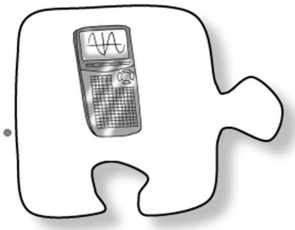
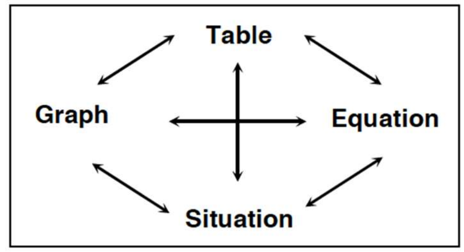
0.4 How can I represent intersections?



Points of Intersection in Multiple Representations



Throughout this course, you will represent functions in several different ways, and you will find connections between the various representations. These connections will give you new ways to investigate functions and to justify your conclusions.

How can these connections help you understand more about systems of equations? In this lesson, you will make connections between ways of representing a system of equations as you use your graphing calculator to find the points of intersection in multiple representations.

1. INTERSECTION INVESTIGATION

In Lesson 0.3, you used the features of your graphing calculator to find a point of intersection of two graphs. Can you use other representations as well? What about other strategies? Are all strategies equally accurate? Which do you prefer?

Your Task: Work with your team to find *as many ways as you can* (with *and* without your graphing calculator) to determine the points of intersection of the functions $f(x) = 2x^2 - 5x + 6$ and $g(x) = -2x^2 - x + 30$. Be sure to think about tables, graphs, and equations as you work. Be prepared to share each of your methods to the class.

Hint: If you are using a TI-83/84+ calculator, explore the TABLE, TBLSET, and CALC features on your graphing calculator. (Look at the very top row of commands on your calculator):

Discussion Points

How can we find it using graphs?

How can we find it in tables?

How can we find it using equations?

MATH NOTES

METHODS AND MEANINGS

Solving a Quadratic Equation

In a previous course, you learned how to solve **quadratic equations** (equations that can be written in the form $ax^2 + bx + c = 0$). Review two methods for solving quadratic equations below.

Some quadratic equations can be solved by **factoring** and then using the **Zero Product Property**. For example, the quadratic equation $x^2 - 3x - 10 = 0$ can be rewritten by factoring as $(x-5)(x+2) = 0$. The Zero Product Property states that if $ab = 0$, then $a = 0$ or $b = 0$. So if $(x-5)(x+2) = 0$, then $(x-5) = 0$ or $(x+2) = 0$. Therefore, $x = 5$ or $x = -2$.

Another method for solving quadratic equations is using the **Quadratic Formula**. This method is particularly helpful for solving quadratic equations that are difficult or impossible to factor. Before using the Quadratic Formula, the quadratic equation you want to solve must be in standard form (that is, written as $ax^2 + bx + c = 0$).

In this form, a is the coefficient of the x^2-term, b is the coefficient of the x-term, and c is the constant term. The Quadratic Formula is stated at right.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This formula gives two possible solutions for x. The two solutions are shown by the "$\pm$" symbol. This symbol (read as "plus or minus") is shorthand notation that tells you to evaluate the expression twice: once using addition and once using subtraction. Therefore, Quadratic Formula problems usually must be simplified twice to give:

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{or} \quad x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Of course if $\sqrt{b^2 - 4ac}$ equals zero, you will get the same result both times.

To solve $x^2 - 3x - 10 = 0$ using the Quadratic Formula, substitute $a = 1$, $b = -3$, and $c = -10$ into the formula, as shown below, then simplify.

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-10)}}{2(1)} = \frac{3 \pm \sqrt{49}}{2} = \frac{3+7}{2} \text{ or } \frac{3-7}{2}$$

$$x = 5 \quad \text{or} \quad x = -2$$