

Unit 7 Lesson 22: Rewriting Quadratic Expressions in Vertex Form

1 Three Expressions, One Function (Warm up)

Student Task Statement

These expressions each define the same function.

$$x^2 + 6x + 8 \quad (x + 2)(x + 4) \quad (x + 3)^2 - 1$$

Without graphing or doing any calculations, determine where the following features would be on a graph that represents the function.

1. the vertex
2. the x -intercepts
3. the y -intercept

2 Back and Forth

Student Task Statement

1. Here are two expressions in vertex form. Rewrite each expression in standard form. Show your reasoning.

a. $(x + 5)^2 + 1$

b. $(x - 3)^2 - 7$

2. Think about the steps you took, and about reversing them. Try converting one or both of the expressions in standard form back into vertex form. Explain how you go about converting the expressions.

3. Test your strategy by rewriting $x^2 + 10x + 9$ in vertex form.
4. Let's check the expression you rewrote in vertex form.
 - a. Use graphing technology to graph both $x^2 + 10x + 9$ and your new expression. Does it appear that they define the same function?
 - b. If you convert your expression in vertex form back into standard form, do you get $x^2 + 10x + 9$?

3 Inconvenient Coefficients

Student Task Statement

1. a. Here is one way to rewrite $3x^2 + 12x + 9$ in vertex form. Study the steps and write a brief explanation of what is happening at each step.

$$3x^2 + 12x + 9 \quad \text{Original expression}$$

$$3(x^2 + 4x + 3)$$

$$3(x^2 + 4x + 3 + 1 - 1)$$

$$3(x^2 + 4x + 4 - 1)$$

$$3((x + 2)^2 - 1)$$

$$3(x + 2)^2 - 3$$

- b. What is the vertex of the graph that represents this expression?
- c. Does the graph open upward or downward? Explain how you know.

2. Rewrite each expression in vertex form. Show your reasoning.

a. $-2x^2 - 4x + 6$

b. $4x^2 + 24x + 20$

c. $-x^2 + 20x$

4 Info Gap: Features of Functions (Optional)

Student Task Statement

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.

If your teacher gives you the data card:

1. Silently read the information on your card.
2. Ask your partner "What specific information do you need?" and wait for your partner to ask for information. Only give information that is on your card. (Do not figure out anything for your partner!)
3. Before telling your partner the information, ask "Why do you need to know (that piece of information)?"
4. Read the problem card, and solve the problem independently.
5. Share the data card, and discuss your reasoning.

If your teacher gives you the problem card:

1. Silently read your card and think about what information you need to answer the question.
2. Ask your partner for the specific information that you need.
3. Explain to your partner how you are using the information to solve the problem.
4. When you have enough information, share the problem card with your partner, and solve the problem independently.
5. Read the data card, and discuss your reasoning.

Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.