IDEA

89

GRAPHING QUADRATICS 1

While resources such as graphical calculators and function graph plotting computer programs are marvellous tools to aid learning, I also want students to experience graphs by drawing them from first principles, by working out input, output values or $(x, f(x))$ and seeing for themselves how a graph illustrates a function. As students gain competence and confidence at graphing functions then using more sophisticated technology seems to be a logical next step to help them deepen their knowledge.

This idea, therefore, is based upon students exploring a range of connected functions that all have a coefficient of 1 for the x^2 term. The first task is for students to work in pairs to produce some display materials which will, in turn, act as a stimulus for discussion.

- Provide pairs of students with an A3 sheet of square grid paper showing a pair of axes and the function $f(x) = x^2$ drawn in a thick felt-tip pen.
- Ask them to plot the following graphs, each on a separate sheet of paper:

  $f(x) = x^2 + 2$
  $f(x) = x^2 - 2$
  $f(x) = (x + 2)^2$
  $f(x) = (x - 2)^2$
  $f(x) = (x + 2)^2 + 2$
  $f(x) = (x + 2)^2 - 2$
  $f(x) = (x - 2)^2 + 2$
  $f(x) = (x - 2)^2 - 2$

It does not matter if some pairs of students do more than others (this is one aspect of differentiated learning), what is important is being able to gather together enough information to form an instant display. I develop this in Idea 90.

IDEA

90

GRAPHING QUADRATICS 2

This idea follows on from Idea 89 where a display has been created. By gathering students around the display they can be encouraged to discuss the similarities and the differences between the graphs and explore how they are related to the functions the students have plotted.

Because the coefficient of the x^2 term is always 1, then each graph will obviously have the same shape but will be positioned differently on the grid.

Other valuable information, in terms of analysing the graphs, is where the line of symmetry lies; again this information can be connected to the function under discussion.

Discussing how each of the graphs is a vector translation of $y = x^2$ is a development of this work, and determining how the vector translation relates to the corresponding function is a further complexity to consider.

A further development is for students to predict what happens if the graph is: $y = x^2 + 3$, or $y = (x - 3)^2$, etc.

Seeing what happens when the coefficient of the x^2 term becomes -1 will provide students with plenty to think about and try to make sense of.

So far students have been exploring quadratic graphs as transformations of $y = x^2$.

A next step could be to classify graphs in terms of whether they have two, one or no real roots.

Determining how real roots can be calculated is a further development and this is described in Idea 92.