Pick a card...

Teacher notes

Why use this resource?

This resource offers multiple perspectives on quadratic functions of the form $y = ax^2 + bx + c$ with non-negative discriminant and their graphs, and requires students to convert between these many representations. It could be used to introduce some aspects of quadratics, as a fluency exercise or as revision.

The resource also offers the option to restrict to quadratics with $a = 1$, offering a simpler set of problems.

This resource is restricted to quadratics with a non-negative discriminant, that is $b^2 - 4ac \geq 0$, to ensure that the graphs will intersect the x-axis. Discriminants are investigated more fully in Discriminating, while graphing quadratics with a possibly-negative discriminant is also explored in the second task of GeoGebra constructions... quadratic edition.

Preparation

It will be very useful to print out blank grids for students to complete individually or in small groups.

Alternatively, you may wish to prepare specific quadratics to use, in which case you can print out partially filled-in grids (using the "print" facility in the applet).

Possible approach

Begin by demonstrating how the grid works, so that the students are aware of exactly what information goes in each card. Then explain that the task will be to complete the grid given the information on just one card.

Question for discussion: Which card would you like to be revealed, and why? For example, some students may think that the top-left card is the most useful, while others may prefer the factorised form (bottom right card). Then hide all of the cards (using the "Reset cards" button), either generate a random quadratic or type one in (see below) and reveal this card. (If you do not have a projector, this can all be done on paper instead using a copy of the blank grid.)

A second question for discussion: Which card would be the hardest to start with? Then with a new quadratic, reveal this card and repeat the exercise. In this case, common choices for students to choose include the graph (top middle) and the three values card (middle left).

You could use randomly generated quadratics, or alternatively one of your choice. In the latter case, you can enter it before projecting the page or pre-print partially completed grids. Some good quadratics to choose for the "$a = 1$" case are:

- $(x+2)(x+4)$, which involves no fractions and for which the middle left card has no easy entry point
- $(x-2)(x+3)$, for which the completed square involves fractions but the middle left card has $f(2)=0$
- $(x-3)(x+2)$, for which the completed square involves fractions but the middle left card has two equal values

For the "Allow $a \neq 1$ case", some good quadratics include:

- $(2x-1)(x+2)$, which involves fractions, but the numbers involved are relatively small and the calculations are straightforward
- $(2x+2)(x+3)$, which has a removable factor of 2 and no fractions involved
- $(-x-1)(x-4)$, which involves fractions and a negative coefficient of x^2, but the middle left card has two equal values

Key question

How much information is needed to specify a quadratic function? This is related to the Constraints pervasive idea.

Possible extensions

The second question in "Some questions to consider" will take some thinking about. For most cards, the answer is "yes", but not for all. For example, considering the bottom middle card for the ax^2+bx+c version, if $x=-2$ is a solution to $f(x)=0$, then it is only possible to write $f(x)=a(x+2)(x-k)$ where k is the other solution, but a cannot be determined.

Another interesting question is: Can you create a new card which would also be enough to specify a quadratic function?