## Lesson 16: 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:

$x+4$

$\left(x+4\right)^{2}$

$-\left(x+4\right)^{2}$

$-\left(x+4\right)^{2}+5$

### 16.2: Four Functions

1. Complete the table of values for each function.
* $f\left(x\right)=\left(x−4\right)^{2}$

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * $x$
 | * 0
 | * 1
 | * 2
 | * 3
 | * 4
 | * 5
 | * 6
 | * 7
 |
| * $f\left(x\right)$
 | *
 | *
 | *
 | *
 | *
 | *
 | *
 | *
 |

* $g\left(x\right)=-\left(x−4\right)^{2}$

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * $x$
 | * 0
 | * 1
 | * 2
 | * 3
 | * 4
 | * 5
 | * 6
 | * 7
 |
| * $g\left(x\right)$
 | *
 | *
 | *
 | *
 | *
 | *
 | *
 | *
 |

1. Use the completed tables to answer these questions:
	1. What are the coordinates of the vertex of each graph? How can you tell?
	2. Does the graph of function $f$ open up or down? How can you tell?
	3. Does the graph of function $g$ open up or down? How can you tell?
2. Suppose function $h$ is defined by $h\left(x\right)=\left(x−4\right)^{2}+5$ and function $j$ is defined by $j\left(x\right)=-\left(x−4\right)^{2}+5$. Make predictions about the graph of each function using the questions here. If you get stuck, try creating a tables of values.
	1. What are the coordinates of the vertex of the graph of $h$ and $j$?
	2. 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 |
| $t\left(x\right)$ | -11 | -2 | 1 | -2 | -11 | -26 | -47 |

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

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $x$ | -4 | -3 | -2 | -1 | 0 | 1 | 2 |
| $w\left(x\right)$ | -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.
* 
* 
* 
* 
*
1. Here are some expressions that define quadratic functions. Match each function $t$, $u$, $v$, and $w$ with an expression that defines it.
	1. $3x^{2}+1$
	2. $-3\left(x−4\right)^{2}+1$
	3. $3\left(x−4\right)^{2}+1$
	4. $-3x^{2}+1$



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