

2D Shape Drawing Activity

Age: 7-11 years

Type: Offline (to be completed without a computer or internet)

Curriculum Links to: Maths

Computational Thinking Concepts & Approaches: Debugging, Collaborating, Logic, Algorithms

Introduction

In this activity learners will follow an algorithm to draw pictures constructed from 2D shapes. The algorithms they follow will include errors and they will use logical reasoning to detect and correct these.

What you will learn

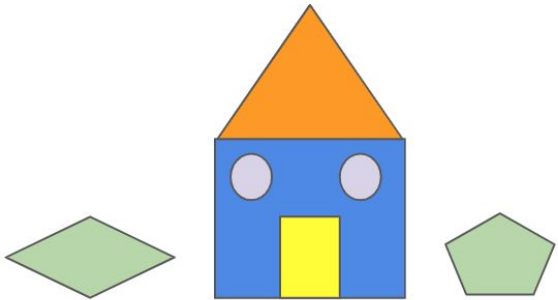
In this offline project you will learn how to use logical reasoning to detect and correct errors in an algorithm.

Instructions for adult

Ask the learner to recap what an algorithm is, if they're not sure explain that an algorithm is a sequence of instructions or a set of rules to get something done

- Explain they will be following algorithms made up of a sequence of instructions. These algorithms will include errors, and their task is to detect and correct the errors in the algorithm. Explain that this process is called debugging.
- Explain that they will be using logical reasoning which allows us to 'think through' the steps in algorithms to determine their outcome. We can use logical reasoning to identify where errors might be happening and fix them

Here is an algorithm for drawing a house:

ALGORITHM	DESIRED OUTCOME OF ALGORITHM
<p>1. Draw a blue square in the centre of your page.</p> <p>2. Draw an orange triangle with one edge aligned with the top of the square.</p> <p>3. Draw two blue triangles inside the square</p> <p>4. Draw a yellow square with sides half the length of the first square, inside the first square.</p> <p>5. Draw a green regular pentagon to the right of the square. The bottom of this shape should be inline with the bottom of the square.</p> <p>6. Draw a purple regular diamond to the left of the square.</p>	

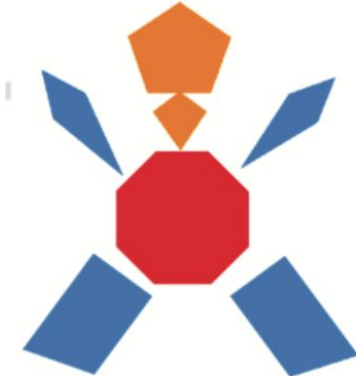
Explain that on the left is an algorithm. This algorithm is made up of a sequence of instructions to create a picture of a house. On the right is how you would like the house to look. However, you suspect there might be some mistakes in the algorithm. The learners task is to use logical reasoning to work through this algorithm to detect and correct any errors – to debug it. These mistakes are included in a diagram at the end of this document.

Note: the algorithm includes errors such as incorrect shapes or locations. Some steps of the algorithm are not sufficiently precise to specify where the shapes should be located or their size relative to others. When following through the algorithm, deliberately highlight this lack of precision by drawing huge/tiny shapes in strange locations on a piece of paper

Explain that to help you detect and correct any errors, you are going to draw out each step of the algorithm:

1. Read each step of the algorithm above and draw this on a separate sheet of paper.
2. After drawing each step, follow this process:
 - Check whether what you have drawn from the algorithm matches the picture
 - If it does then move on to next step; if it doesn't then debug the algorithm.
3. When debugging the algorithm we want to emphasise the use of logical reasoning to justify the changes we make. Follow this process for debugging M):
 - **Identify** the difference
 - **Think** what you need to change
 - **Change** the algorithm
4. At each step, make any corrections to the algorithm on the sheet of paper you have already used.
5. Give the learner a copy of the worksheet (there is a blank one below). Explain that the main task for the activity will be in two sections.

6. Firstly, they will have 10 minutes to create a simple drawing made from 2D shapes in the right hand part of the table and then write the algorithm for this drawing in the left hand box. Importantly, they should purposefully include three mistakes in their algorithm. An example is shown below, try and spot the errors together:

ALGORITHM	DESIRED OUTCOME OF ALGORITHM
<ol style="list-style-type: none">1. Draw a small orange rectangle at the top of the page2. Then add a green kite underneath3. Next add a hexagon as a body underneath this4. Add two wide blue trapeziums under the hexagon5. Add a narrow blue kite to the right top of the hexagon6. Add a narrow blue kite to the left top of the hexagon	

7. Once they have completed this, you should use the debugging process to detect and correct the errors in their algorithm.

NOTE: To help them do this, they should use paper to draw out each step. Remind them of how you modelled this process and draw their attention to the 'Identify, Think, Change' steps you have written on the paper. They should edit the algorithm using a coloured pencil to indicate the changes that they have made

8. Next, swap roles. You will use another worksheet to create a drawing and the learner will follow the above process to de-bug your algorithm.

Project Ends.

2D Shape Drawing Worksheet

Date:

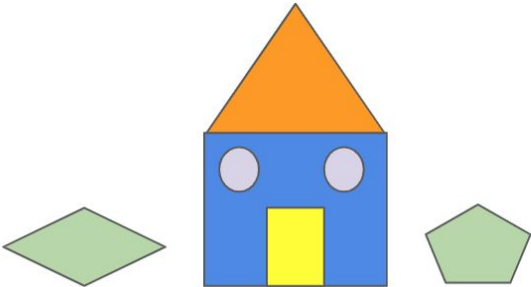
Algorithm designed by:

Algorithm debugged by:

Write your algorithm for this 2D shape picture in this box. (Remember to include 3 errors in your algorithm)


Draw your 2D shape picture in the box below.

Solutions

ALGORITHM	DESIRED OUTCOME OF ALGORITHM
<p>1. Draw a blue square in the centre of your page.</p> <p>2. Draw an orange triangle with one edge aligned with the top of the square.</p> <p>3. Draw two blue triangles inside the square</p> <p>4. Draw a yellow square with sides half the length of the first square, inside the first square.</p> <p>5. Draw a green regular pentagon to the right of the square. The bottom of this shape should be inline with the bottom of the square.</p> <p>6. Draw a purple regular diamond to the left of the square.</p>	

The mistakes are highlighted in bold:

1. There should be two GREY CIRCLES inside the square
2. There should be a GREEN regular diamond to the left of the square, and it should be IN LINE WITH THE BOTTOM OF THE SQUARE.

ALGORITHM	DESIRED OUTCOME OF ALGORITHM
<p>1. Draw a small orange rectangle at the top of the page</p> <p>2. Then add a green kite underneath</p> <p>3. Next add a [RED] hexagon as a body underneath this</p> <p>4. Add two wide blue trapeziums under [BOTTOM LEFT] the hexagon</p> <p>5. Add a narrow blue kite to the right top of the hexagon</p> <p>6. Add a narrow blue kite to the left top of the hexagon</p>	

The mistakes are highlighted in bold:

1. The shape should be a pentagon
2. The colour of the kite should be orange
3. The hexagon should be red
4. The algorithm needs to be more specific about where the trapeziums should be place, in this example 'the bottom left and bottom right of the hexagon'

This activity was originally created by Barefoot Computing -
<https://www.barefootcomputing.org/>