IDEA

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GRAPHING QUADRATICS 3

Having considered quadratics where the coefficient of the x^2 term is 1, this idea is intended to develop students' thinking by considering coefficients of the x^2 term as something other than 1 (or −1). To try to achieve this the same procedure as described in Idea 89 – of asking pairs of students to work together to produce graphs on sheets of A3 paper which have $y = x^2$ graph already drawn on it – could be utilized.

Graphs for students to draw might be:

$y = 2x^2$
$y = 2x^2 - 3$
$y = 2x^2 + 3$
$y = 2x^2 + x - 3$
$y = 2x^2 + x + 3$
$y = 2x^2 - x - 3$
$y = 2x^2 - x + 3$
$y = \frac{1}{2}x^2$
$y = \frac{1}{2}x^2 - 3$
$y = \frac{1}{2}x^2 + 3$
$y = \frac{1}{2}x^2 + x - 3$
$y = \frac{1}{2}x^2 + x + 3$
$y = \frac{1}{2}x^2 - x - 3$
$y = \frac{1}{2}x^2 - x + 3$

Once students have produced sufficient graphs to form a display they can again gather around their work to discuss and analyse similarities and differences. The key aspects of this task are to recognize how the graphs compare to each other and to $y = x^2$.

IDEA

92

GRAPHING QUADRATICS 4

This idea is a development from the previous four ideas; in my scheme of work these five ideas formed the basis for a module lasting three to four weeks.

The idea is based upon an exploration of real roots and the turning point for quadratics of the form: $y = ax^2 + bx + c$ where a, b and c are in the range −4 to 4.

I would certainly encourage the use of graphical calculators or a computer graph plotting program; this is because I want students to start to examine what the real roots are, if any exist, together with the turning point, for graphs of quadratic functions. I also want students to systematically gather a lot of information for purposes of analysis.

This idea, therefore, is to encourage students to form systematic collections of families of graphs in order to see where the real roots and the turning point occurs, and how these are connected to the line of symmetry on a quadratic graph.

To enable students to work systematically I would suggest they initially restrict the coefficients (and the constant term) to values of −4, −3, −2, −1, 0, 1, 2, 3 and 4; this will provide them with plenty to have a go at.

The most confident students might be able to construct a procedure for predicting whether a function will have two, one or no real roots and where these real roots are. I expect some students to be capable of constructing a procedure for determining the turning point. At what point any teacher might decide to offer students procedures such as completing the square or 'the' quadratic formula will of course vary.