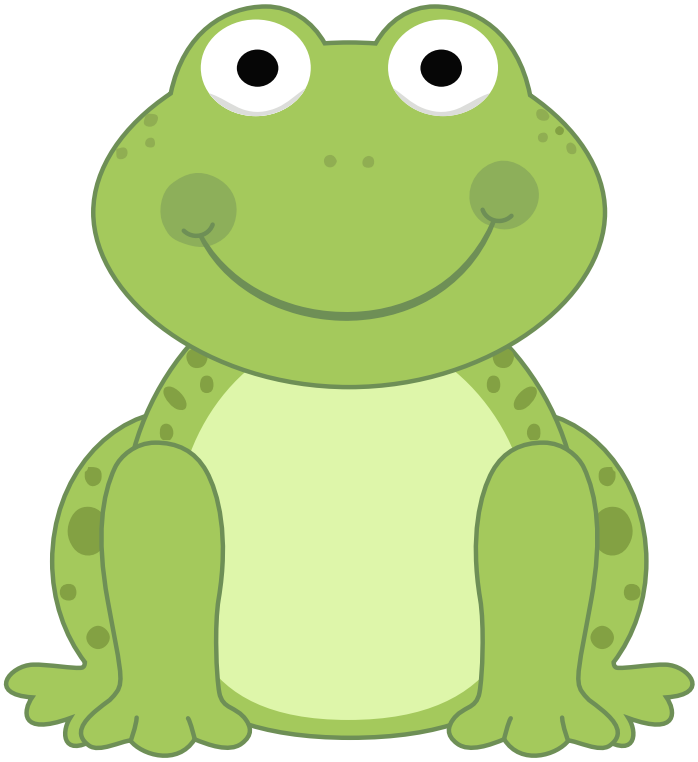
Reasoning in the classroom

Ffion the frog

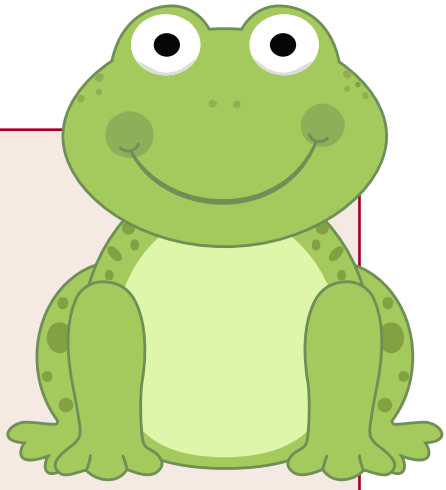


Support materials for teachers

Year 3

Llywodraeth Cymru
Welsh Government

Year 3 Reasoning in the classroom – Ffion the frog



These Year 3 activities start with an item that was included in the 2014 National Numeracy Tests (Reasoning). They continue with three linked activities, requiring learners to use their numeracy skills to solve problems within a range of different contexts.

Activity 1

Ffion the frog

Learners find different ways for a frog to jump to 10. Then they consider how many spiders the frogs eat.

Includes:

- Teachers' script
- PowerPoint presentation
- Ffion the frog questions
- Markscheme

Activity 2

Frogs

They use their knowledge of times tables to play a game, choosing numbers that give their 'frog' an advantage over other groups.

Includes:

- Explain and question – instructions for teachers
- Teachers' sheet – Number cards

Activity 3

Perfect web

Learners explore the shapes made within a spider's web, then create their own.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – Spider's web
- Whiteboard – Perfect web

Activity 4

Zigzag leaps

They find the quickest route for their frog to reach safety.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – Zigzag
- Resource sheet – Zigzag

Reasoning skills required

Identify

Learners use their numerical skills within a variety of contexts.

Communicate

They explain their approach and also their findings.

Review

They consider their results and how they can be changed to match different scenarios.

Procedural skills

- Simple combinations
- Addition and subtraction
- Multiplication tables (2, 3, 4, 5)
- Shape names and simple properties
- Simple geometric construction, using dotty paper
- Number patterns
- Use of letters and numbers to identify squares on a grid

Numerical language

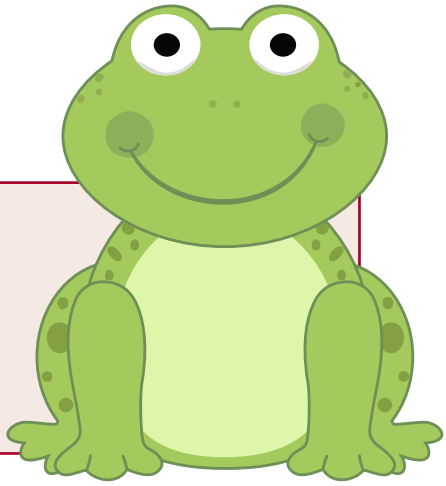
- Same/different
- More than
- Altogether
- Multiple (if appropriate)
- Digit
- Even/odd
- Triangle, square, rectangle, trapezium, hexagon, rhombus (diamond)
- Right angle
- Fewest

Activity 1

Ffion the frog

Activity 1 – Ffion the frog

or



Outline

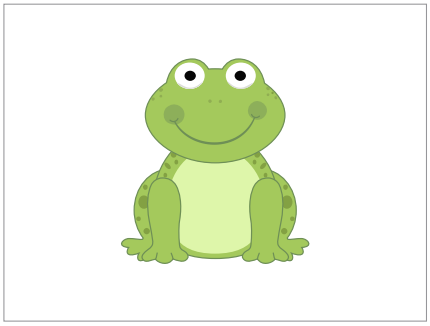
This Year 3 activity is based around three numerate frogs. Learners watch an animation that shows a frog jumping, and use simple combinations to work out onto which lily pads different frogs can jump. Then they solve a problem to find the number of spiders eaten by each of the three frogs.

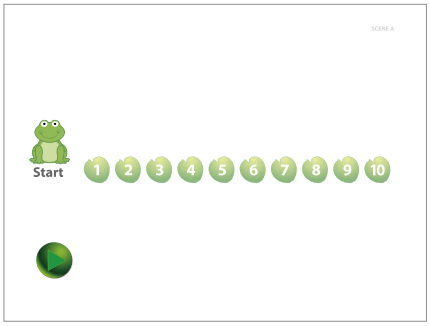
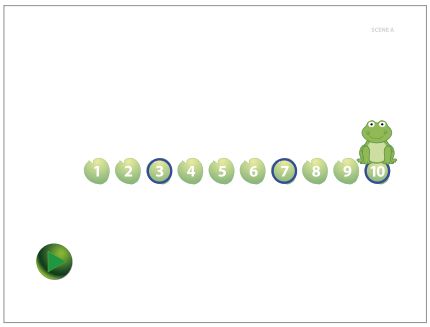
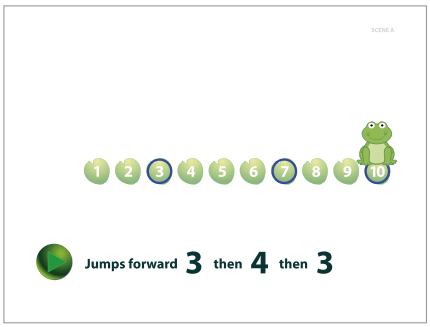
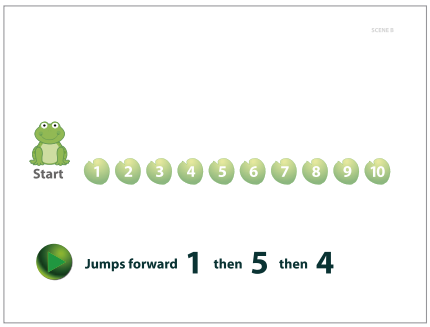
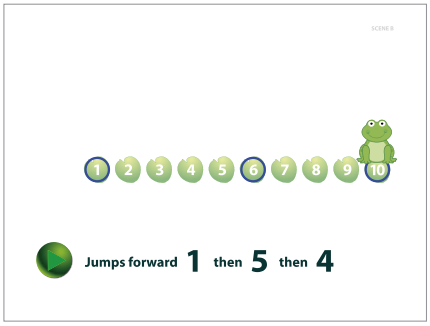
You will need

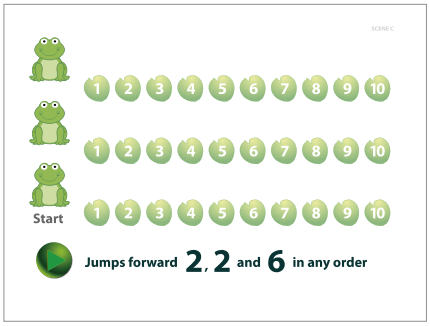
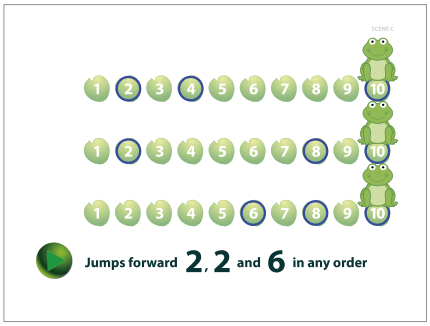
- **Teachers' script**
- **PowerPoint presentation**
- **Ffion the frog questions**
  Three pages for each learner, can be printed double-sided
- **Markscheme**

Presentation to be shown to learners before they work on Ffion the frog

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 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		This is Ffion the frog. She is very good at jumping!

Slide 3 with animation	  	*(From this point on, do not use the arrow keys on the computer, but navigate using the arrow buttons that appear on the screen.)* Ffion starts here *(point to her)* and jumps forward. Watch her jump forward … *(Click on the large arrow button to the left of the screen, and she will jump to 3. Then click on it again and she will jump to 7. Click again and she will jump to 10)* So, when she started, Ffion jumped forward 3 to land on lily pad number 3. Then she jumped forward 4 *(count out loud)* to land on number 7. How much did she jump forward then? That's right, she jumped forward 3 to land on 10 *(Now click on the arrow button again, and the text beneath the lily pads appears. Read it out loud, and then click on the arrow button again. An option to replay is given; unless necessary, ignore and click the button to move to the next scene.)*
Slide 3 animation continued	 	This time we can see that Ffion is going to jump forward 1, then 5, then 4 *(point to the relevant text)*. Which lily pads will she land on? *(Discuss and agree together that she will land on 1, then 6, then 10* *Now show the jumps by clicking to show each stage of the animation, saying out loud what is happening.* *Then click on the arrow button again. An option to replay is given; again, unless necessary, ignore and move to the next screen.)*

Slide 3 animation continued	 	Now Ffion is going to jump forward 2, 2 and 6 – but she can jump them in any order. There are 3 ways she can do this. Can you tell me about all 3? *(Encourage learners to discuss among themselves, and then ask for solutions, but do not discuss methods used.)* Well done! You have found all 3 different ways. Let's watch her … *(Repeated clicking reveals all 3 possible outcomes. As the frog moves, describe the move out loud, e.g. she jumps 6)* Now you are going to answer some questions about Ffion and how she jumps forward. 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. 15 minutes.)*

1

2, 3, 5

Ffion jumps forward 2, 3 and 5, in any order.

Show all the **different** ways she can do this.

One is done for you.

Start 1 2 3 4 5 6 7 8 9 10

Start 1 2 3 4 5 6 7 8 9 10

Start 1 2 3 4 5 6 7 8 9 10

Start 1 2 3 4 5 6 7 8 9 10

Start 1 2 3 4 5 6 7 8 9 10

Start 1 2 3 4 5 6 7 8 9 10

4m

2

Fred jumps forward 3 and 7, in any order.

How many **different** ways can he jump to 10?

1m

3

Flo jumps to 10 using jumps of the **same size**.

Show **different** ways she can do this.

Start 1 2 3 4 5 6 7 8 9 10

1m

Start 1 2 3 4 5 6 7 8 9 10

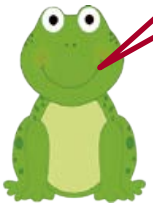
1m

4 Flo, Fred and Ffion eat spiders. 

Flo

Fred

I eat **2 more** than Flo.



Ffion

I eat **2 more** than Fred.

Flo, Fred and Ffion eat 30 spiders altogether.

How many spiders does each one eat?

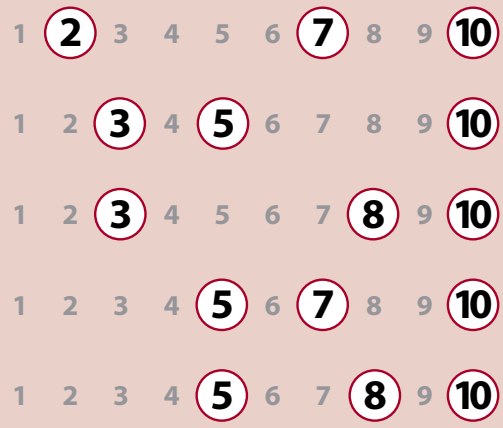
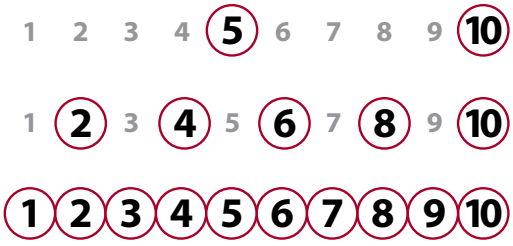
Flo eats _____ spiders.

Fred eats _____ spiders.

Ffion eats _____ spiders.

3m

Activity 1 – Ffion the frog – Markscheme

Q	Marks	Answer
1	4m	Shows all five remaining ways, in any order, i.e. 
	Or 3m	Gives any **four** different ways
	Or 2m	Gives any **three** different ways
	Or 1m	Gives any **two** different ways
2	1m	**2** Or Shows **7** and **3** in that order
3	2m	Any two of the rows below 
	Or 1m	Any one of the rows above

As 3 and 7 is given in the question, 7 and 3 is condoned as 2 ways are then identified, even if not explicitly

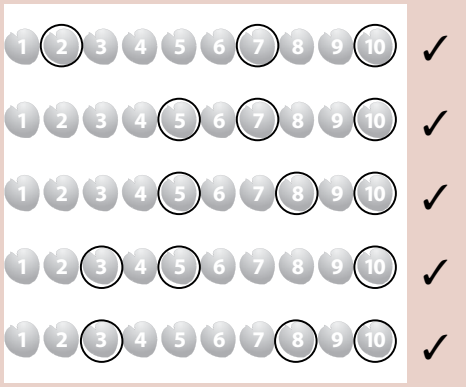
Activity 1 – Ffion the frog – Markscheme (continued)

Q	Marks	Answer
4	3m	All three correct, and in the right order, i.e. **8** **10** **12**
	Or 2m	Gives **8**, **10** and **12** but in an incorrect order Or Gives **10**, **12**, **14** or **6**, **8**, **10** Or Gives three values, all greater than 0, that **total 30** and the second value is **2 more** than the first, or the third value is **2 more** than the second, e.g. • 6 8 +2 16 • 4 12 14 +2
	Or 1m	Gives three values, all greater than 0, that **total 30** Or Gives three values, all greater than 0, and the second value is **2 more** than the first, and the third value is **2 more** than the second, e.g. • 2 4 +2 6 +2

Has recognised the significance of 10 and the difference of 2, but has forgotten that the total is 30

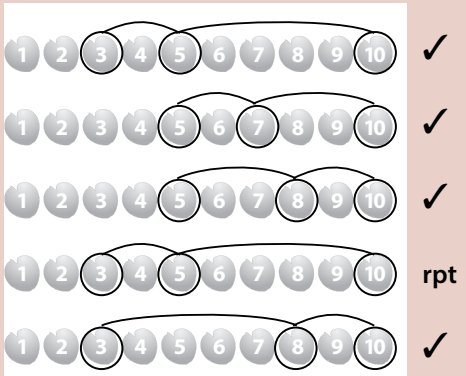
Activity 1 – Ffion the frog – Exemplars

Question 1



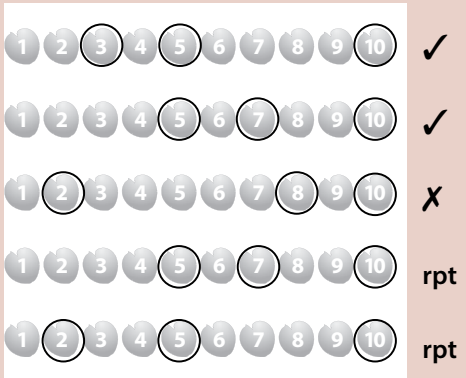
All five correct; **4 marks**

- This learner has a clear and effective system for generating the outcomes.



Four correct; **3 marks**

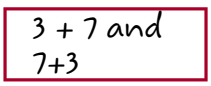
- 3, 5, 10 is repeated: 2, 7, 10 is omitted.



Two correct; **1 mark**

- 2, 8, 10 is incorrect.
- 5, 7, 10 is repeated and 2, 5, 10 is a repeat of the way shown within the question.

Question 2



Shows 7 and 3; **1 mark**

- Both ways are shown.

Incomplete; **0 marks**

- This learner has repeated the information given but has not identified the other way, 7 and 3

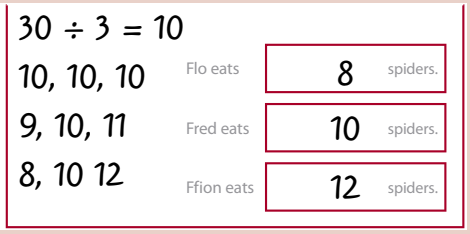
Question 3

One correct row; **1 mark**

- The use of crosses is unambiguous. The first row is correct but as the second row includes 1 it is incorrect.

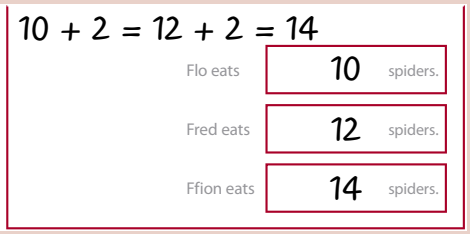
Activity 1 – Ffion the frog – Exemplars (continued)

Question 4

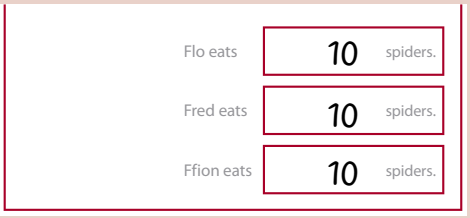


Correct; **3 marks**

- This learner shows a clear and effective method.

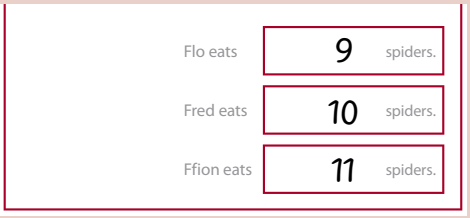


10, 12, 14; **2 marks**

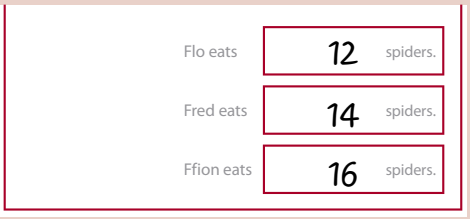


Total 30; **1 mark**

Common error This learner shows some understanding but does not engage with '2 more'.



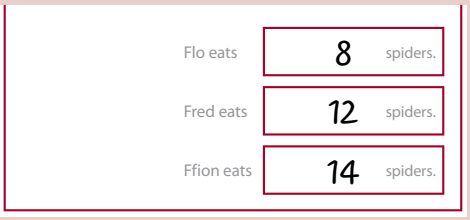
Total 30; **1 mark**



Two differences of 2; **1 mark**

Two differences of 2; **1 mark**

Common error This learner has ignored the word 'altogether'.



Incorrect; **0 marks**

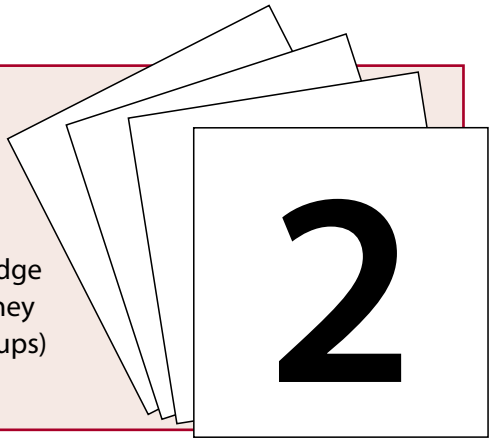
- The total is not 30 and only one difference of 2 is shown, so no credit can be given.

Activity 2

Frogs

Activity 2 – Frogs

Outline



This Year 3 activity continues the theme of frogs presented in **Activity 1 – Ffion the frog**.

Each group chooses one person to be their 'frog', then uses their knowledge of multiplication tables to decide whether their frog can move. Finally, they choose numbers that will allow their frog (but not the frogs of other groups) to move.

You will need

A large space, e.g. playground or hall

Chalk or masking tape

Teachers' sheet – Number cards

Activity 2 – Frogs

Explain

Mark a starting line in the playground, or other large space. Then ask each group to select a number at random from **Number cards**, and choose one of their group to be their first 'frog'. *(Emphasise that each learner will have a turn.)*

The frogs from each group stand on the line, with you standing an appropriate distance away. Tell learners they are going to race and the winning group will be the one whose frog reaches the finishing line *(you)* first. Call out a whole number that is 40 or less. Frogs can move if the number called is in the times table for the number on their card *(learners may need support to realise that times tables continue beyond 10 × or 12 ×)*. The group discusses then, if it is, tells their frog to move one toe-to-heel step towards you.

Repeat the game, but this time each group takes it in turn to call out a number of their choice. Each number can only be called once *(record as you go, to avoid dispute)*. Give learners time to decide what numbers to call.

Once a winner is found, discuss, using the questions below as a guide. Then repeat, to allow them the chance of improving their performance through the choice of numbers they call. *(Replace number 2 cards with different numbers – see questions below.)*

Repeat until each learner has had the opportunity to be a frog. At the end, discuss, again using the questions as a guide.

Question

- What is the best number card to have? *(Number 2, as the frog can then move every time an even number is called. Note: at the end of the first game, take the number 2 cards away and replace them with different numbers.)*
- If groups with number 4 move, who else must be able to move? Why? *(Groups with number 2 as the numbers must be even)*
- How did you decide which number to call? Do you think you made the right choices? Why/why not?

At the end of the game

- If you could have chosen any card other than number 2, which one would it be? Why? *(The smaller the number, the more multiples there are in the numbers from 1 to 40.)*
- What type of numbers could you have called to make sure groups with 2 or 4 could not move? *(Odd numbers)*
- What were the best numbers for your group to call? Why? *(If possible, a multiple that excludes other groups' numbers, e.g. for the group with number 5, 25 as that is not a multiple of any of the other numbers)*

Extension

- What would happen if the number 60 was called out? *(Every frog would move.)* Can you find another number that allows every frog to move at the same time? *(120 or any other multiple of 60)*

One card for each group.

If appropriate, numbers can be changed to allow for other multiplication tables (e.g. include number 6).

2	3	4	5
2	3	4	5

Activity 3

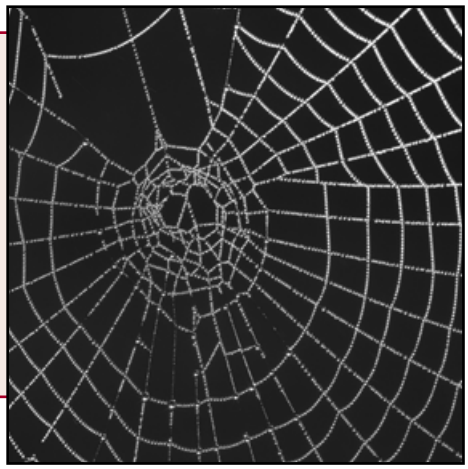
Perfect web

Activity 3 – Perfect web

Outline

This Year 3 activity connects loosely with the theme of frogs eating spiders from **Activity 1 – Ffion the frog**.

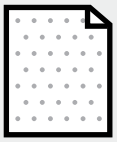
Learners explore the shapes within a real spider's web, then draw their own 'perfect' web, using as much geometric precision as they can, and again considering different shapes within their web. They also investigate a number pattern.



You will need

Whiteboard – Spider's web

Whiteboard – Perfect web



2cm triangular dotty paper/isometric paper
(freely available online, e.g. at http://lrt.ednet.ns.ca/PD/BLM_Ess11/pdf_files/dot_paper/iso_dot_2cm.pdf)

Rulers

Sharp pencils

Activity 3 – Perfect web

Explain

Remind learners that in **Activity 1 – Ffion the frog** the frogs ate spiders. But what do spiders eat? (*Spiders are also carnivores, e.g. they eat flies.)* Show **Spider's web** on the whiteboard, and if appropriate, explain how the spider creates its web to catch its prey. *(There are many websites that provide information, e.g. http://earthsky.org/earth/how-does-a-spider-spin-a-web-between-two-trees)*

Ask learners to look at the shapes within the spider's web. Point to one of the four-sided shapes that is clearly not a rectangle and ask why the shape is not a rectangle. (*Rectangles have two pairs of parallel sides and four right angles.)* Draw a trapezium  on the whiteboard to show the difference between a rectangle which has four right angles and a trapezium which doesn't. *(Be careful not to imply that a trapezium has no right angles as it can have two, e.g.*  *)*

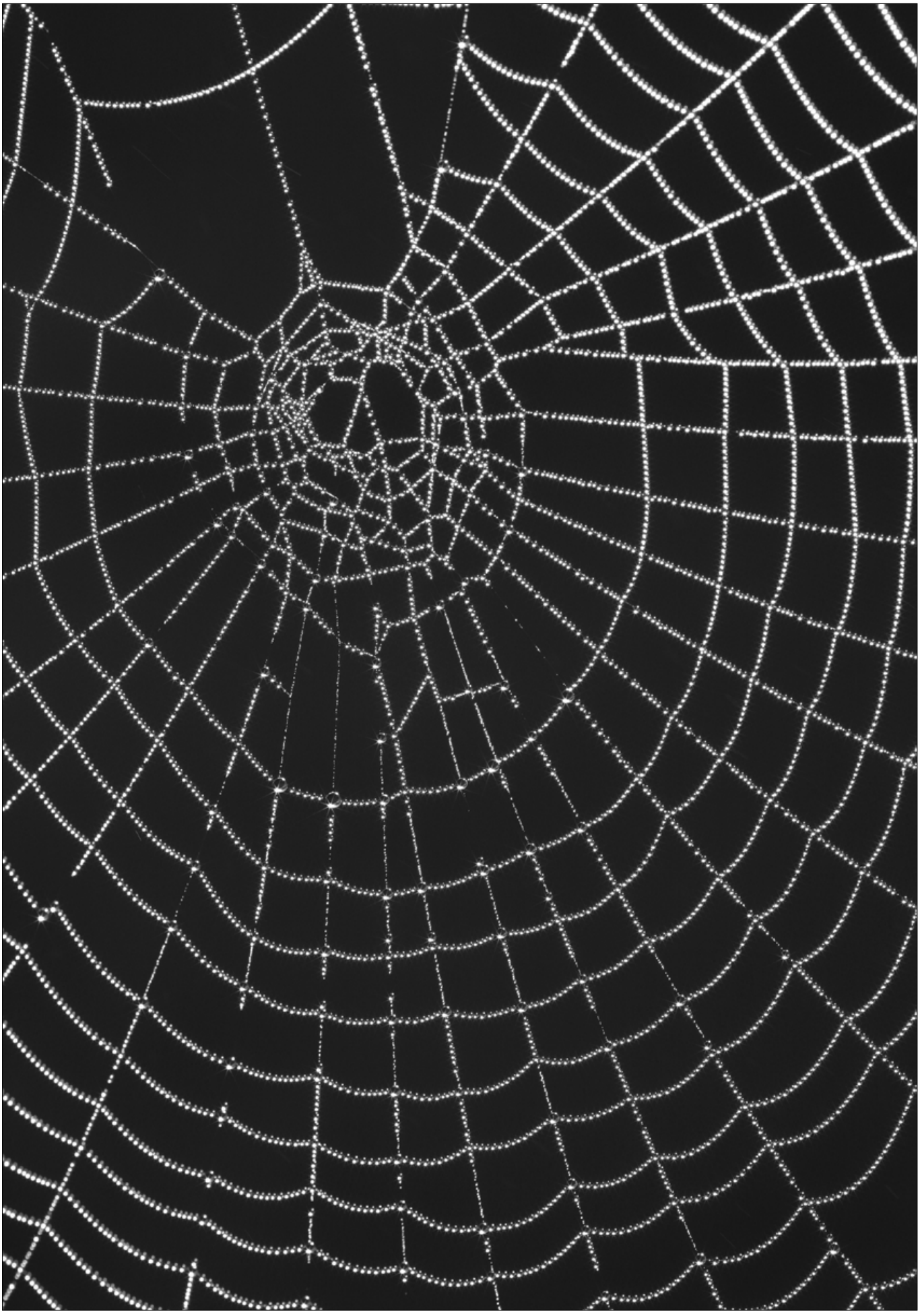
Explain that as a spider doesn't have a ruler, the shapes in its web are not 'perfect'. Tell learners they are going to make a 'perfect' web and show **Perfect web** on the whiteboard. Give each learner a sheet of 2cm triangular-dotty paper, a ruler and pencil. Ask them to put a dot to show the centre of their web, then encourage discussion on how to continue.

Once they have drawn their webs, ask them in their pairs/groups to explore what shapes they can see and colour in shapes if appropriate. Discuss, helping learners to see *(and name)* different sizes of hexagons, *(equilateral)* triangles, trapeziums and rhombuses *(diamonds)*.

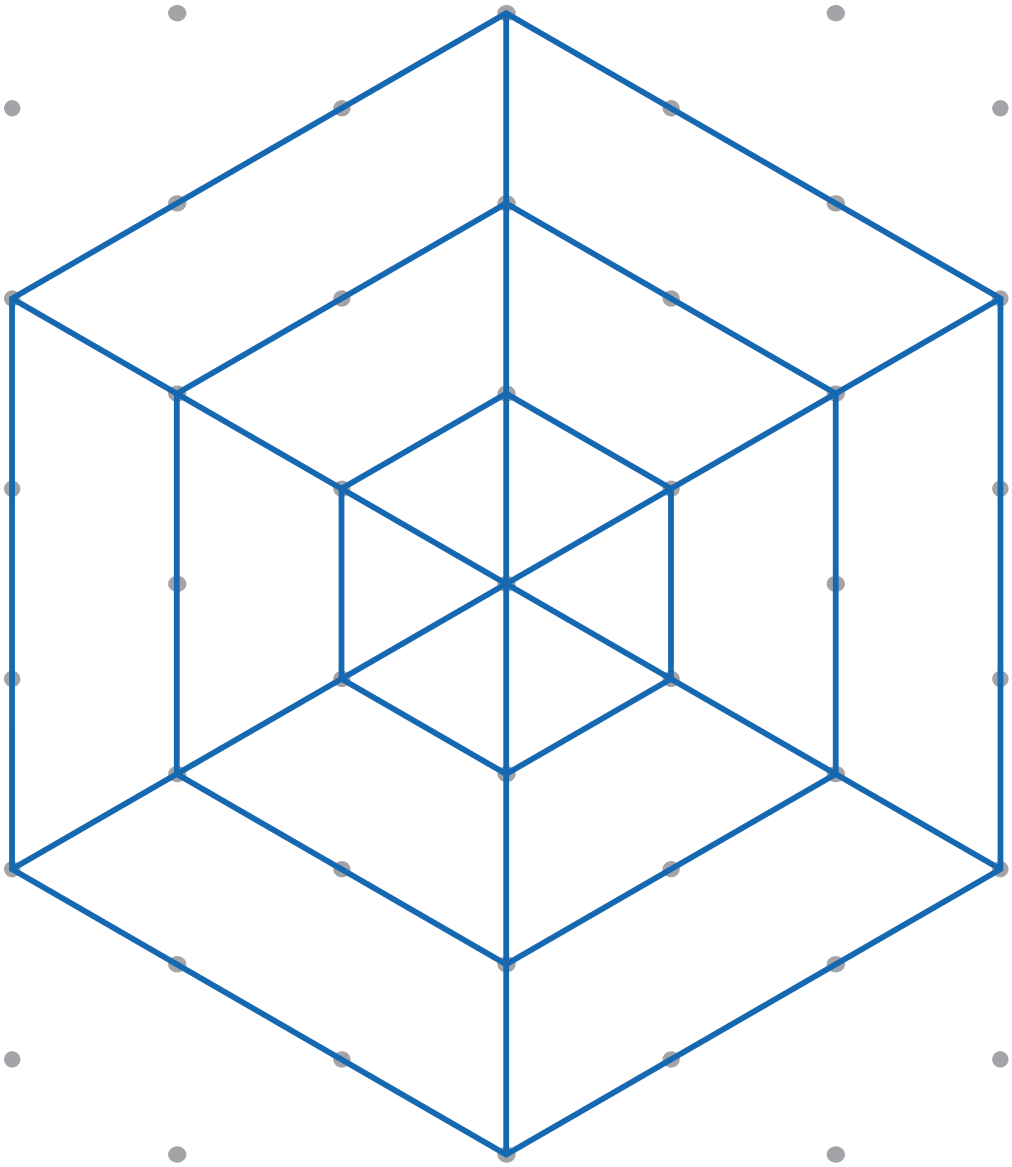
Finally, draw attention to the number of dots that can be seen on each 'ring'. The first ring has 6 dots. How many rings does the second ring have? *(12)* What about the third ring? *(18)* How many dots do learners think would be on the fourth ring, and why? *(24, because the number of dots increases by 6 each time a ring is added)*

Question

- What shapes can you see in the real spider's web? Can you see another . . . ? And another?
- Why do you think the spider doesn't spin its web *(the threads)* with perfectly straight lines? *(It doesn't need to and there needs to be flexibility.)*
- How can you start drawing your web? *(Join the dots to each other and to the centre.)* How can you make sure your lines are 'perfect'? *(Use a ruler.)*
- How can you make sure the rings of your web are 'perfect'? *(Count the number of dots along the radial lines.)*
- What shapes can you see in your web? How many . . . can you see? What else?
- How many dots would be in the fifth ring . . . or the sixth . . . or . . . ? How are you working out the answers?
- Which ring has 60 dots? How do you know? *(Learners can use their knowledge of the 10-times table – as $10 \times 6 = 60$ it must be the tenth ring.)*



WB

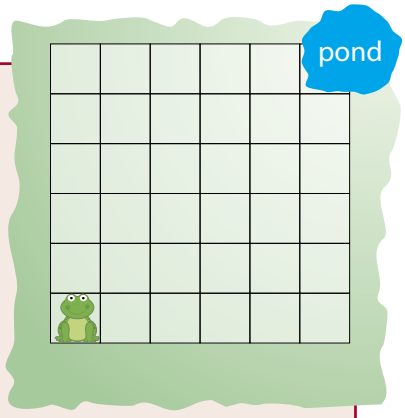


Activity 4

Zigzag leaps

Activity 4 – Zigzag leaps

Outline



This Year 3 activity continues the context of frogs leaping as introduced in **Activity 1 – Ffion the frog**.

In the real world, frogs leap in a zigzag pattern in order to confuse predators. Learners use this way of moving to help the frog reach the safety of a pond.

As this activity requires reuse of the resource sheet, it may be helpful for an adult to work with a small group of learners at one time.

You will need

Whiteboard – Zigzag

Resource sheet – Zigzag
One for each pair, laminated if possible

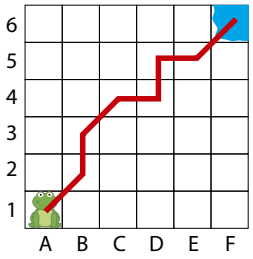
Activity 4 – Zigzag leaps

Explain

Remind learners of the way Ffion the frog leaps across the lily pads in **Activity 1 – Ffion the frog**. Explain that in the real world, when frogs are frightened, it is unusual for them to leap in a straight line; instead they zigzag in order to confuse predators. They cannot jump backwards.

Tell learners they are going to play a game to see how quickly their frog can zigzag across the land to the safety of the pond. Show **Zigzag** on the whiteboard and explain that this is the land the frog needs to cross. Show how each square can be identified using a letter followed by a number, and check understanding.

The frog must jump one square at a time, so where can the frog go on its first jump? *(A2, B1 or B2)* Choose one of these squares, then draw a line from the frog to that square. Now say that the frog must change direction. Where can it jump to now? *(For example, if it jumped from A1 to B2, it cannot jump to C3 as that continues the previous direction. And it cannot go back to A1 as this would entail jumping directly backwards, which it cannot do.)* Continue the frog's jumps until it reaches safety on square F6.

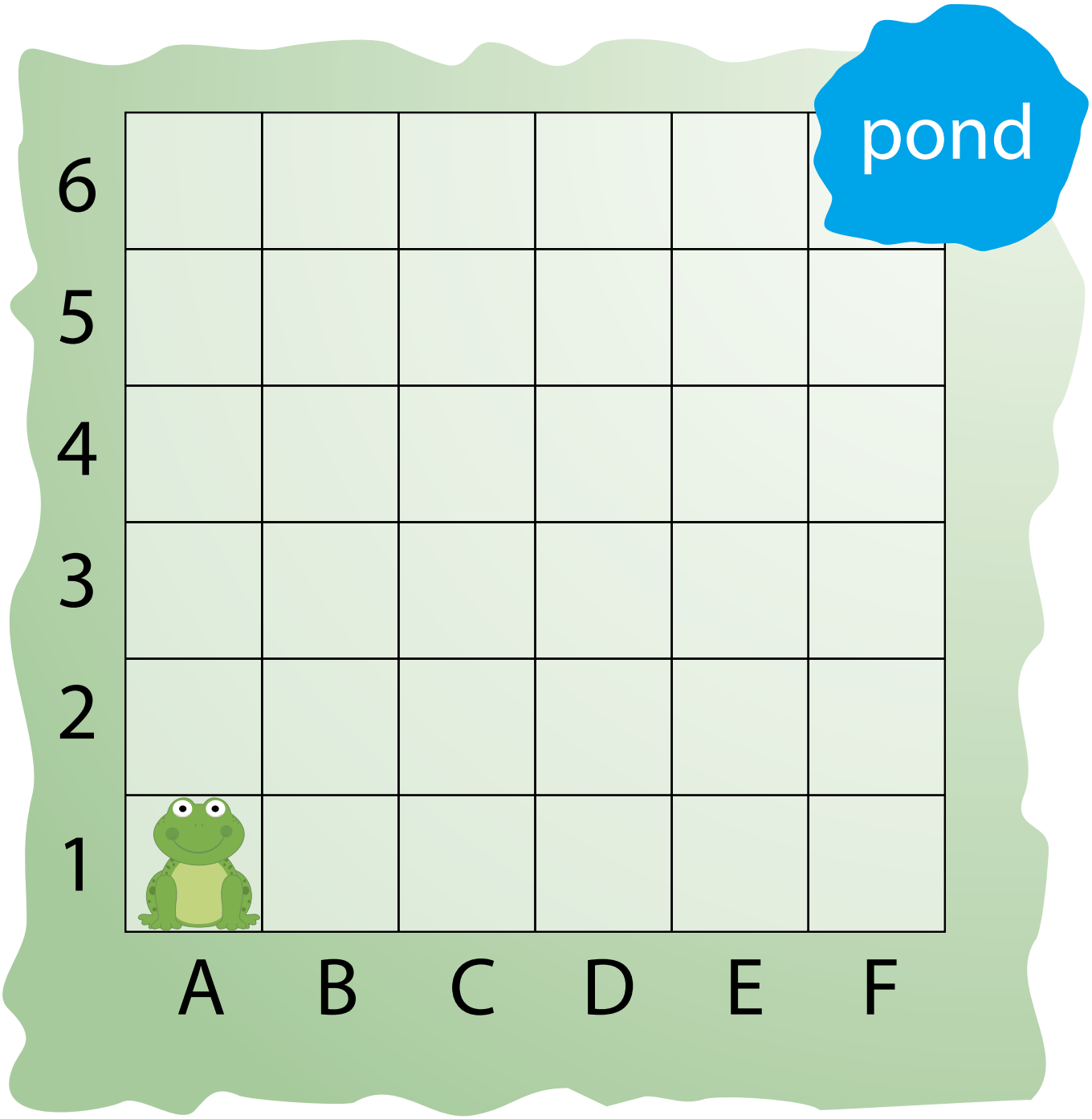


Now give each pair/group a laminated copy of **Zigzag**. Ask them to create a different route for the frog to jump from A1 to the pond. Then ask learners to count how many jumps their frog has made, and compare across the class. Explore which is the quickest route *(there are several)* and the minimum number of jumps needed *(seven)*, e.g.

Now introduce the rule that the frog can jump up to two squares in the same direction at any one time – now what is the minimum number of jumps needed? *(Four, e.g. C3, E3, E5, F6)* Once the class has compared their solutions, ask them to find a route that takes exactly five jumps, or six, or . . .

Question

- In real life, why is it harder for a bird to catch a frog if it is zigzagging rather than jumping in straight lines? *(The bird can't predict where the frog is going next, and it might find it harder to change direction as quickly as the frog.)*
- Why do we use letters and numbers on the grid? *(So that each square is unique)*
- *(When the frog is only jumping one square at a time)* If your frog is in the middle of the grid, how many squares can it jump to next? (*There are eight adjacent squares, but one entails the frog jumping directly backwards, and one is in the same direction as it has come from, so six.)*
- If your frog jumps from this square *(point)* to this one *(any two jumps that create a right angle, e.g. D4 to E4 to E5)* what turn has it made? *(A quarter-turn)* Do you know another name for that? *(Right angle)*
- How can you quickly change a route that has four jumps to one that has five jumps? *(Replace a diagonal with a horizontal line and a vertical line.)*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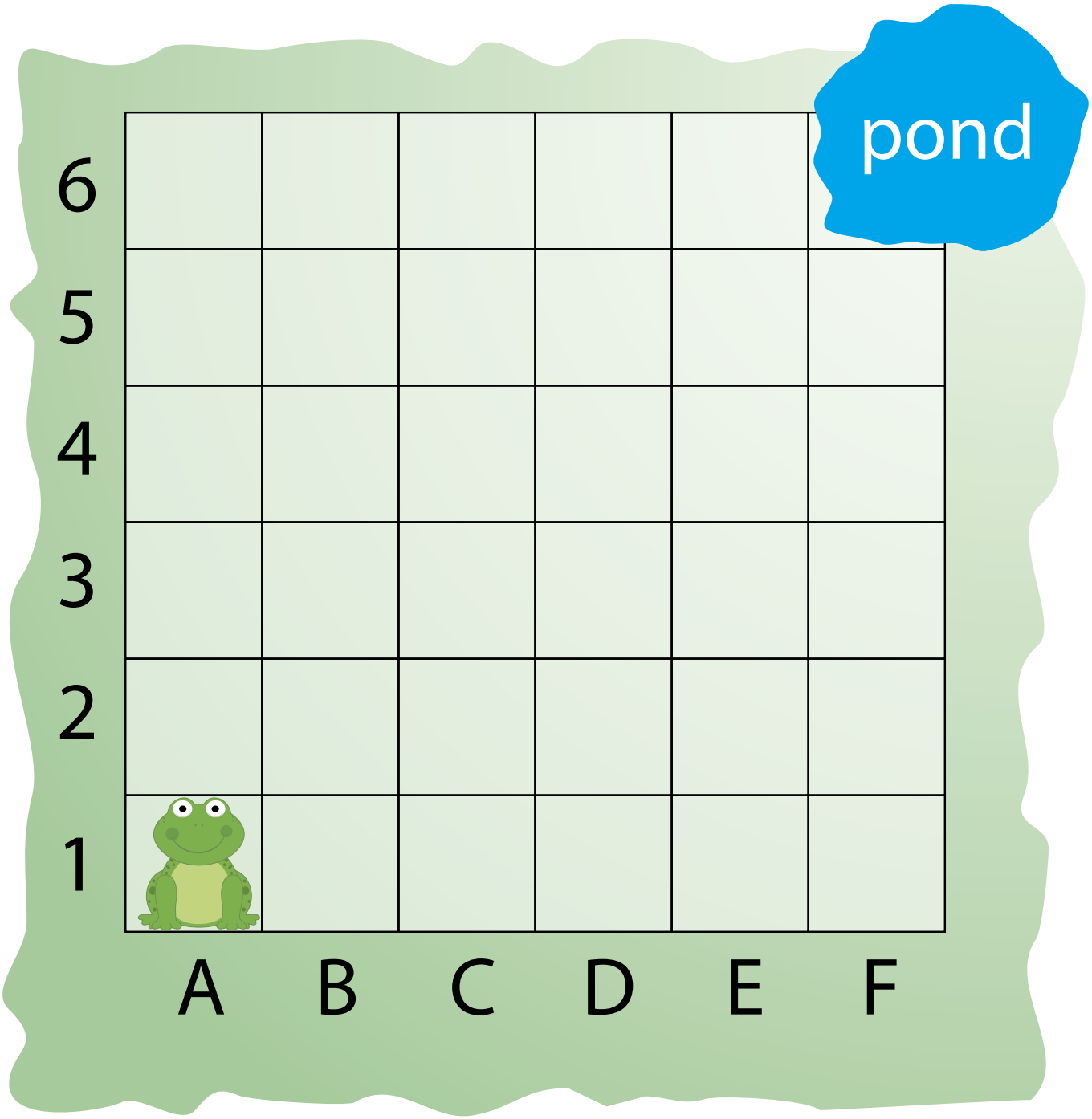
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