A Geometry-Graphing Connection

Teacher's Page

I use this lesson with Lab Gear in Algebra 2. It can readily be adapted for any algebra manipulatives. It is probably best to take two days for it, perhaps more, depending on your students' background.

Rectangles and Squares

First, have students make as many Lab Gear rectangles as possible, using x^2, 8x's, and any number of yellow blocks. They should keep the rectangles in front of them, so they can see all of them at once. Since there are five solutions, students should split the work with their neighbors. At each table, they should find the following:

$$(x+8)x = x^2 + 8x$$
$$(x+7)(x+1) = x^2 + 8x + 7$$
$$(x+6)(x+2) = x^2 + 8x + 12$$
$$(x+5)(x+3) = x^2 + 8x + 15$$
$$(x+4)^2 = x^2 + 8x + 16$$

Next, ask them to rearrange the blocks in each rectangle to get as close to a square as possible. Have them make a note of how many additional one-blocks they would need to complete the square in each case. Tell them to get comfortable going back and forth between the rectangle and the (incomplete) square.

Parabolas

Hand out pages 2 and 3 of this document, on separate pieces of paper. Ask students to answer the questions. They can of course get help from each other and from you. Depending on how much background they have, your students may or may not be able to answer all the questions or to use parameters in their answers

When it seems like they are not going to get any further, project page 3 and have a whole-class discussion of the questions. Do not be afraid to provide explanations, or to introduce parameters. (I use p and q for the x-intercepts, S for their sum, P for their product, and a, b, c as usual.)

Before and After

This whole discussion is about quadratics $ax^2 + bx + c$, with $a = 1$. To avoid students over-generalizing, it is best to do this lesson after they have worked with cases where $a \neq 1$.

A good follow-up is to discuss how this would turn out with different values for b. Can they predict what will be needed to complete the square?

More Stuff

For much more on parabolas and quadratics, go to: www.MathEducationPage.org, and search for "parabolas".

A Geometry-Graphing Connection

For each parabola:

1. How does the y-intercept show up in the Lab Gear representation?

2. Why?

3. How do the x-intercepts show up in the Lab Gear representation?

4. Why?

5. How does the product of the x-intercepts show up in the Lab Gear representation?

6. Why?

7. How does the sum of the x-intercepts show up in the Lab Gear representation?

8. Why is it always the same?

9. How does the axis of symmetry show up in the Lab Gear representation?

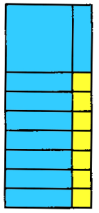
10. Why is it always the same?

11. How does the y-coordinate of the vertex show up in the Lab Gear representation?

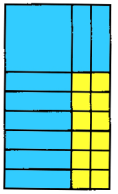
12. Why?

13. Discuss the intercepts and the vertex for $x^2 + 8x + 19$, and how they would show up in the Lab Gear representation.

$(x + 8)x$
$= x^2 + 8x$

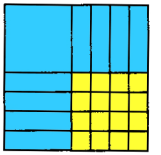


$(x + 7)(x + 1)$
$= x^2 + 8x + 7$

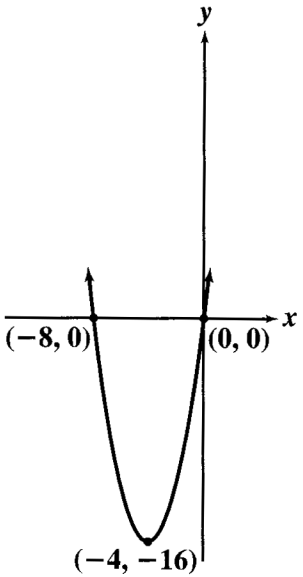


$(x + 6)(x + 2)$
$= x^2 + 8x + 12$

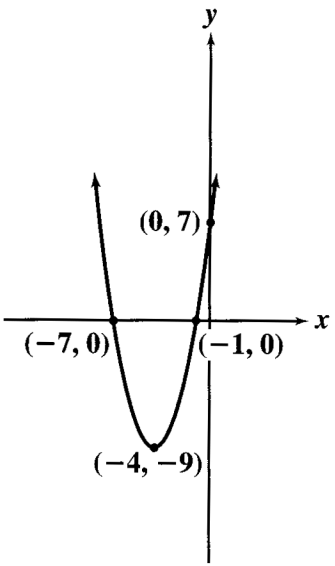
$(x + 5)(x + 3)$
$= x^2 + 8x + 15$



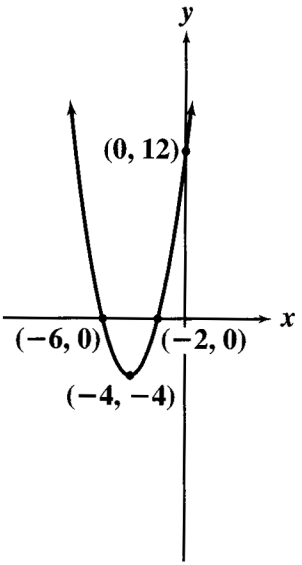
$(x + 4)^2$
$= x^2 + 8x + 16$



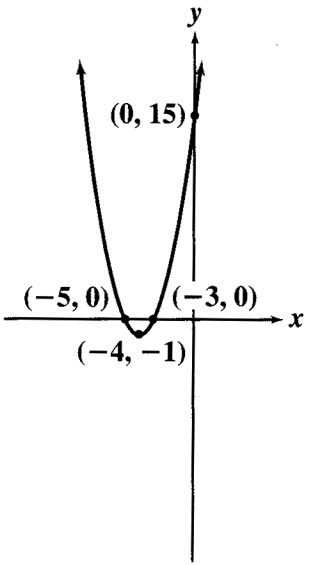
$y = x^2 + 8x$



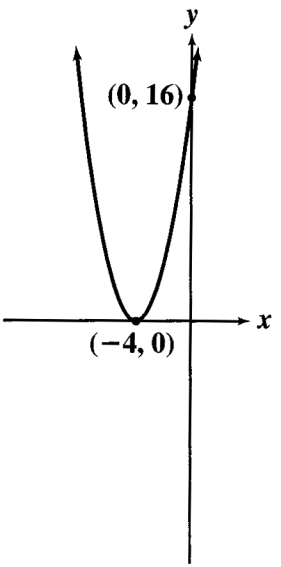
$y = x^2 + 8x + 7$



$y = x^2 + 8x + 12$



$y = x^2 + 8x + 15$



$y = x^2 + 8x + 16$