



# Graphing from the Vertex Form

Let's use vertex form to reason about a graph.

## 16.1 Math Talk: When $x$ Is -7

Evaluate each expression when  $x$  is -7, mentally.

- $x + 4$
- $(x + 4)^2$
- $-(x + 4)^2$
- $-(x + 4)^2 + 5$

## 16.2 Four Functions

- Complete the table of values for each function.

$$f(x) = (x - 4)^2$$

| $x$    | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|---|---|---|---|---|---|---|---|
| $f(x)$ |   |   |   |   |   |   |   |   |

$$g(x) = -(x - 4)^2$$

| $x$    | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------|---|---|---|---|---|---|---|---|
| $g(x)$ |   |   |   |   |   |   |   |   |



2. Use the completed tables to answer these questions:
- What are the coordinates of the vertex of each graph? How can you tell?
  - Does the graph of function  $f$  open up or down? How can you tell?
  - Does the graph of function  $g$  open up or down? How can you tell?
3. Suppose function  $h$  is defined by  $h(x) = (x - 4)^2 + 5$  and function  $j$  is defined by  $j(x) = -(x - 4)^2 + 5$ . Make predictions about the graph of each function using the questions here. If you get stuck, try creating tables of values.
- What are the coordinates of the vertex of the graphs of  $h$  and  $j$ ?
  - Which way—up or down—does the graph of each function open? How do you know?



## 16.3 Four More Functions

Here are some tables of values that represent quadratic functions.

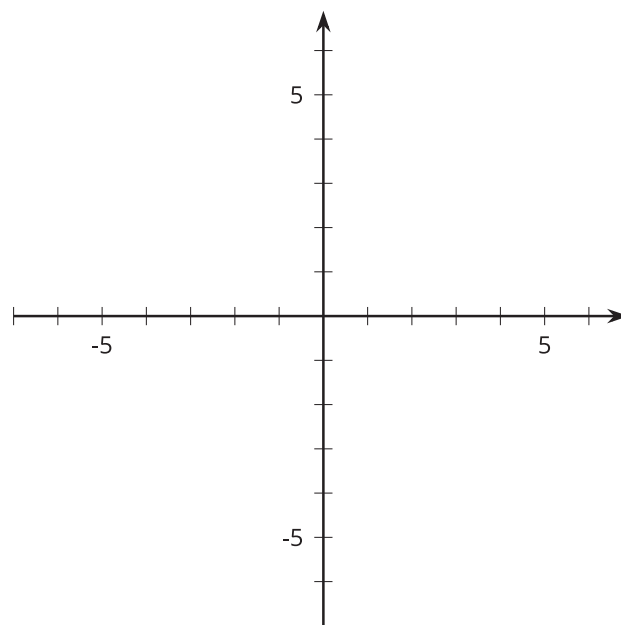
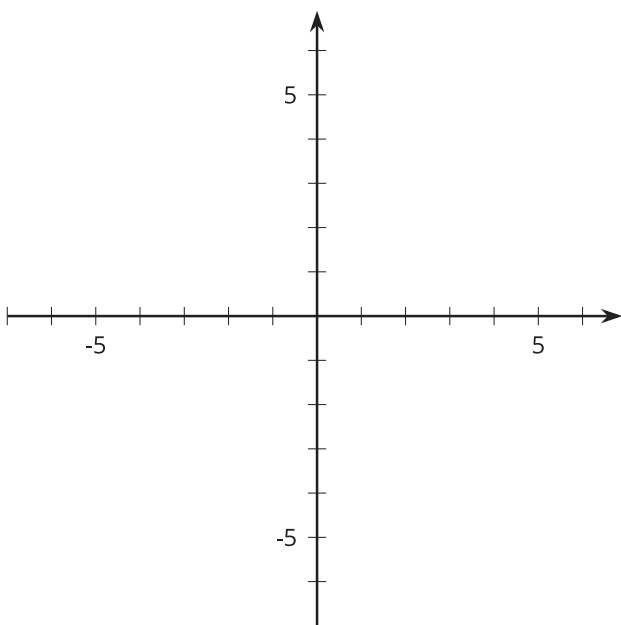
|        |     |    |   |    |     |     |     |
|--------|-----|----|---|----|-----|-----|-----|
| $x$    | 2   | 3  | 4 | 5  | 6   | 7   | 8   |
| $t(x)$ | -11 | -2 | 1 | -2 | -11 | -26 | -47 |

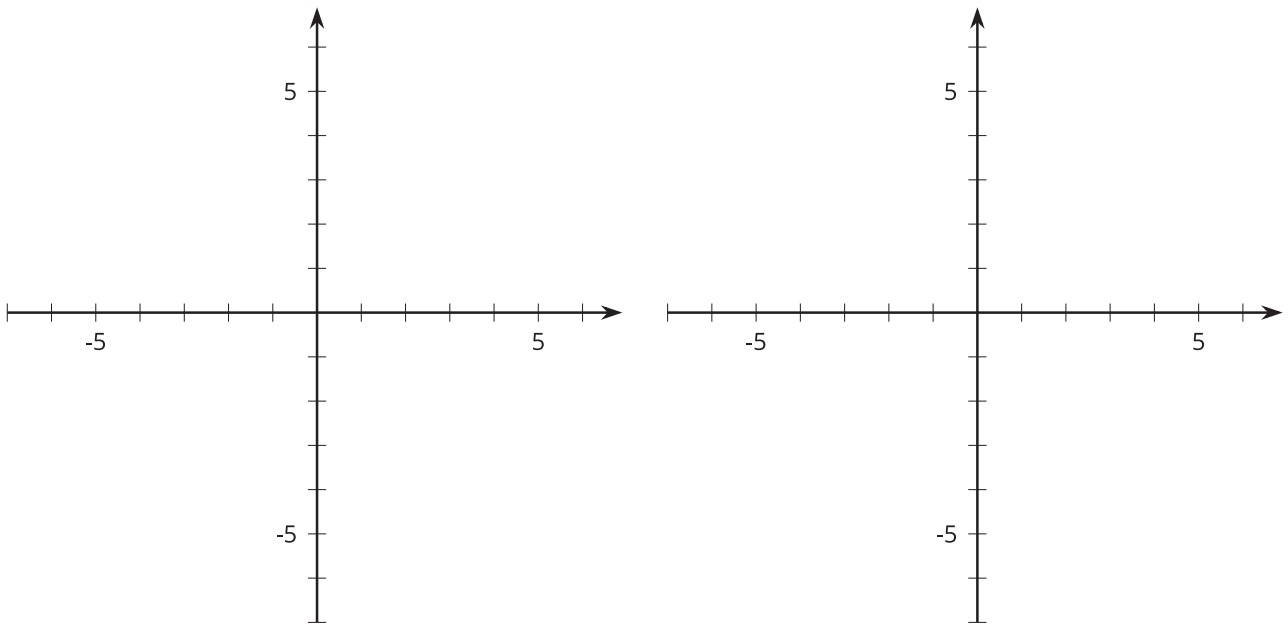
|        |    |    |   |   |    |    |    |
|--------|----|----|---|---|----|----|----|
| $x$    | -2 | -1 | 0 | 1 | 2  | 3  | 4  |
| $u(x)$ | 13 | 4  | 1 | 4 | 13 | 28 | 49 |

|        |    |    |    |    |   |   |   |
|--------|----|----|----|----|---|---|---|
| $x$    | -1 | 0  | 1  | 2  | 3 | 4 | 5 |
| $v(x)$ | 76 | 49 | 28 | 13 | 4 | 1 | 4 |

|        |     |     |     |    |   |    |     |
|--------|-----|-----|-----|----|---|----|-----|
| $x$    | -4  | -3  | -2  | -1 | 0 | 1  | 2   |
| $w(x)$ | -47 | -26 | -11 | -2 | 1 | -2 | -11 |

1. Make a rough sketch of a graph of each function. Label the vertex of each graph with its coordinates.





2. Here are some expressions that define quadratic functions. Match each function  $t$ ,  $u$ ,  $v$ , and  $w$  with an expression that defines it.

- a.  $3x^2 + 1$
- b.  $-3(x - 4)^2 + 1$
- c.  $3(x - 4)^2 + 1$
- d.  $-3x^2 + 1$