

Why use this resource?

In this resource students are introduced to an implicit equation. The problem provides opportunities for students to apply their thinking about functions to something more unusual. Students should be encouraged to recognise that they do not need to immediately rearrange the implicit equation to be able to get a handle on some of the key features and behaviours of the graph. Allowing students to play with the GeoGebra applet is essential for this process to be successful and students should be encouraged to consider this approach when faced with other complicated and unfamiliar algebraic representations.

Preparation

Students need to have access to the GeoGebra applet. This can be accessed directly from the Problem page on students' own devices or could be downloaded and shared with the students in advance of the lesson.

Possible approach

The warm-up image could be projected at the start of the lesson for students to consider and discuss informally. After a few minutes the example questions could be revealed and the students given a short amount of time to consider these.

Students could now be ready to consider the main problem. They might be encouraged to do this individually at first, giving them time to 'play' with the GeoGebra applet and make some observations for themselves. When ready, they should be encouraged to work together in pairs or small groups, to consider their responses to the questions. The "Thinking about the form $y = f(x)$ " section can be revealed once students have explored the initial questions.

Key questions

- What do you see in the graphical representation that tells you that?
- What do you see in the algebraic representations that tells you that?
- Is there anything that one particular representation reveals, that you might not otherwise have noticed?

Possible support

Allowing students to explore the behaviour of this family of curves using the GeoGebra applet will enable all students to get a feel for the problem and to make some conjectures about particular features and behaviours. Students could be supported to explore the applet systematically in order to reveal similarities and differences between the curves for different values of a . They might be encouraged to record some of their observations by sketching the curves for $a = 1, 2, 3, \dots$, making explicit some of the features and perhaps revealing others that were missed at first.

Possible extension

Students could be asked to try to reconstruct the journey from the implicit equation to the equation rearranged in the form $y = f(x)$. This is not straightforward but students may be able to make progress if encouraged to discuss their approach with someone else.