 • It goes up more
ii	3m	Shows the complete correct route, i.e. 
	Or 2m	Shows a route that includes going up the ladders at 3 and at 21, e.g. • 
	Or 1m	Shows a correct first step by going up the ladder at 3
iii	1m	Identifies the correct numbers thrown for their route, e.g. for the correct answer scoring 3 marks above • 3, 5, then 4 (or 5 or 6) e.g. for the route shown in the 2m section above • 3, 2, 1 then 4 (or 5 or 6)

If the amounts increased are calculated, they must be correct

Accept any unambiguous means of showing the complete route

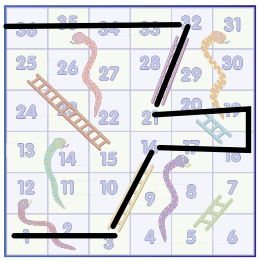
Activity 1 – Snakes and ladders – Exemplars

Part i

The little one goes up 13 and the big one goes up 10 so it goes up more which is why he said it was better	Correct; **1 mark**
25 – 15 = 10 16 – 3 = 13	Correct; **1 mark** • This response is acceptable, but the communication would be improved by an explicit comparison.
It goes 15 to 25 and the other one goes 3 to 16	Incomplete; **0 marks** • Had this learner quantified or compared the amounts gone up, they would have scored 1 mark. As it is, this statement is incomplete since no comparison is offered.
15 – 25 = 10 and 3 – 16 = 14 so the one on 3 is better	Incorrect; **0 marks** • 16 – 3 is not equal to 14, so the response is incorrect. Had 13 been calculated correctly, the mark would have been given. However, this learner would benefit from discussion as to why 15 – 25 and 3 – 16 are written in the incorrect order.
She says 15 because it is longer but 3 is a better ladder.	Incomplete; **0 marks** Common error This learner simply restates the information given in the question.

Activity 1 – Snakes and ladders – Exemplars (continued)

Parts ii and iii



What numbers were thrown?

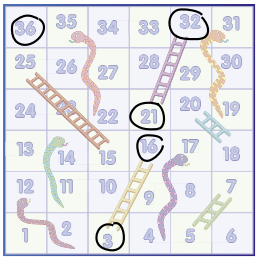
353

Part ii, correct; **3 marks**

- The use of lines rather than arrows is unambiguous.

Part iii, incorrect; **0 marks**

- Although this looks like a 3-digit number, it can be assumed to show 3 throws of the dice. However, the final throw is incorrect.



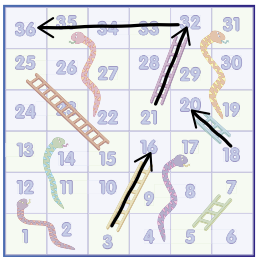
What numbers were thrown?

Part ii, ladders at 3 and 21; **2 marks**

- As the route between squares 16 and 21 is not shown, only 2 marks can be given.

Part iii, route unknown; **0 marks**

- As we cannot be sure of the route, we cannot check the dice. This illustrates the importance of effective communication.



What numbers were thrown?

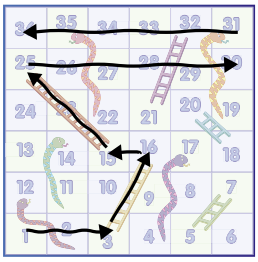
3 then 2 then 1 then 4

Part ii, ladders at 3 and 21; **2 marks**

Common error

The route includes a ladder from 18 to 20.
That 4 throws of the dice, not 3, are needed should have prompted this learner to review their work.

Part iii, correct for their route; **1 mark**



What numbers were thrown?

3, 1, 5, 6

Part ii, ladder at 3; **1 mark**

Common error

This learner goes backwards from 16 to 15.

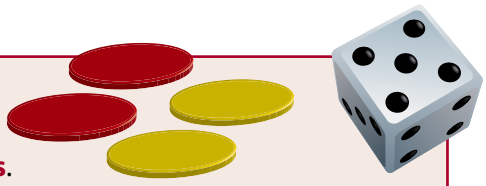
Part iii, correct for their route; **1 mark**

Activity 2

My game

Activity 2 – My game

Outline



This activity is designed to carry on from **Activity 1 – Snakes and ladders**.

Learners create their own game, using their knowledge of multiplication tables.

You will need

WB **Whiteboard – My game**

Dice
Each pair will need one dice

Activity 2 – My game

Explain

Tell learners that they are going to play a different game, but they need to decide the rules.

Show **My game** on the whiteboard and ask what times tables they would like to use. Fill in the gaps for both rules with the numbers suggested *(e.g. 'If you land on a number in the 5-times table, go forward 3, and if you land on a number in the 4-times table, go back 2', then check that learners understand how to play)*.

Now ask if anyone can see a problem – which numbers, if you land on them, would mean that you wouldn't know what to do? *(If, for example, the 5-times table and the 4-times table are chosen and you land on 20 there will be two conflicting rules.)* Agree together what to do if that happens *(e.g. if you land on a number that is in both the 5-times table and in the 4-times table, stay where you are)*.

The learners then work in pairs. They choose the size of their board and decide on their rules, then they play their game.

Question

- Why might using the 2-times table as one of my rules not be a good idea? *(It involves too many numbers.)* What about the 10-times table?
- Does the 2-times table stop at 20 (or 24)? *(No, it includes all the even numbers.)*
- If you were using the 5-times table, why wouldn't you want to use 'move forward 5' as part of the rule?
- What numbers are in both of your times tables? How did you work it out?
- If your board was a different size, e.g. 7 squares across and 7 squares up, how could you work out the greatest number on your board without writing all the numbers out?
- If I wanted 64 to be the biggest number on my board, what size board would I need to choose? *(8 by 8)* What if the board was a rectangle but not a square?

WB

36	35	34	33	32	31
25	26	27	28	29	30
24	23	22	21	20	19
13	14	15	16	17	18
12	11	10	9	8	7
1	2	3	4	5	6

If you land on a number in the ☐-times table go forward ☐

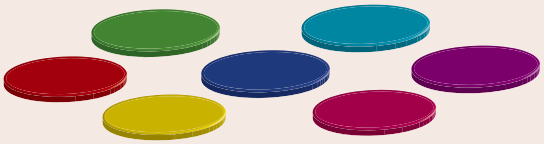
If you land on a number in the ☐-times table go back ☐

Activity 3

Nim–7

Activity 3 – Nim–7

Outline



This activity can be undertaken after **Activity 2 – My game**, or after **Activity 1 – Snakes and ladders**.

It is based on the ancient game of Nim and uses information that is available on the NRICH website. Learners work in pairs to find winning strategies.

You will need

Teacher instructions for the game can be found at nrich.maths.org/1204/note

Each pair needs seven counters

Activity 3 – Nim–7

Explain

Give each pair seven counters (colour is irrelevant).

Explain the rules: the first player takes away either one or two counters. Then the second player takes away either one or two counters, and so on. The player who takes away the last counter wins.

Ask the learners to play the game, taking it in turns to be the first player. Which player would they choose to be, first or second? Why?

Question

The NRICH website offers these suggestions:

- What happens when there are three counters left?
- Does it matter who goes first? Why or why not?
- How can you win at this game?

Extension (also from the NRICH website)

- Can you show all possible moves to prove that the person who goes first can always win?
- What happens if you start the game with a different number of counters? *(This suggestion is also from the NRICH website.)*