Cubetto in the Sea - Unit 1

Year 1, Ages 5 to 6, UK National Curriculum

Subjects covered:

Number: Counting / Addition and Subtraction

Position and Direction

Measures

Problem Solving

Materials required:

6x Cubettos

6x Boards

6x Sets of Blocks

6x Ocean Maps

Resources provided:

Squid square

Octopus square

Octopus counting template

Tinkering techniques

'How do we send messages?' pictures

Alphabet code breaker worksheet 1-2

Correct 'H' algorithm

Submarine template

'Through the window' example

Algorithms

Treasure chest squares

Pirate algorithm

'Treasure Map Coordinate' worksheet

'Sea snake' worksheet

'Sea snake' template

Bridge model examples

Home square

'Which way?' activity sheet

Example algorithms

Party square

Under the sea headband example

Submarine race worksheet

Introduction

The Cubetto Playset is a Montessori inspired coding toy that allows children ages 3 to 6 to program a friendly wooden robot without screens and is powered by a programming language you can touch.

New technology can sometimes be overwhelming to understand and adopt. The activities contained in this guide were created by educators for educators.

We want to make it simple for you to integrate the Cubetto Playset and its tangible programming language into your teaching.

Development and learning in other key areas

Beyond coding

The collaborative nature of Cubetto makes it an extremely versatile tool for the classroom. Cubetto fosters learning in key development areas that go beyond programming.

Communication

Children practice listening through a range of stories and narratives in relation to Cubetto, accurately anticipating key events and responding with comments, questions or actions. They also develop their own narratives and explanations.

Dexterity

Children develop coordination in large and small movements around the playset. They negotiate the placement of obstacles around the world map and place blocks on our tangible interface.

Social-Emotional

Children become confident by trying new, open-ended activities that remove “wrong” outcomes, and easily encourage group work. The open nature of the maps allows them to choose the resources they need for their play session.

Mathematics

Children add and subtract blocks to a sequence. They solve problems, including doubling and halving to get Cubetto from A to B. They discuss size, shapes and patterns, distance, position, and time to solve problems.

Logical reasoning

The blocks allow children to create and debug simple programs with their hands. They use technology purposefully to create, organise, store, manipulate and retrieve meaningful sequences.

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Introducing the Playset

Introducing Cubetto

Introduce Cubetto as a friendly robot that children can program. Children should be told that Cubetto cannot think for himself, and can only move as programmed by the child, just like any other machine. If in a group setting, sit children in a circle, and allow them to pass Cubetto around to one another, saying hello or acknowledging the presence of the object.

Doing so forms a bond with Cubetto, in the same way they would with a stuffed animal, or a toy, and solving problems through narratives later on is more engaging.

Introducing the Board

Introduce the Board as a remote control that children can use to send instructions to Cubetto.

Without the Board, there is no way of sending Cubetto his instructions.

It is important for children to understand Cubetto is only able to move with a human's command. This is not only empowering, but also key to understanding computing.

Encourage children to also explain what other objects in their homes and lives function within a similar paradigm. A television needs a human to change its channels for example, or a washing machine needs a human to select its settings.

These examples, like Cubetto, are machines that need human programming to do their job.

Introducing the Blocks

Introduce the Instruction Blocks as the directions Cubetto follows when inserted in the Board and sent by pressing the action button.

Different Blocks represent different instructions, and an unambiguous, distinct command. These Blocks are what make up Cubetto's hands on coding language, and are key in the learning of computational thinking.

When each block is inserted in the Board, a child should be encouraged to predict what Cubetto will execute before pressing the "Go" button.

This is key in understanding concepts like program design, and it helps develop abstraction.

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Unit 1 Overview

Year 1

By the end of the unit pupils will be able to:

- Create and debug a simple algorithm and use logical reasoning to predict the behaviour of simple programs.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
NC Computing Objectives	To write a simple program	To write a simple program	To debug and test a simple program	To debug and test a simple program
Outcomes	• I can use the negation block • I can count in 2s and 4s	• I can use the backward block • I can solve maths problems	• I can debug an algorithm • I can describe full, quarter and half turns	• I can debug and test an algorithm • I can give coordinates
Cross-curricular Subject	Number: Counting/Addition and Subtraction	Number: Counting/Addition and Subtraction	Position and Direction	Position and Direction
Computational Thinking	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging
Main Activities	Cubetto's Octopus Opposites! 1. Cubetto is visiting some underwater friends! Take some 'tinkering time' to work out how the negation block works. 2. Make a Counting Octopus!	Cubetto's Messy Message! 1. Cubetto is stuck on a desert island. Use the backward block to write a 'H' for 'HELP'! 2. Use addition and subtraction to read a secret message.	Cubetto's Silly Submarine! 1. Silly Submarine keeps getting lost! Program a Cubetto to rescue the other. 2. Write instructions to save Silly Submarine.	Cubetto's Crazy Coordinates! 1. We've found a secret algorithm for the pirates' hidden treasure! Test out which blocks are missing. 2. Find the coordinates of places on a map.
Challenge	Can you use the opposite block to get Cubetto back to his starting place?	Can you write an 'E' using Cubetto?	Can you use the function block to make the Rescuer use fewer blocks?	Can you give your partner treasure coordinates for them to move Cubetto?
Creative Play	Create 'Hand Fish' and decorate the map.	Write messages in trays filled with shaving foam and take pictures.	Create a 'through the window' submarine scene.	Create a treasure chest.
Resources	Squid square, Octopus square, Octopus counting template, Tinkering techniques, Coloured paper/card, Lollipop sticks, Felt tips, Scissors, Sequins/buttons	'How do we send messages?' pictures, Alphabet code breaker worksheet, Correct 'H' algorithm, Pens, Masking tape, Large plain paper sheet, Number lines, Counters	Submarine template, 'Through the window' example, Algorithms, Pens and paper, Paper plates, Craft materials including plastic	Treasure chest squares, Pirate algorithm, 'Treasure Map Coordinate' worksheet, Play coins, 'Top secret' box, Coloured card, Art materials
Assessment	Photos, Counting activity, Verbal statements, Observation	Drawings on paper, Worksheet, Verbal statements, Observation	Photos, Verbal statements, Observation	Photos, Treasure map, Verbal statements, Observation

	Lesson 5	Lesson 6	Lesson 7	Lesson 8
NC Computing Objectives	To write an algorithm	To write an algorithm	To debug a simple program	To create and debug a simple program
Outcomes	• I can solve a problem using programming • I can measure length in centimetres	• I can solve a problem using programming • I can solve problems involving length	• I can debug a simple algorithm • I can solve an open-ended problem	• I can debug and test a simple algorithm • I can solve an open-ended problem
Cross-curricular Subject	Measurements: Length	Measurements: Length	Problem Solving	Problem Solving
Computational Thinking	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging	Logic & Algorithm/Tinkering, Collaborating & Debugging
Main Activities	Cubetto's Pirate Prisoner! 1. Cubetto has been captured by pirates! Measure the string tying it to the pirate ship to decide who can save Cubetto. 2. Measure sea snakes in cm.	Cubetto's Broken Bridge! 1. Cubetto's bridge is broken! Plan a route then program Cubetto to get to safety. 2. Measure and make a bridge strong enough for Cubetto.	Cubetto's Double Trouble! 1. Two Cubettos need to work together to transport the fish across the map. Debug the algorithm. 2. Work out every route mini Cubetto can take.	Cubetto's Queue 1. Debug the random block to get three Cubettos to the underwater festival in time! 2. Compete in pairs adding up three dice to win the submarine race!
Challenge	Where could Cubetto get to if he had 80cm of string?	Where else can Cubetto travel? How long does the bridge need to be?	Can you use the function block to move Cubetto further?	Can you program the Cubettos to change order?
Creative Play	Make a hanging sea snake.	Create a pop-up island scene.	Make scaled, coloured paper fish.	Make under the sea themed festival hats!
Resources	'Sea snake' worksheet, 'Sea snake' template, 'Under the sea friend' squares (Lesson One), Toy boat, Felt tips, Coloured card, String, scissors & sticky tack	Bridge model examples, Images of bridges around the world, Rulers, tape & lollipop sticks, 3D cubes to make a bridge for Cubetto,	Home square, 'Which way?' activity sheet, Example algorithms, Paper plates, Coloured paper, Glue, ruler, Plastic fish/sea life	Party square, Under the sea headband example, Submarine race worksheet, Mini whiteboards, Dice and coloured pens, Coloured card, Glue, Scissors
Assessment	Photos, Worksheet, Verbal statements, Observation	Photos, Bridges, Verbal statements, Observation	Photos, Worksheet, Verbal statements Observation	Photos, Worksheet, Verbal statements Observation

Lesson 1: Cubetto's Octopus Opposites! (1 of 2)

Cross-curricula Area: Maths Numbers: Counting

NC Objectives

To write a simple program

Outcomes

- I can use the negation block
- I can count in 2s and 4s

Resources Needed

- Coloured paper/ card
- Lollipop sticks
- Felt tips
- Scissors
- Sequins/buttons/ beads

Prep Needed

- Copy and cut out 'under the sea friend' squares and place on map.
- Copy 'octopus counting sheet'.

Resources Provided

- 'Under the sea friend' squares
- Octopus square
- Octopus counting template
- Tinkering techniques

Key Vocabulary

- Negation
- Test
- Reason
- Create
- Tinkering

Computational thinking concept

Logic

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Show the children (or read if available) 'Commotion in the Ocean': www.youtube.com/watch?v=1n9KGqlwX_8
2. Introduce the Ocean Map and encourage children to discuss what they can see: "I can see /I spotted ".
3. Tell pupils they will be using their numeracy skills to help Cubetto on his adventures, this time under the sea!
4. Use the Splat 100 board to recap counting in 2s and 4s with pupils. 'Splat' a multiple of 2/4 and ask the children to count on. www.primarygames.co.uk/pg2/splat/splatsq100.html
5. Ask: What other animals and creatures might we see under the sea? Discuss and give feedback on pupils' ideas. Record ideas on whiteboard.
6. Place octopus on map and ask: How many legs does an Octopus have? How many legs will 3 octopuses have? Model counting in 2s/4s.
7. Explain that today Cubetto is going on a journey across the ocean floor to visit some squid friends. NB: Opportunity to explain that octopuses and squids are both Cephalopods.

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Lesson 1: Cubetto's Octopus Opposites! (2 of 2)

Creative Play

Create a 'Hand Fish'!

Guided Activity

1. Place Cubetto on D6, with the octopus and squid nearby. Ask: How could we get Cubetto to visit one of his underwater friends?
2. Allow time for pupils to test out their ideas.
3. Show the negation block and ask: What do you think this block does? Why? How do you know? How can we test what it does?
4. Children are given 'tinkering time' to play with the blocks and feedback their solutions to the class. Model using techniques
5. Explain that the negation block makes Cubetto do the opposite of the block before. Ask: What is the opposite of left? How about forward?
6. Model using the negation block to get Cubetto to move towards the octopus.
7. Ask children to write an algorithm to get to either the octopus or squid using the negation block.

Independent Activity

1. Look at the example octopus counting sheet. How many sequins are on the first leg? What about the second leg?
2. Cut out your octopus and its legs, then colour in the pieces.
3. Count one sequin and stick this to the first leg.
4. Continue counting out numbers up to 8 and sticking on the sequins to make a Counting Octopus.

Challenge

Can you talk about how Cubetto moves?

Plenary and Assessment

1. Display some 'negation' instructions for children to work out the correct movement (e.g, using the negation block, left, backwards, right = right, forwards, left).
2. Ask: Can you give your partner negation instructions to work out? Why is the negation block useful?
3. Ask volunteers to share their Counting Octopus sheets and count in 2s/4s with the class.

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Lesson 2: Cubetto's Messy Message (1 of 2)

Cross-curricula Area: Maths: Numbers: Addition & Subtraction

NC Objectives

To write a simple program

Outcomes

- To use the backward block
- To use addition and subtraction to solve a problem

Resources Needed

- Pens
- Masking tape
- Large plain paper sheet
- Number lines
- Counters

Prep Needed

- Copy 'How do we send messages?' pictures.
- Attach a pen to Cubetto.
- Test out algorithm to write 'H'

Resources Provided

- 'How do we send messages?' pictures
- Alphabet code breaker worksheet
- Correct 'H' algorithm

Key Vocabulary

- Message
- Minus/plus
- Algorithm
- Backwards

Computational thinking concept

Algorithms

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Tell the class that you think that the sky will be green tomorrow. Collect their reactions. Ask: Why don't you agree?
2. Explain that we use what has happened before to tell us what will happen in the future. This is called predicting.
3. Ask: Can you think of something you can predict will happen? (E.g. If you are hungry and you eat, then you will feel better.)
4. Show the board with one red block to the class. Ask: What do you think will happen when we press the action button?
5. Ask a volunteer to complete the sentence based: "If I use a __ block, I predict that Cubetto moves __."
6. Today the class will be thinking about feelings: what makes us feel certain things and how our face shows our feelings.
7. Introduce the map. Ask: Where on the map do you think Cubetto feels happy? Collect ideas e.g. Cubetto feels happy in the desert because it's quiet. Repeat for where it feels sad e.g. Cubetto feels sad in the mountains because it's cold.
8. Decide as a class on how Cubetto feels in the sea, in the grass, in the city and in the desert, and why.
9. Write these up, modeling drawing the happy/sad face next to the relevant square e.g. sand = sad; grass = happy. (Optional: use mirrors to explore what pupils' faces look like with different feelings, including your eyebrows, mouth and eyes).
10. Explain that their task is to move Cubetto around the map to the places it feels happy or sad. When it arrives, change its face!

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Lesson 2: Cubetto's Messy Message (2 of 2)

Creative Play

Write messages in trays filled with shaving foam and take pictures.

Guided Activity

1. Show first four blocks of algorithm spelling letter 'H' (keep this a secret!) and explain that Cubetto is trying to draw a letter!
2. Ask: What letter do you think Cubetto is trying to write?
3. Place Cubetto with pen attached on plain paper and run the algorithm. Algorithm will begin a 'H', then stop.
4. Explain Cubetto was trying to write a 'H'. Ask: What word could he be trying to tell us? "H for HELP, HOME, HUNGRY?"
5. Put children in groups of five and explain that the first four blocks are correct but they need to write the rest of the algorithm.
6. Allow time for trial and error. Use 'Halfway there' tinkering technique (see Lesson One).
7. Model writing down all of Cubetto's movements in a sequence and using this to finish the algorithm.
8. Run groups' algorithms on plain paper and discuss.

Independent Activity

1. Look at the 'alphabet code breaker' worksheet.
2. Use addition and subtraction to work out each maths question.
3. When you have an answer, find the number in the code, then the letter above it.
4. What word do the letters spell? What is Cubetto trying to tell you?

Challenge

Can you write an 'E' using Cubetto?

Plenary and Assessment

1. Ask volunteer groups to share their algorithm spelling the letter 'H': place Cubetto on a large sheet of paper, then run.
2. Ask: What other letters could Cubetto write? What words would Cubetto be trying to tell us?
3. Ask: Why is the backward block useful? How did you use it? What else could we use the backward block for?

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Lesson 3: Silly Submarine! (1 of 2)

Cross-curricula Area: Maths Position & Direction

NC Objectives

To debug and test a simple program

Outcomes

- I can debug an algorithm
- I can describe full, quarter and half turns.

Resources Needed

- Pens and paper
- Paper plates
- Craft materials including plastic

Prep Needed

- Copy and stick the submarine templates to two Cubettos. Label one 'Silly' and the other 'Rescuer'.
- Prepare example algorithms

Resources Provided

- Submarine template
- 'Through the window' example
- Algorithms

Key Vocabulary

- Quarter turn left/ right
- Submarine
- Rescue
- Bug
- Debug
- Fix
- Algorithm

Computational thinking concept

Algorithms

Computational thinking approach

Tinkering

Teacher-led Introduction

1. Use www.iboard.co.uk/activity/Shape-Rotator-117 to recap full, quarter and half turns (left and right).
2. Play 'Cubetto says' with turns (e.g. "Cubetto says take a quarter turn left").
3. Explain that Cubetto needs the pupils' help with his quarter turns today as he's got all muddled up! He's inside a submarine to go underwater.
4. Ask: What is a submarine? Option to show photos/video. Can you find the submarine on Cubetto's map?
5. Explain that Cubetto's 'Silly Submarine' keeps getting lost! One of Cubetto's friends is going to rescue it in another submarine!
6. Introduce two Cubettos: Silly Submarine and the Rescuer. Explain that the Rescuer only travels forwards and backwards, scanning the sea floor for people needing help.
7. Recap what debugging means and ask pupils to share how they have fixed other algorithms before.

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Lesson 3: Cubetto's Holiday (2 of 2)

Creative Play

Create a 'through the window' submarine scene.

Guided Activity

1. Place the Rescuer facing South on the pirate square. Run the algorithm and watch it go forward and backward.
2. Place Silly Submarine on C6 (or other) and run algorithm. Ask: What is Cubetto doing? Discuss.
3. Explain that the Rescuer needs to get to Silly Submarine. Ask: How could we debug the Rescue algorithm
4. to get the Rescuer to Silly Submarine?
5. Use tinkering techniques (e.g. At which block does Rescuer Cubetto need to change direction?).
6. Allow time for pupils to explore.
7. Ask children to present algorithms and solutions to the group.

Independent Activity

1. Look at the Board with the Rescuer algorithm blocks.
2. Can you write instructions in words for Rescuer Cubetto to follow?
3. Use these words: forward, backward, full, quarter and half turn.

Challenge

Can you use the function block to make the rescuer use fewer blocks?

Plenary and Assessment

1. Ask: What does debug mean? What bugs did you find today?
2. Ask: How did you debug the Rescuer's algorithm? Which blocks did you change? What did you find easy/difficult?
3. Ask: How could we make Cubetto move a quarter turn left? Repeat for other directions, testing out blocks in turn.

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Lesson 4: Cubetto's Crazy Coordinates (1 of 2)

Cross-curricula Area: Maths Position & Direction

NC Objectives

To debug and test a simple program

Outcomes

- I can debug and test an algorithm
- I can give coordinates

Resources Needed

- Play coins
- 'Top secret' box
- Coloured card
- Art materials

Prep Needed

- Laminate treasure chest squares and place on map.
- Copy 'Treasure Map Coordinate' worksheet.
- Make 'pirate algorithm' on Board.
- Prepare 'top secret' box big enough for Primo Board and place Board inside.

Resources Provided

- Treasure chest squares
- Pirate algorithm
- 'Treasure Map Coordinate' worksheet

Key Vocabulary

- Coordinates
- Algorithm
- Bug/Debug
- Direction
- Route
- Treasure

Computational thinking concept

Logic

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Tell the children they're going to play a game: 'Under the sea battleships' using the map.
2. Show a large version of the map and explain that the children need to use coordinates to compete against you.
3. Point to the letters across the top of the map, and the numbers down the side.
4. Model finding the treasure chest coordinates by tracing up to E and along to 2: E2.
5. Ask class to work in pairs to find the coordinates of the submarine. Choose a pair and discuss.
6. Place the treasure chest images on the map at random and explain that children will compete against you to find the coordinates of each picture. Each time the coordinates are correct, you win one coin!
7. Play the game, taking it in turns with the children to give correct coordinates and hand out coins. Whoever has the most wins!
8. Ask: What are coordinates used for? Why are they useful? Coordinates help us describe where things are on a map.

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Lesson 4: Cubetto's Crazy Coordinates (2 of 2)

Creative Play

Create a treasure chest.

Guided Activity

1. Ask child to open the 'top secret' box and take out the Primo Board, identifying the blocks on the Board.
2. Explain that the algorithm is a pirate's top secret algorithm for where they have buried their treasure!
3. Ask: What do you notice about this algorithm? Do you think this will work? Why/why not?
4. Model using sentence stems, "I know that Cubetto will move " then, "This algorithm won't work because ".
5. Ask: What is the bug in this algorithm? Missing blocks. How could we fix this?
6. Tell the children that they are going to debug and test this algorithm many times to find out where the treasure might be. Explain that they will work just like computer programmers who run lots of tests to check for bugs.
7. Allow time for children to work in pairs starting at the pirate square, trying out different combinations of blocks and with Cubetto facing in different directions.
8. Before the children run an algorithm, they must place the treasure chest square where they think the treasure could be.

Independent Activity

1. Look at the treasure map sheet.
2. Can you find the blue lagoon? Point at the lagoon and trace your finger up until it hits a letter. Go across to find the number.
3. Write the letter and the number in the spaces underneath.
4. Repeat with the other places on the map.

Challenge

Can you give your partner treasure coordinates for them to move Cubetto?

Plenary and Assessment

1. Ask: Where do you think the treasure could be? Ask volunteers to share their ideas for where it could be buried.
2. Hint: the treasure is not in the sea but on an island. Pupils have to guess the location.
3. Establish that the treasure is on the desert island and ask: What are the missing blocks we need?
4. Demonstrate the algorithm to find the treasure!
5. Ask: What are the coordinates of the buried treasure? How do we find coordinates?

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Lesson 5: Cubetto's Pirate Prisoner! (1 of 2)

Cross-curricula Area: Maths: Measurements - Length (cm)

NC Objectives

To write an algorithm

Outcomes

- I can solve a problem using programming
- I can measure lengths in centimetres

Resources Needed

- Toy boat
- Felt tips
- Coloured card
- String, scissors & sticky tack

Prep Needed

- Wrap Cubetto in 60cm of string with one end tied to a toy boat.
- Cut out three squid squares (Lesson One) and place on map
- Copy 'sea snake' sheet.

Resources Provided

- 'Sea snake' worksheet
- 'Sea snake' template
- Squid and Octopus squares (Lesson One)

Key Vocabulary

- Length
- Centimetres
- Distance
- Measure

Computational thinking concept

Algorithms

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Recap units of measurement for length. Ask: What would you like to measure in the room? What can we use to measure it?
2. Discuss different methods for measuring length: rulers, tape measures, metre sticks, wheel rollers.
3. Use the 'comparing lines activity': www.iboard.co.uk/activity/Comparing-Lines-cm-269 to compare length.
4. Model reading the scale accurately in cm and writing the length clearly on the board.
5. Display a squiggly sea snake and ask: How would we measure this? What could we use? Children discuss and feedback ideas.
6. Model carefully using a piece of string to trace the shape of the snake, then cut the string.
7. Ask for a volunteer to measure the string using their item of choice and to tell the class how long the snake is.

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Lesson 5: Cubetto's Game (2 of 2)

Creative Play

Make a hanging sea snake.

Guided Activity [two Cubettos and boards will be needed per game]

1. Announce that Cubetto has being taken prisoner by some pirates! The pirates found out about us trying to find their treasure (reference previous lesson) and have kidnapped Cubetto!
2. Place boat on pirate square and show Cubetto tied up. Explain that one end is tied to the ship so he can't move far.
3. Explain that the only way for Cubetto to escape is to try and get to one of his squid friends on the map to help pull Cubetto free.
4. Tell the children that they need to write an algorithm that gets Cubetto to one of the squids.
5. Ask: What are some of Cubetto's problems? How far can Cubetto move? Are there any other ways to make Cubetto move further?
6. Encourage children to explore if the string could be unwound (but can't be untied completely) to let him move a bit further.
7. Ask: How can we solve this problem? Which squid do you think Cubetto can try to get to? Children discuss and feedback ideas.
8. Use open-ended questions and discussion to lead children towards these steps:
9. Measure how long the string is.
10. Work out which friend Cubetto can get to.
11. Use tinkering techniques to write an algorithm to get Cubetto to a friend, without rocking the boat/breaking the string.

Independent Activity

1. Look at the sea snakes on the sheet.
2. Can you work out how long the first snake is? Try using sticky tack to stick one end of the string to the snake's head to help you.
3. Straighten string and measure using a ruler, then record in cm.

Challenge

Where could Cubetto get to if he had 80cm of string?

Plenary and Assessment

1. Ask: What problem did we help Cubetto solve today?
2. Ask volunteers to say which squid helped Cubetto escape and ask them to share their algorithms.
3. Ask: How did you know how far to go? Which friend was closest?

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Lesson 6: Cubetto's Broken Bridge! (1 of 2)

Cross-curricula Area: MathsMeasurements - Length (cm)

NC Objectives

To write an algorithm

Outcomes

- I can solve a problem using programming
- I can solve problems involving length

Resources Needed

- Images of bridges around the world
- Rulers, tape & lollipop sticks
- 3D cubes to make a bridge for Cubetto

Prep Needed

- Make a model bridge from materials too narrow for Cubetto.

Resources Provided

- Bridge model examples

Key Vocabulary

- Measure
- Length
- Bridge
- Strong
- Program
- Function block

Computational thinking concept

Logic

Computational thinking approach

Collaborating

Teacher-led Introduction

1. Play 'Harbour Measurement': www.bbc.co.uk/bitesize/ks1/maths/length_and_weight/play/ to recap measuring length.
2. Ask: Has anybody gone over a bridge before? Where were you going? What was the bridge like? Discuss the importance of bridges connecting two places and being strong enough to carry the load.
3. Show different pictures of bridges in the world, including a local one, and discuss what they look like and how they're made.
4. Show the map and point out the two beach squares: A2 to C5.
5. Explain that Cubetto has a problem: he was enjoying a day out at the beach and spotted an island nearby that he wanted to visit, but can't swim! Cubetto decided to build a bridge but when he got on, it broke! Can you help?
6. Ask: How could we help make Cubetto a bridge? Handle Cubetto & suggest items around the classroom to make a strong enough bridge.
7. Collect ideas and tell children that their task today is to make a new bridge and program Cubetto to reach the other beach!
8. Recap the function block and ask: How could we use this block today to move Cubetto?

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Lesson 6: Cubetto's Broken Bridge! (2 of 2)

Creative Play

Create a pop-up island scene.

Guided Activity

1. Explain that the children's task is to program Cubetto to move between the two beaches.
2. Show the 3D cubes and allow time for children to plan Cubetto's route between the squares.
3. Ask: Which directions can Cubetto move in? Use open questions to encourage planning a route in two stages:
4. Once the route is planned, remove blocks and ask children to line the route with lollipop sticks.
5. Tell the children to write an algorithm that moves Cubetto along the route using the function block.
6. Test out the algorithm in stages and encourage tinkering.

Independent Activity

1. Look at the materials available. How could we make a bridge for Cubetto?
2. Look at the bridge model your teacher made. Would this work? Test it out.
3. Use the ruler to measure Cubetto and work out how wide your bridge needs to be.
4. Work in groups to make a bridge, testing it out with Cubetto to check it can hold Cubetto's weight.

Challenge

Where else can Cubetto travel? How long does the bridge need to be?

Plenary and Assessment

1. Ask children to showcase their bridge designs and algorithms.
2. Ask: How did you design your bridge? What was challenging? What did you need to think about?
3. Place bridges onto the map. Test algorithm and bridge strength in groups.
4. Ask: Which is the best design? Why?

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Lesson 7: Cubetto's Double Trouble! (1 of 2)

Cross-curricula Area: Maths: Problem Solving

NC Objectives

To debug a simple program

Outcomes

- I can debug a simple algorithm
- I can solve an open-ended problem

Resources Needed

- Paper plates
- Coloured paper
- Glue, ruler
- Plastic fish/sea life

Prep Needed

- Prepare two Boards with matching algorithms, then 'bug' one for pupils to fix.
- Cut out home square.
- Prepare 'Which way?' template.

Resources Provided

- Home square
- 'Which way?' activity sheet
- Example algorithms

Key Vocabulary

- Teamwork
- Problem solving
- Algorithm
- Bug/Debug
- Direction
- Route

Computational thinking concept

Algorithms

Computational thinking approach

Debugging

Teacher-led Introduction

1. Ask children to get into pairs. Explain that half the class watches first, then the other half has a turn.
2. Give each pair a ruler and a tennis ball and explain that their task is to work as a team to get the tennis ball from one side of the classroom to the other. Teacher to decide additional rules such as no touching the ball.
3. When the whole class has had a go, ask: What was difficult about the activity? Children to discuss and feedback challenges.
4. Use open questions and emphasise importance of timing and moving in the same direction.
5. Explain that pupils will be using Cubetto to solve a problem and will need to work together, taking turns and helping each other.
6. Show the 'Which way?' grid template on board and explain that mini Cubetto needs to get from one side to the other.
7. Model one route (see sheet) and ask: How would you tell Cubetto to take this journey? Model saying, "left, forward, right ".

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Lesson 7: Cubetto's Double Trouble! (2 of 2)

Creative Play

Make scaled, coloured paper fish.

Guided Activity

1. Explain that two Cubettos are doing a very important job cleaning the sea bed, picking up sea life and taking them back to where they belong, working as a team! Ask: What is important in teamwork?
2. Place two Cubettos next to each other on the map with a ruler resting on top between them.
3. Ask children to place plastic sea life onto ruler that the Cubettos have collected.
4. Ask: How could we make sure the Cubettos don't drop the fish when they move? Collect ideas (e.g. matching algorithms, press the Go button at exactly the same time).
5. Show prepared algorithms and ask: What do you predict will happen? Run algorithm and discuss what happens (they drop the fish!).
6. Ask: How are we going to solve this problem? Allow time for discussion and exploration, encouraging tinkering technique: speak through it ('robot talk' the moves Cubetto needs to make to get there).
7. Ask: Can you find a bug in the algorithm? Which one? How can we fix it?

Independent Activity

1. Look at the 'Which way?' sheet and the example of a route for mini Cubetto.
2. What route could Cubetto take to cross the grid? Draw a line to show his route and 'robot talk' it through with your partner.
3. Have you moved mini Cubetto in every direction?

Challenge

Can you use the function block to move Cubetto further?

Plenary and Assessment

1. Ask: What problems did we solve today?
2. Ask children to present their algorithms and explain how the two Cubettos moved together to transport the sea life.
3. Ask: What bug did you find? How did you fix it?
4. Ask: How did you work together today? What did you find easy and what was challenging?

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Lesson 8: Party Pandemonium! (1 of 2)

Cross-curricula Area: Maths: Problem Solving, Number: Addition

NC Objectives

To debug and test a simple program

Outcomes

- I can debug and test a simple algorithm
- I can solve an open-ended problem

Resources Needed

- Mini whiteboards
- Dice and coloured pens
- Coloured card
- Glue
- Scissors

Prep Needed

- Prepare three algorithms.
- Laminate the party square.
- Sea headband example.
- Submarine race worksheet.

Resources Provided

- Party square
- Under the sea headband example
- Submarine race worksheet

Key Vocabulary

- Algorithm
- Bug/ Debug
- Direction
- Route
- Restriction
- Length
- Festival
- Distance
- Avoid
- Pandemonium

Computational thinking concept

Algorithms

Computational thinking approach

Debugging

Teacher-led Introduction

1. Show the mini Cubetto grid from Lesson Seven and ask: What were the different journeys you thought of?
2. Ask: What journeys could two mini Cubettos take? Discuss, draw ideas on whiteboards and feedback.
3. Model drawing the route with two Cubettos starting in the same place, taking different journeys and ending up at the final square together.
4. Ask: Can you 'robot talk' each Cubetto's movements?
5. Explain that the fish are having a festival (party!) under the sea and that all the Cubettos are invited!
6. Explain that three Cubettos want to get to the festival (show the festival square) but are having some trouble.
7. Ask: What problems has Cubetto had before? How have we helped?

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Lesson 8: Party Pandemonium! (2 of 2)

Creative Play

Make under the sea themed festival hats!

Guided Activity

1. Place the party/festival square on the map and the three Cubettos in line behind each other (see suggestion).
2. Ask: How could all three get to the party at the same time?
3. Tell children to watch the Cubettos very carefully as algorithms run (don't show Boards yet).
4. Ask: What happened? What do you think the algorithms were? Children discuss and feedback ideas.
5. Show algorithms for all Cubettos and ask: What blocks can you see? Why did it not work?
6. Establish that all of the Cubettos have a random block and go off in different directions!
7. Discuss which blocks could be changed and how they want the three Cubettos to move.
8. Explain that this is a really tough problem, so pupils will work in pairs on different Cubettos, then come together to test out their algorithms.

Cubetto 1

Cubetto 2

Cubetto 3

Cubetto 1	**Cubetto 2**	**Cubetto 3**
Left	Right	Left
Forward	Forward	Forward
Random	Random	Random

Independent Activity

1. Find a partner to play 'submarine race' with!
2. Take it in turns to roll three dice.
3. Work together to add the numbers and find that number on the path.
4. Colour in that number.
5. Which submarine will win the race?

Challenge

Can you program the Cubettos to change order?

Plenary and Assessment

1. Ask children to present their different algorithms and journeys for the three Cubettos.
2. Ask: How did you work as a team to solve this problem? What was challenging? What are you most proud of?
3. Ask: What have you learnt about programming Cubetto? What was your favourite task? What surprised you?

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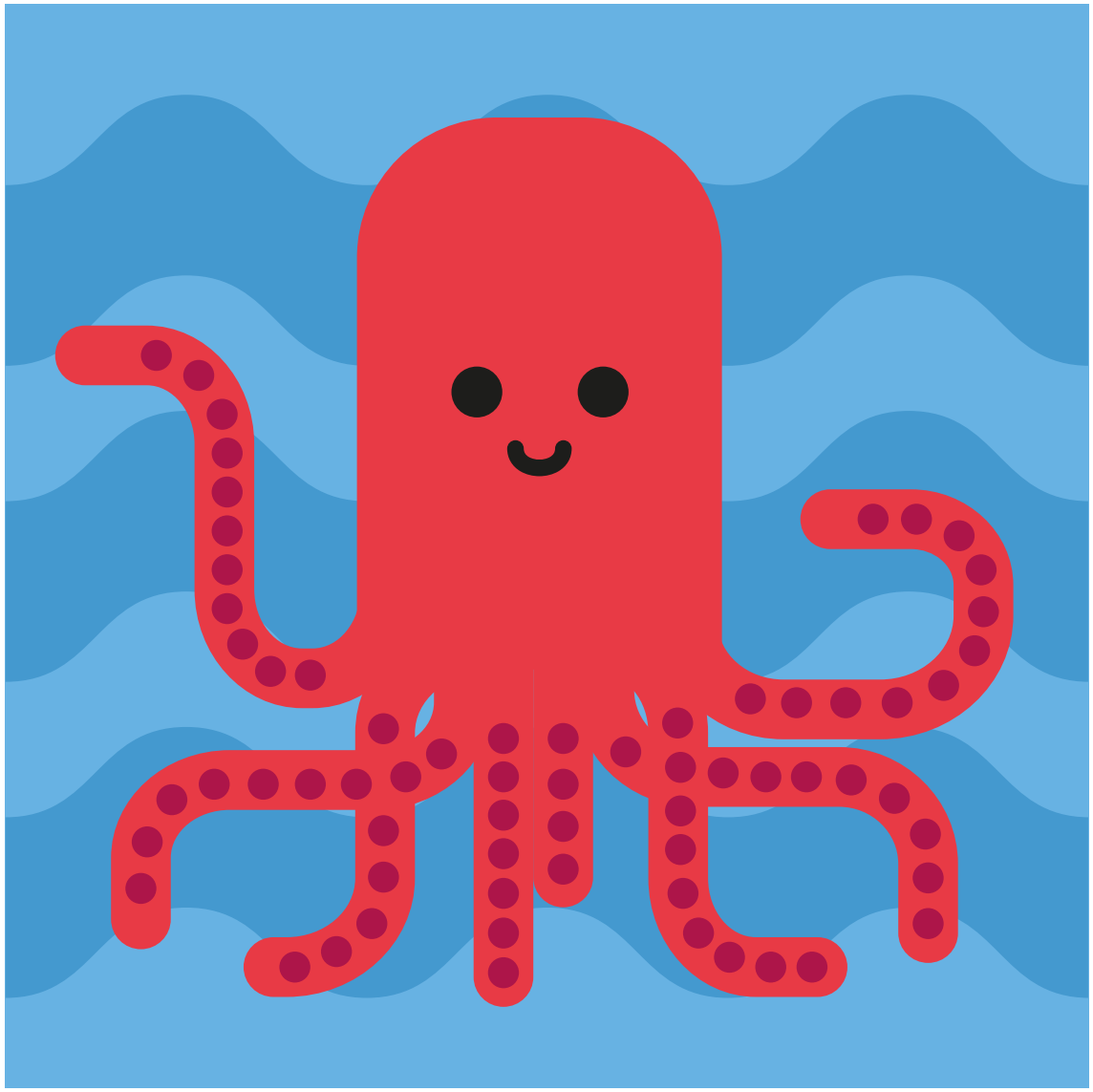

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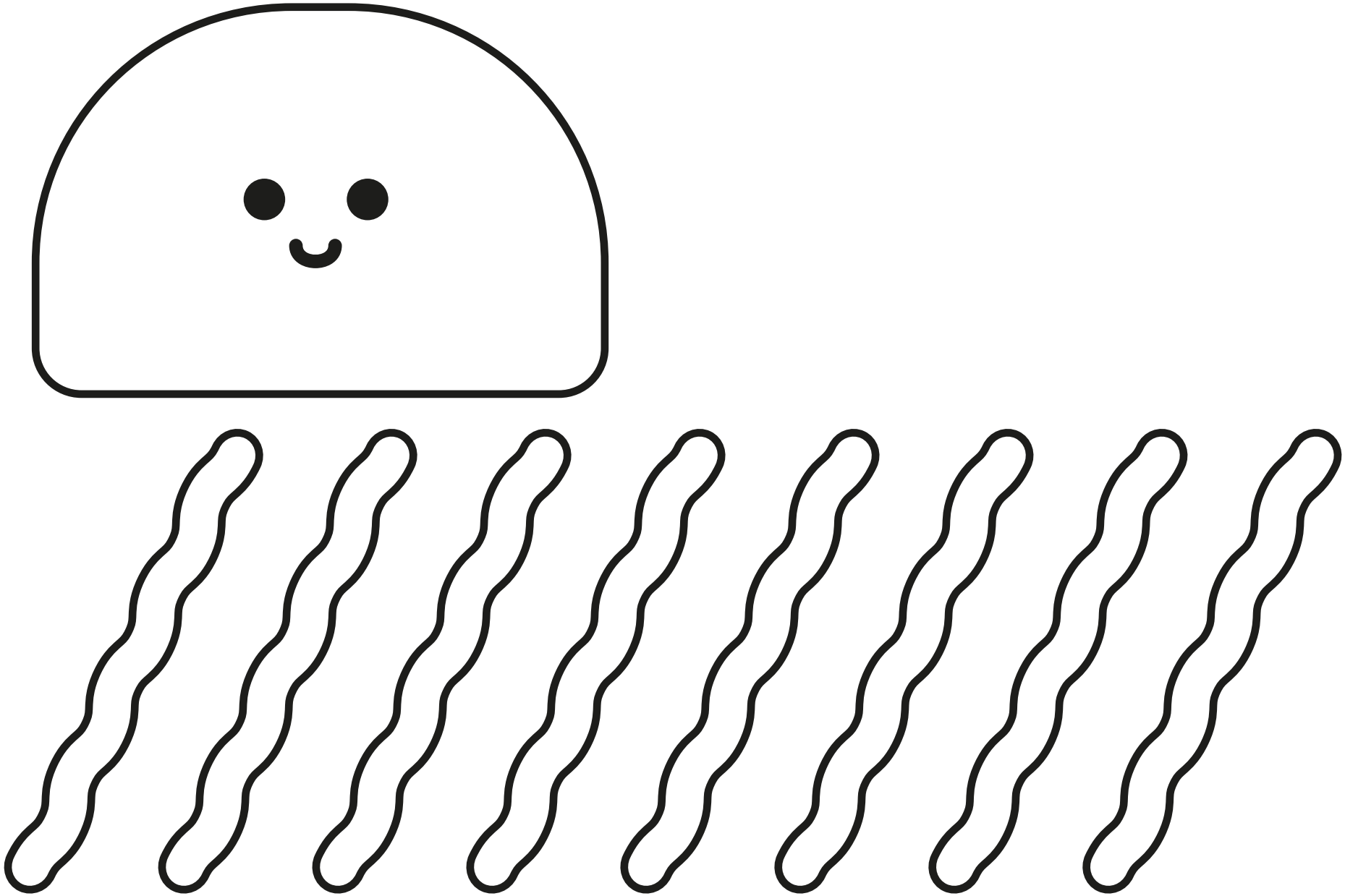

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Tinkering Techniques

Tinkering Time is an opportunity for teachers to model problem solving steps, questions and start points for working out a bug, including:

• **Asking questions**: What happens if I.../What has changed and what has stayed the same? /When I do...this happen.../ At which block does it go wrong?

• **Finding a start point:** Encouraging children to only change one thing at a time and notice changes

• **Robot Talk:** Speak the moves Cubetto needs to make (Like a robot) and select the corresponding blocks

• **Half way there:** Showing the children Cubetto making the correct moves (to help them visualize the blocks) but concealing the algorithm on primo board

• **Team work:** Adding algorithm to 2 primo boards, changing one and running both programs to identify changes

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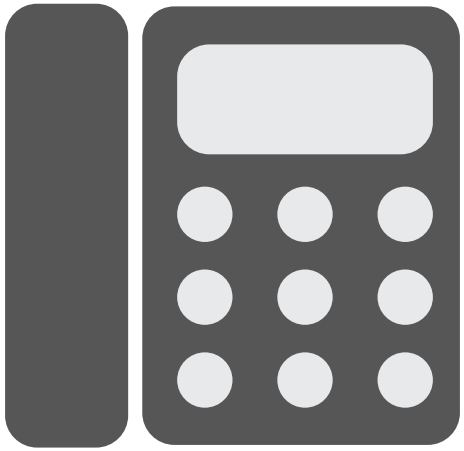

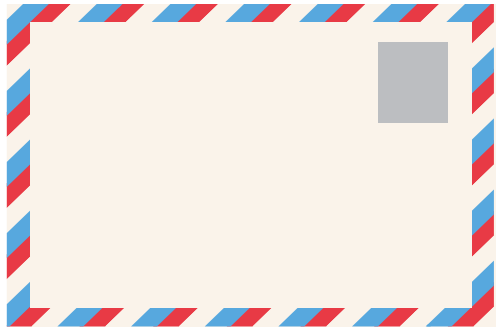

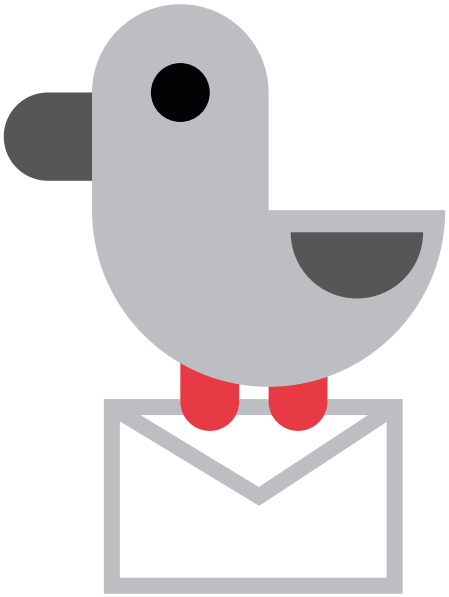

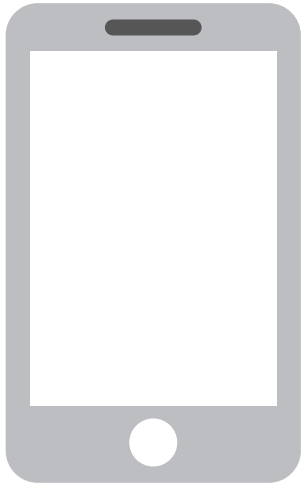

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A	B	C	D	E	F	G	H	I	J
1	2	3	4	5	6	7	8	9	10

K	L	M	N	O	P	Q	R	S	T
11	12	13	14	15	16	17	18	19	20

U	V	W	X	Y	Z
21	22	23	24	25	26

10 - 2 =

12 + 3 =

9 + 11 =

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

U	V	W	X	Y	Z
21	22	23	24	25	26

10 - 4 =

20 - 11 =

12 + 7 =

2 + 6 =

3 + 16 =

18 - 17 =

7 + 7 =

13 - 9 =

24 - 5 =

18 - 10 =

3 + 2 =

20 - 8 =

5 + 3 =

17 + 6 =

14 - 6 =

19 - 18 =

7 + 5 =

11 - 6 =

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Correct ‘H’ algorithm

Forward

Forward

Backward

Right

Forward

Left

Forward

Backward

Left

Left

Forward

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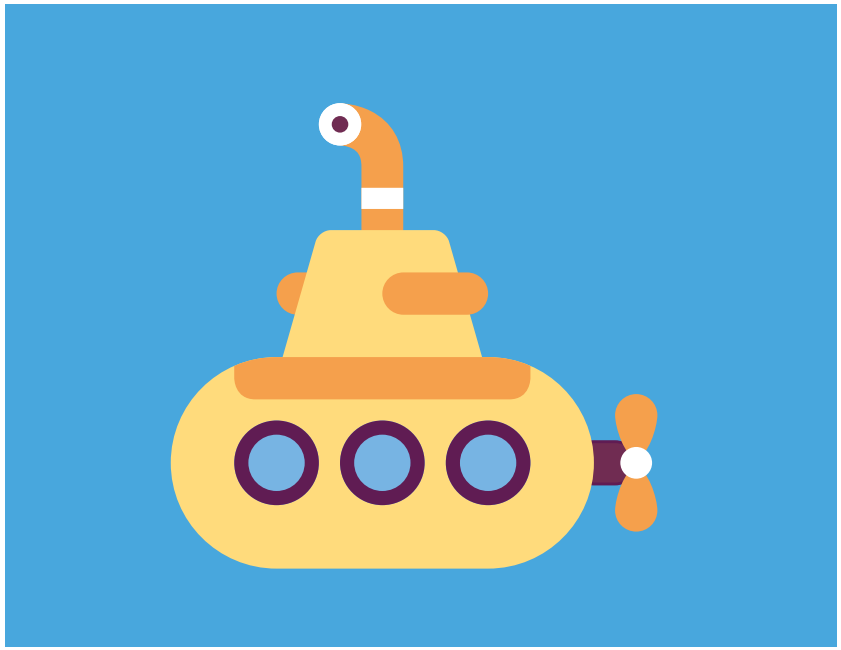

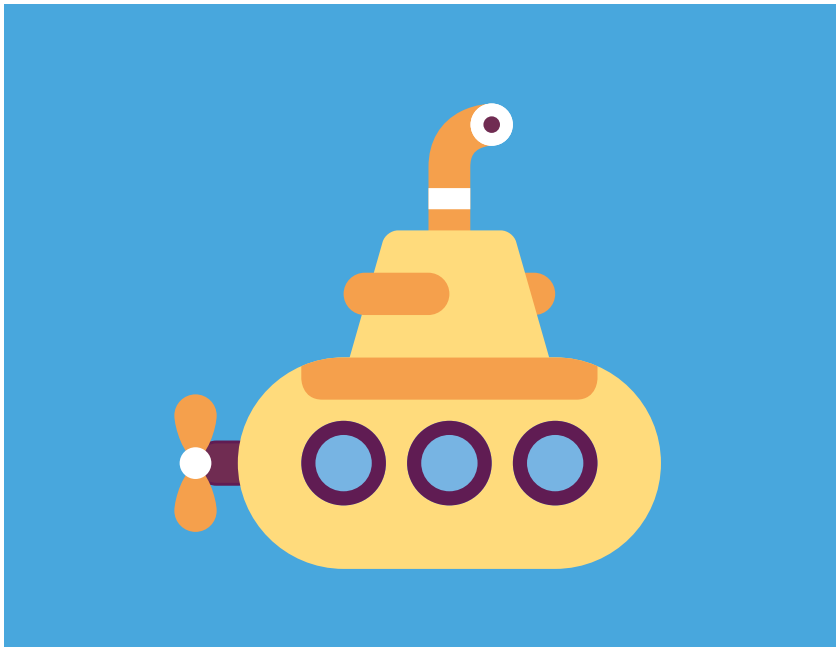

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Silly Cubetto algorithm

Forward

Forward

Random

Random

Rescuer Cubetto algorithm

Forward

Forward

Forward

Forward

Left

Left

Forward

Forward

Forward

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Pirate algorithm

Forward

Forward

Empty

Empty

Right

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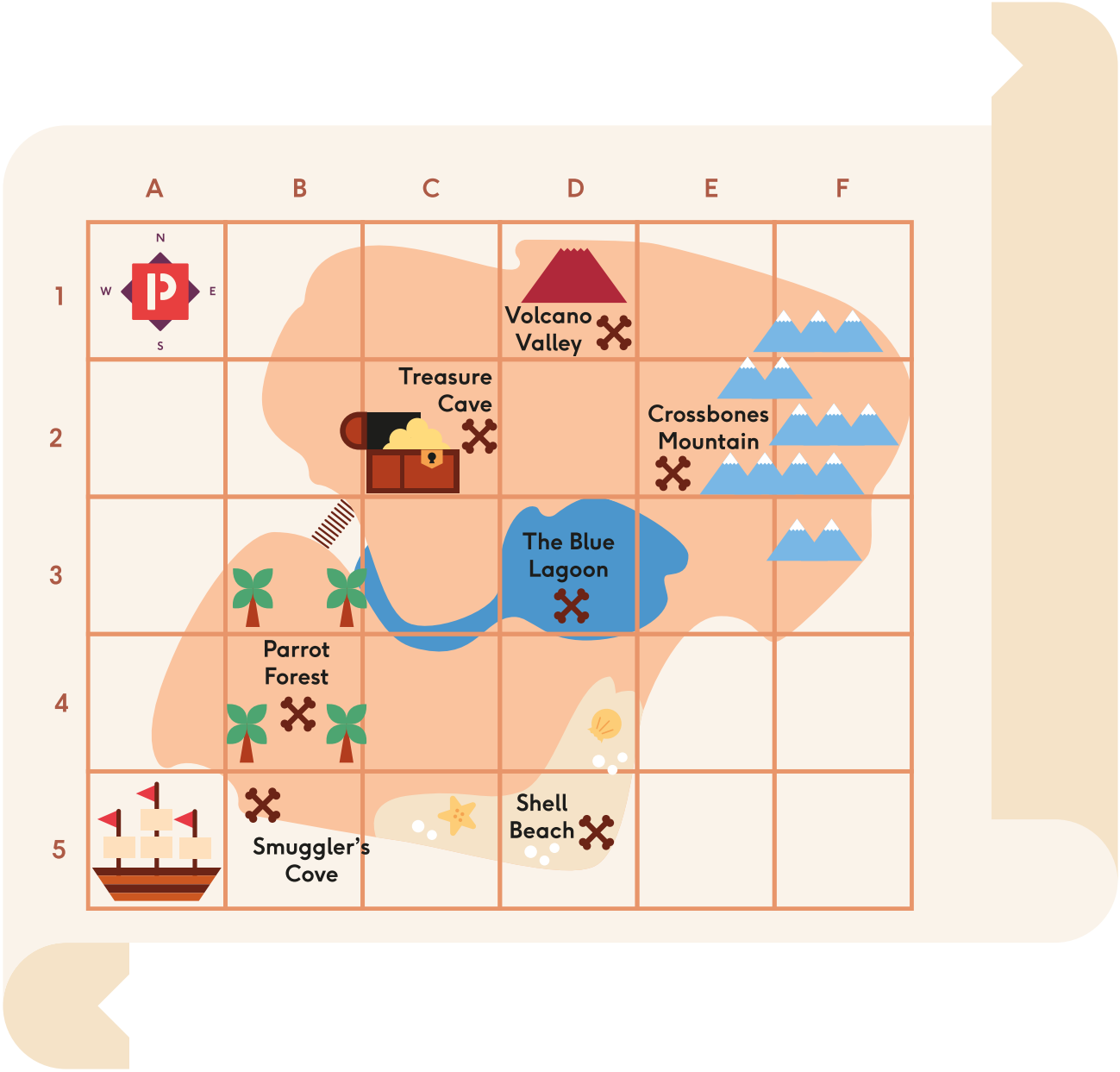

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You will need:

Brown/ Plain card

Felt Tips

Glue

Sequins

Leftover Art materials (pipe cleaners/ card/ glitter)

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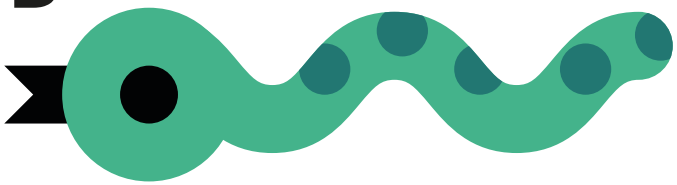
A

B



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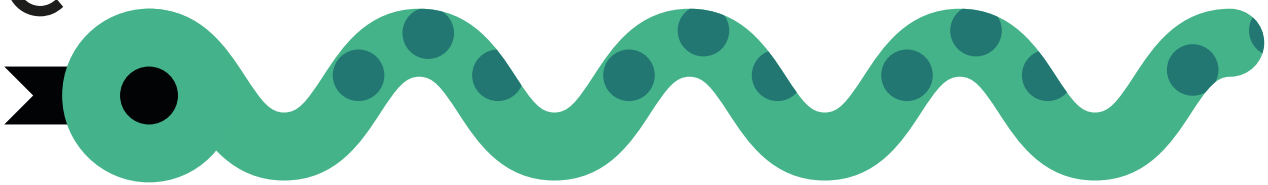
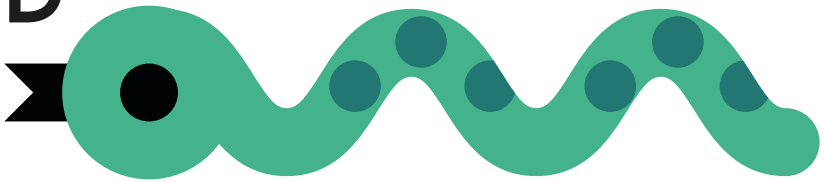


D



A =

B =

C =

D =

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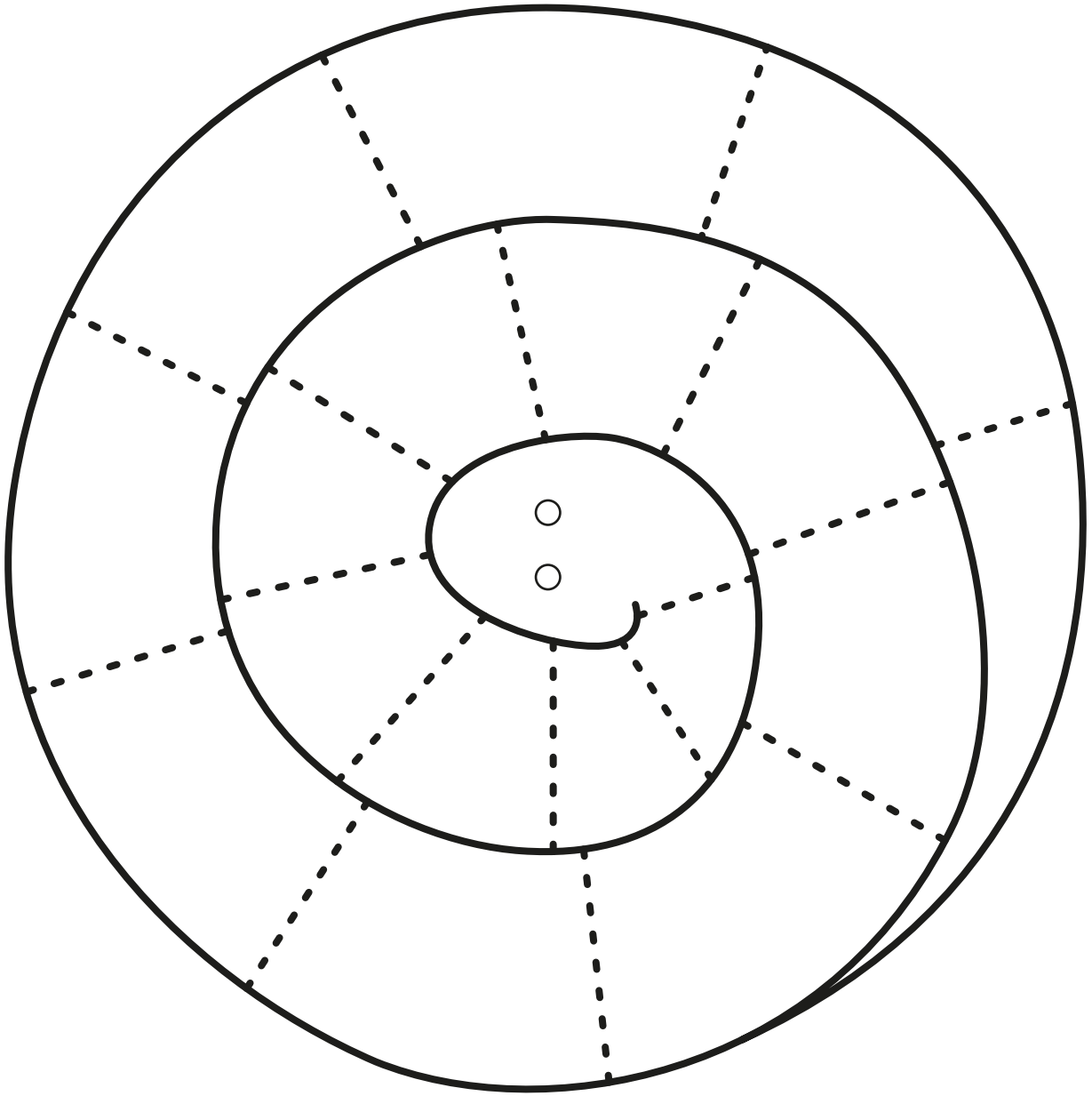

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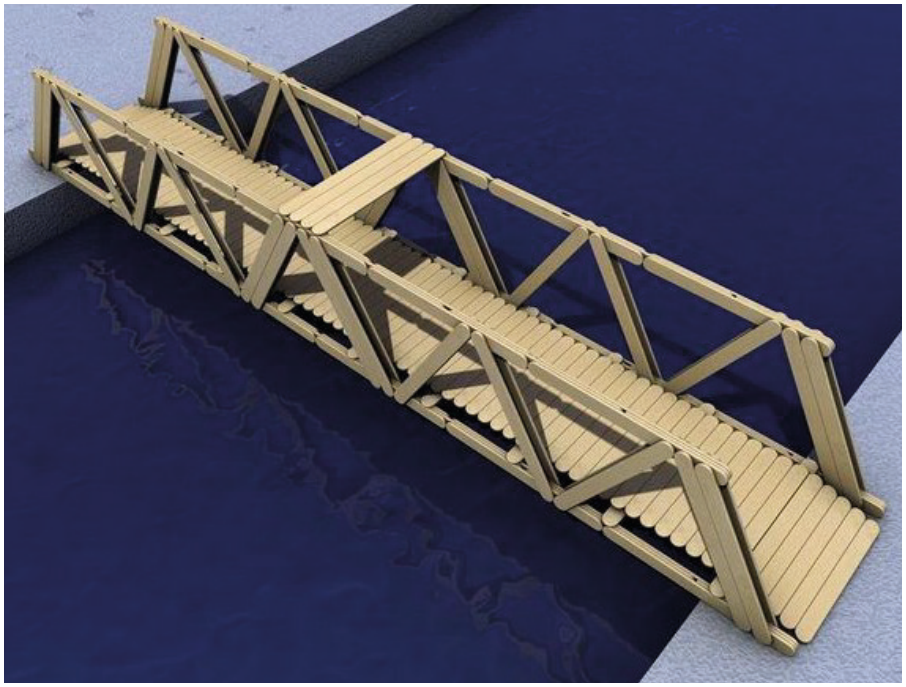

Tip: Use Rulers for the edge of the bridge and lay lolly sticks across the wide and affix with sellotape

Sides are not essential

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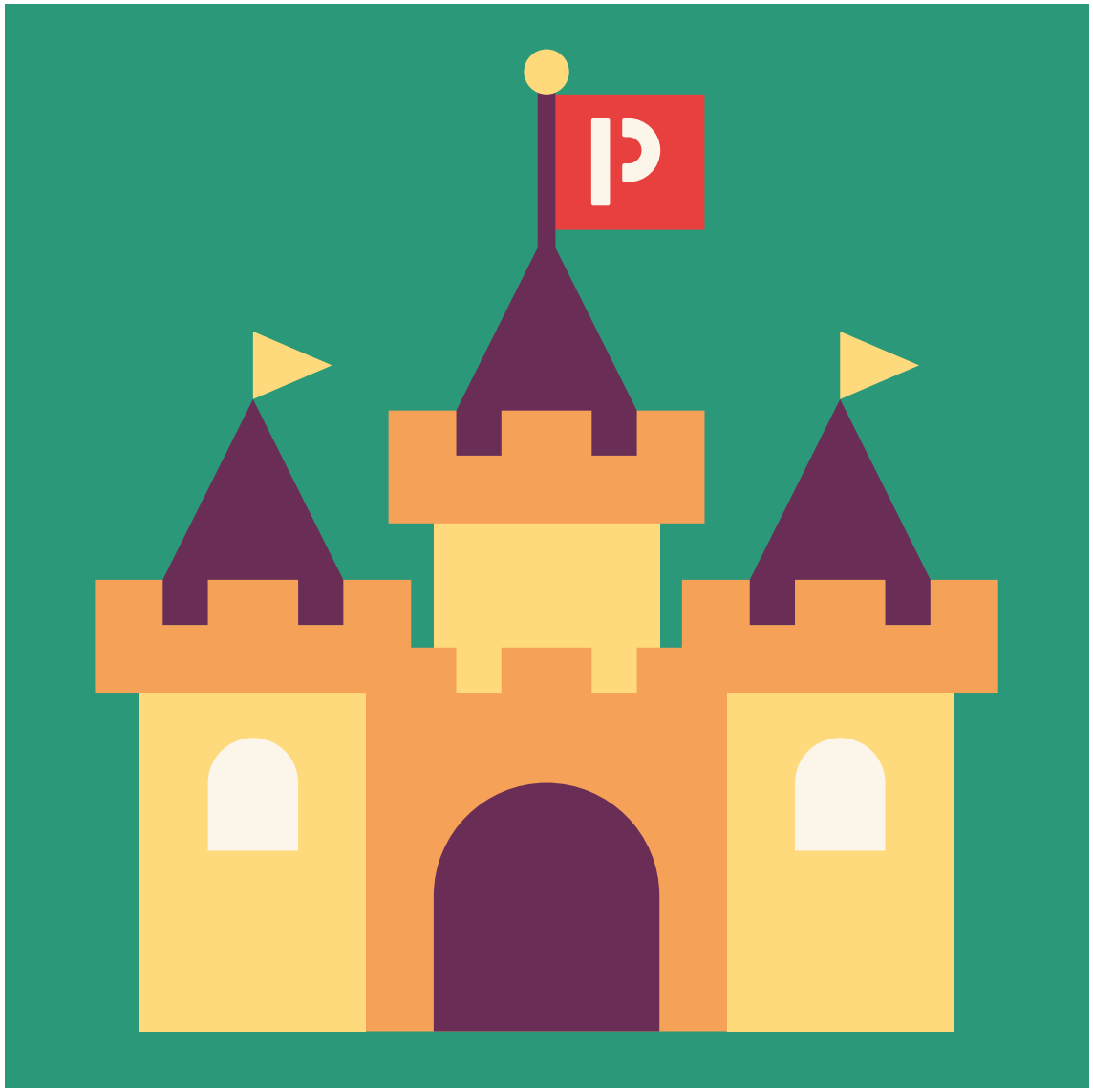

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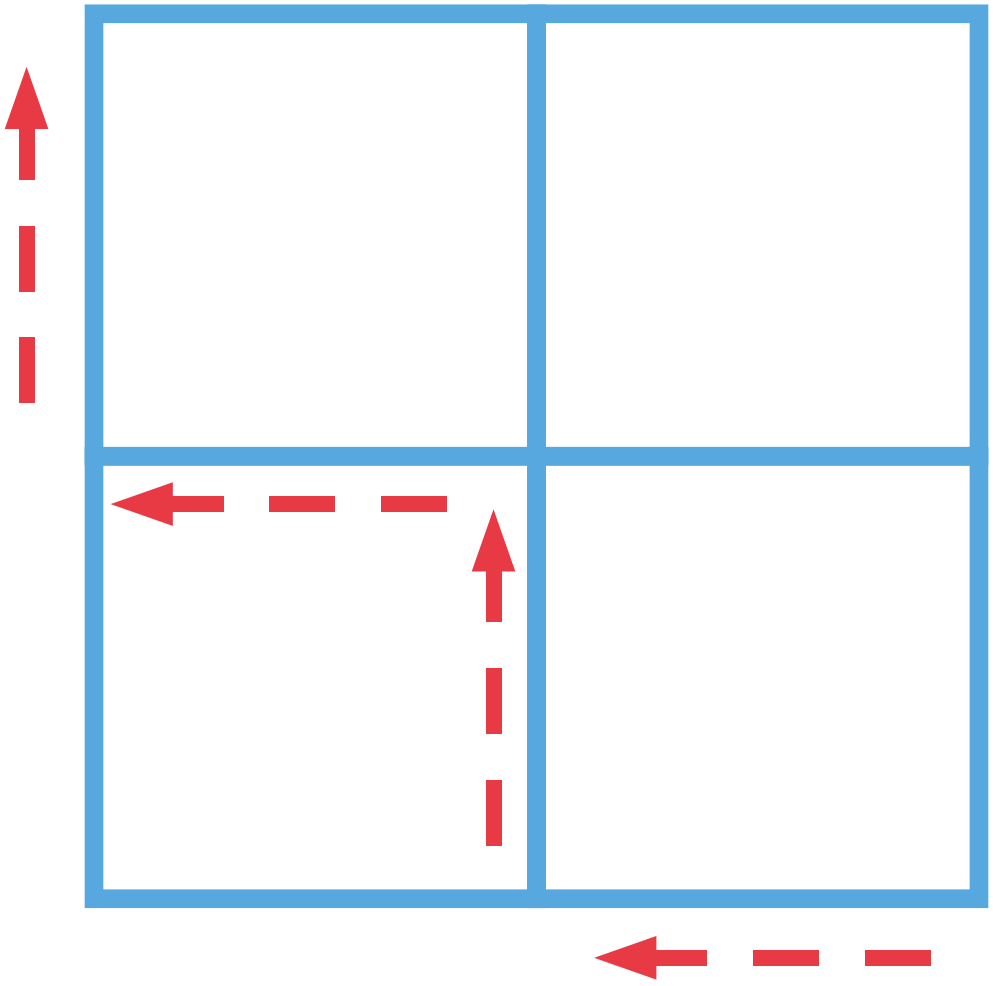
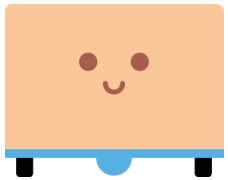
Finish



Start



Mini-Cubetto takes this journey: left, right, left, right

Can you find 5 other journeys Mini-Cubetto could take?

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“Green” Cubetto algorithm

Forward

Forward

Right

Right

Forward

“Orange” Cubetto algorithm

Forward

Forward

Right

Left

Forward

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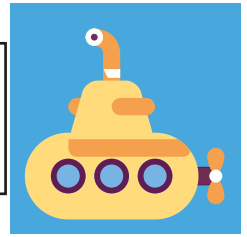
- Take turns at throwing the dice
- Throw 3 dice and add 3 numbers.
- Colour in the matching number on your grid.
- If it is already coloured in you miss a turn.
- The first person to completely colour their grid in is the winner.

18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3



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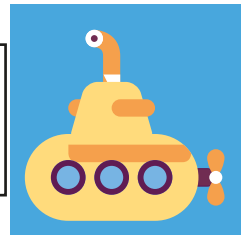

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