Algorithms

ADA LOVELACE

HMDT music STEM SISTERS

EDUCATION ZONE

Learning Objectives:

- To understand the meaning of the term algorithm as a set of instructions which have to be followed in the right order;
- To understand the term 'debug' as making corrections within the algorithm so that the correct outcome is achieved.

Maths skills

- Practising using turns of 90 degrees and 45 degrees and using multiples of those angles.

ICT skills:

- Create short algorithms/programs to describe how a counter should move around the board
- Debug those programmes

Resources:

- Ada Lovelace's Programming Game photocopiable worksheets (board and cards)
- Counters

WHAT YOU NEED TO KNOW BEFORE YOU START

Ada Lovelace was born in 1815. She was the only legitimate child of Lord Byron who was a famous poet and well known for his womanising. Ada's mother moved out of their London home, shortly after Ada was born, taking baby Ada with her. She was keen to educate Ada in maths and other practical subjects as she felt encouraging anything imaginative might lead to Ada becoming like her father. Consequently, Ada was given a strict education in arithmetic, music and French. Despite this, Ada was extremely creative and wanted to invent a way to fly. She recorded all her ideas in a book she called 'Flyology''.

It was a time when scientific ideas were developing all the time. Telescopes were seeing farther into the night sky; Jenner had developed a vaccine for smallpox, but it would be another few decades before Darwin published his ideas on the evolution by natural selection.

When Ada was 17, she attended a party and met Charles Babbage, a mathematician, who showed her a working piece of the 'Analytical Engine' he was working on. Often referred to as the first computer, it was a mechanical device which was designed to carry out complex calculations. Ada was fascinated by this device. Babbage was very impressed with Ada's expertise in mathematics – he called her an 'Enchantress of Numbers'.

In 1842-43 Ada translated an article written, by Luigi Menabrea, about this analytical engine and wrote her own notes to go with it. It is these notes which made Ada famous. In her notes, she included detailed instructions – an algorithm – which if used to program the analytical machine, would enable it to generate a complex set of numbers called Bernoulli numbers. For this reason, she is considered to have written the first computer program. She also envisaged an analytical engine of the future being able to manipulate words and pictures and even make music – she really was ahead of her time.

What is an algorithm?
An algorithm is a set of precise instructions which explain how to do something. The steps are in order so that if the instructions are followed in order, the desired outcome is achieved. We write algorithms for cooking, called recipes, for example. When we write instructions for a computer, we have to write the algorithm in a language the computer can understand: we write in computer code and the list of instructions is called a program.

WARM UP – imagining the impossible… that might, one day, be possible

Watch this short video which introduces Ada Lovelace:

https://www.youtube.com/watch?v=8gHGkN4Vg4g

It mentions that Ada was fascinated by flying and planned to make a flying mechanical horse or a pair of mechanical wings.

Give each group of 4 a piece of paper and pencils.
Ask:

- If you could build your own vehicle, where would it take you?
- How would it move?
- What would it look like?
- What special features might it have?

Draw the vehicle. Try to incorporate everyone's ideas.
Share the inventions with the class.

Tell the children:
Those are amazing inventions and one day they might be possible. Ada Lovelace was famous for imagining things that weren't possible in her day with the science they had then, but she could imagine what might be possible in the future and that her ideas might just be the beginning of something amazing.

INTRODUCTION
Watch this video to see a quick introduction to Ada and the Analytical Machine, envisioned by Charles Babbage. It was the algorithms which Ada wrote for this machine which earned her a place in history.   https://www.youtube.com/watch?v=uBbVbqRvqTM   Not only did she have the mathematical understanding to work the machine and find errors in the algorithms written by Charles Babbage but she also wrote her own algorithms to do some complex mathematical processes. She could also see that computers might one day be able to do more than process numbers and maybe we would use them for practical purposes or making music.   Ask: What do we use computers for?   Create a list of the different functions of computers. They range from monitoring the oxygen level in someone's blood to changing the pitch of the voice of a singer!

MAIN ACTIVITY – Ada's Algorithm Game (a game of strategy)

Introduce the game and run through the rules with the class.
Give each group of 4 one board, one set of cards, 4 counters and 3 blockers.

The children play the game, forming algorithms to move their counter from the cards they have collected. All the players in the game watch each turn to check for bugs in their algorithms.

REFLECT

Ask:

- What is an algorithm?
- Would it be possible to win the game using one algorithm?
- What are your top tips for winning the game?
- Did you have a particular strategy e.g. frequent short algorithms so you can adapt to other players in your route or infrequent long algorithms so the other players can't anticipate your moves?

EXTENSION
Ask:

- Imagine you wanted to write an algorithm to get from one side of the board to the other which would work whether or not there was something in the way. What extra words would you need? (If, then) These conditional terms are used in computer code to allow for different responses to different sets of conditions.

REVIEW
ALL: children can construct an algorithm to move their counters around the board.
MOST: can identify ways to play strategically.
SOME: can identify where the where 'if' and 'then' would be useful.