GRADE 7

GRAPH CUBIC FUNCTIONS

By DataWORKS Educational Research

Learning Objective

We will graph cubic functions.

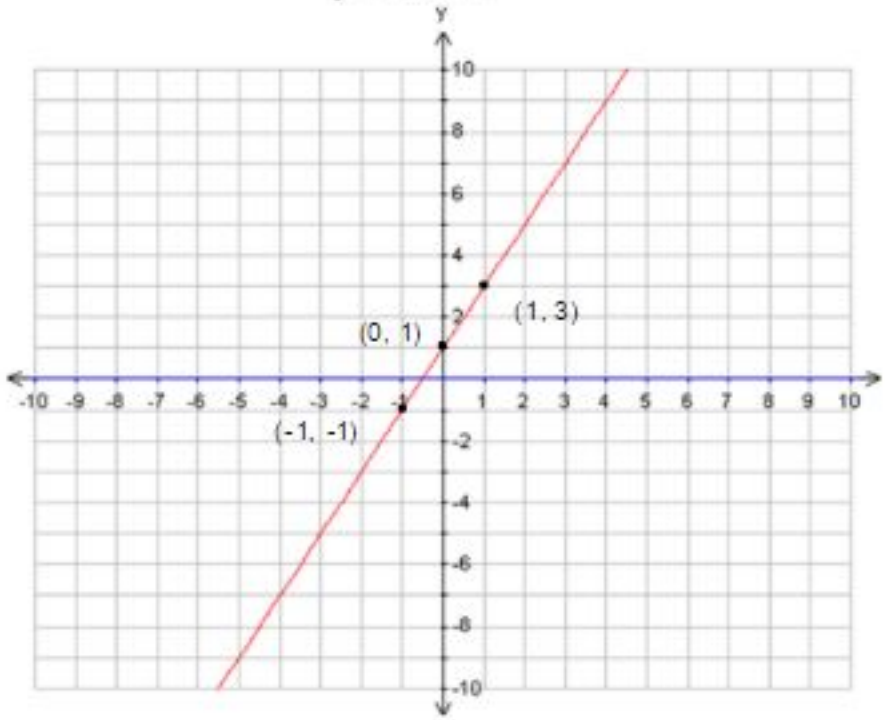
CFU

What are we going to do?

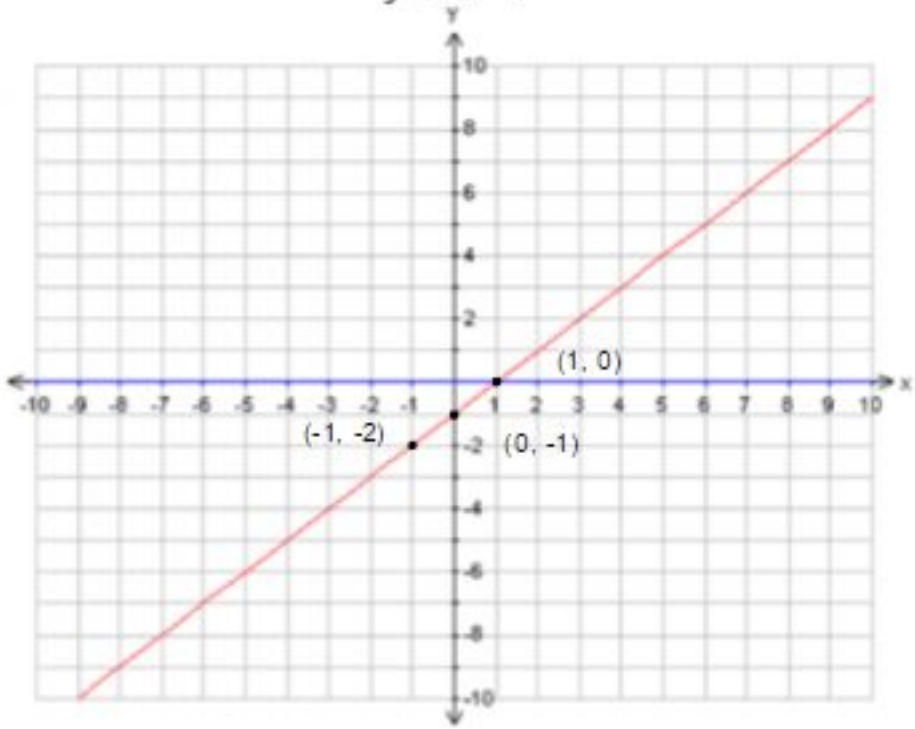
Activate Prior Knowledge

Graph the linear equations.

$y = 2x + 1$



$y = x - 1$



Make Connection

Students, you already know that graphing linear equations requires you to plot several points and connect them to form a line. Now, we will graph cubic functions.

An **equation** is a relationship between quantities that are equal (=). $4d+6=38$

A **function** is a set of ordered pairs (x, y) where each x-value corresponds[1] to exactly one y-value.

A **cubic function** is a function in which the greatest power of the variable is 3.

- *The most basic cubic function is $y = nx^3$, where n is not 0.*
- *The graphs of all cubic functions have the same basic shape.*
- *A table can be used to graph the function.*
- *The points should be connected with a smooth, curved line.*

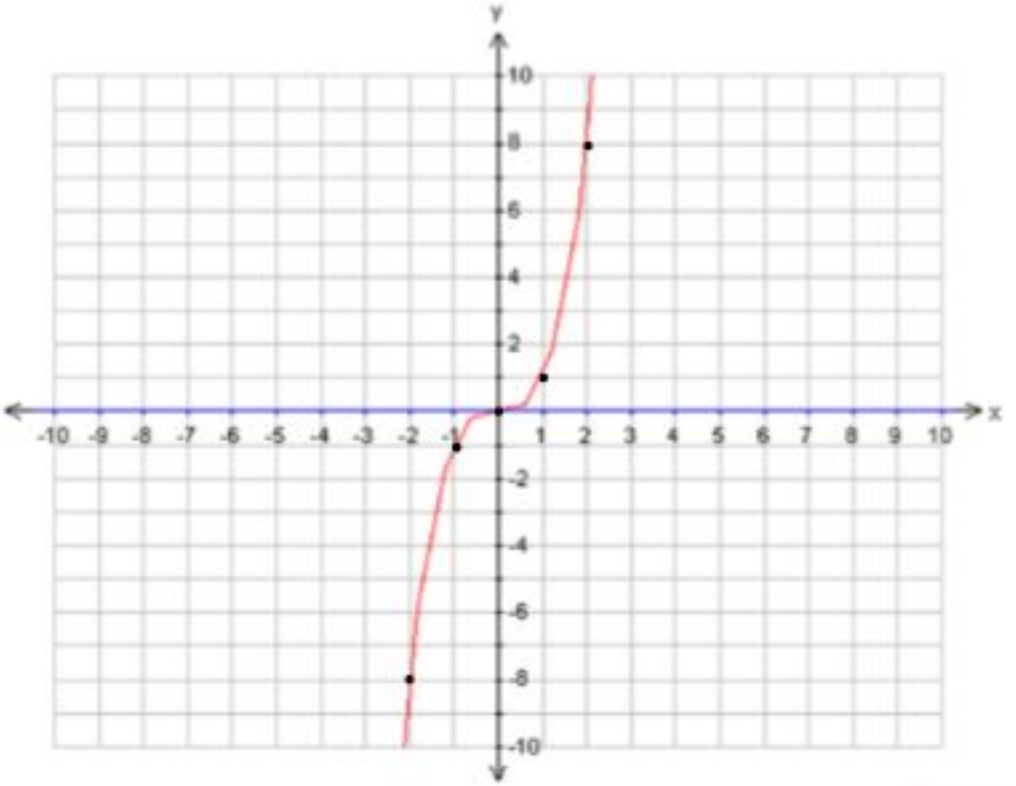
The coefficient of x^3 affects the graph.

- *Negative coefficient: flips the graph*
- *Coefficient larger than 1: narrower graph*
- *Coefficient smaller than 1: wider graph*

Examples:

$y = x^3$

x	$y = x^3$	y
-2	$(-2)^3$	-8
-1	$(-1)^3$	-1
0	$(0)^3$	0
1	$(1)^3$	1
2	$(2)^3$	8

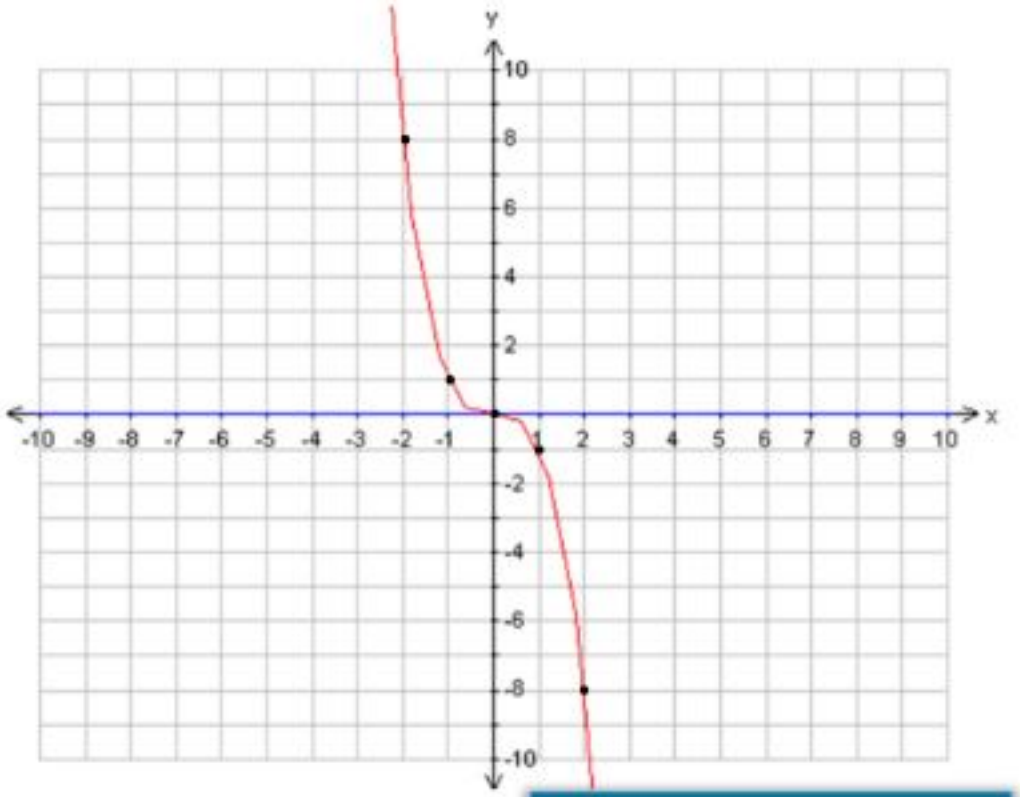


Vocabulary

[1] relates

$y = -x^3$

x	$y = -x^3$	y
-2	$-(-2)^3$	8
-1	$-(-1)^3$	1
0	$-(0)^3$	0
1	$-(1)^3$	-1
2	$-(2)^3$	-8



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In your own words, what is an equation?
"An equation is _____."
In your own words, what is a cubic function?
"A cubic function is _____."
What can you use to graph cubic functions?
Which is an example of a cubic function? How do you know?

A $y = 3x + 1$

B $y = 2x^3 + 6$

A cubic function is a function in which the greatest power of the variable is 3.

- *The most basic cubic function is $y = nx^3$, where n is not 0.*
- *The graphs of all cubic functions have the same basic shape.*

Graph cubic functions.

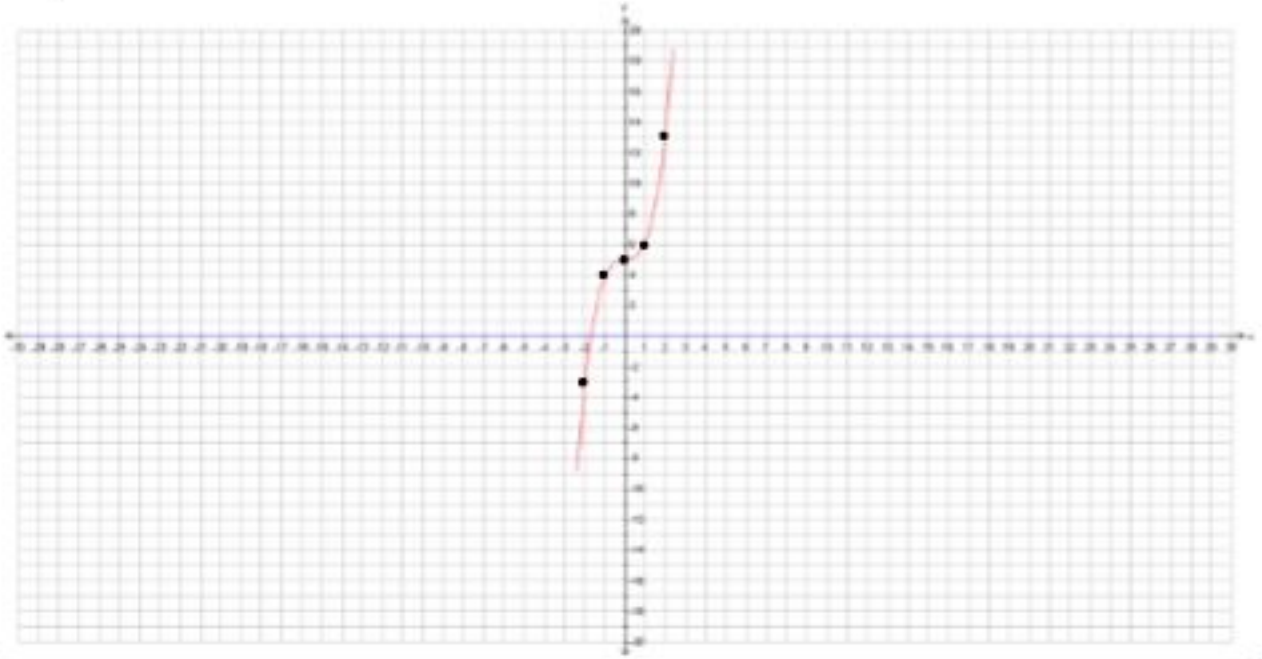
1. Substitute each value into the cubic equation and solve for y.
2. Plot the ordered pairs.
3. Connect the points using a smooth, curved line.

CFU

1. How did I/you solve for y?
2. How did I/you plot the ordered pairs?
3. How did I/you connect the points?

1.

x	$y = x^3 + 5$	y
-2	$y = (-2)^3 + 5$ $y = -8 + 5$	-3
-1	$y = (-1)^3 + 5$ $y = -1 + 5$	4
0	$y = (0)^3 + 5$ $y = 0 + 5$	5
1	$y = (1)^3 + 5$ $y = 1 + 5$	6
2	$y = (2)^3 + 5$ $y = 8 + 5$	13



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CFU

1. How did I/you solve for y?
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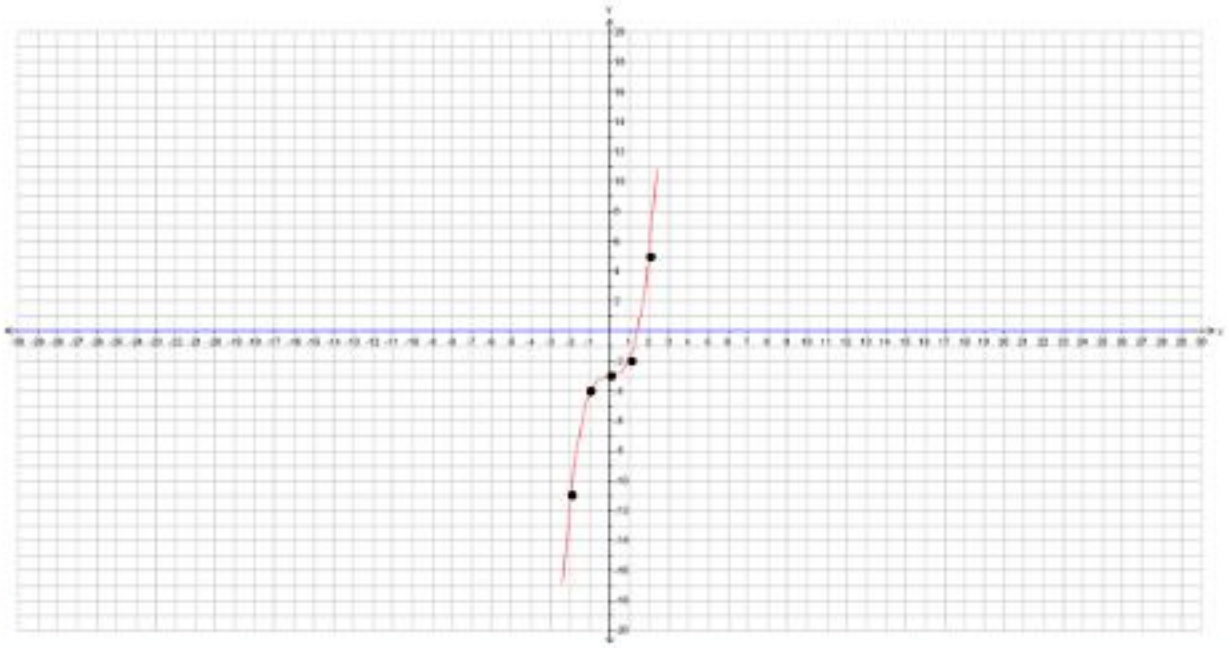
3. How did I/you connect the points?

2.

x	$y = x^3 - 3$	y
-2	$y = (-2)^3 - 3$ $y = -8 - 3$	-11
-1	$y = (-1)^3 - 3$ $y = -1 - 3$	-4
0	$y = (0)^3 - 3$ $y = 0 - 3$	-3
1	$y = (1)^3 - 3$ $y = 1 - 3$	-2
2	$y = (2)^3 - 3$ $y = 8 - 3$	5



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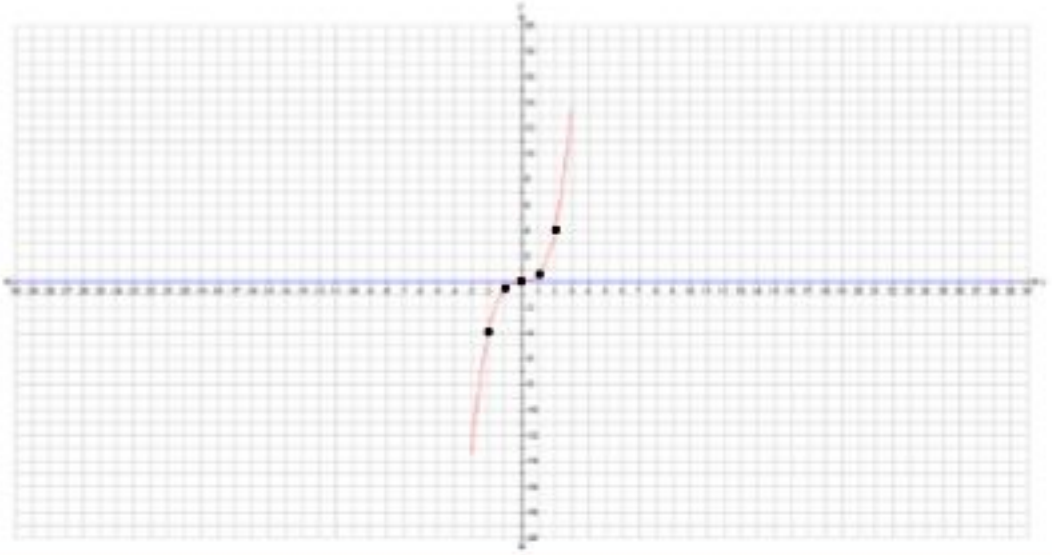
2. How did I/you plot the ordered pairs?
3. How did I/you connect the points?

3.

x	$y = \frac{1}{2}x^3$	y
-2	$y = \frac{1}{2}(-2)^3 \quad y = \frac{1}{2}(-8)$	-4
-1	$y = \frac{1}{2}(-1)^3 \quad y = \frac{1}{2}(-1)$	$-\frac{1}{2}$
0	$y = \frac{1}{2}(0)^3 \quad y = \frac{1}{2}(0)$	0
1	$y = \frac{1}{2}(1)^3 \quad y = \frac{1}{2}(1)$	$\frac{1}{2}$
2	$y = \frac{1}{2}(2)^3 \quad y = \frac{1}{2}(8)$	4



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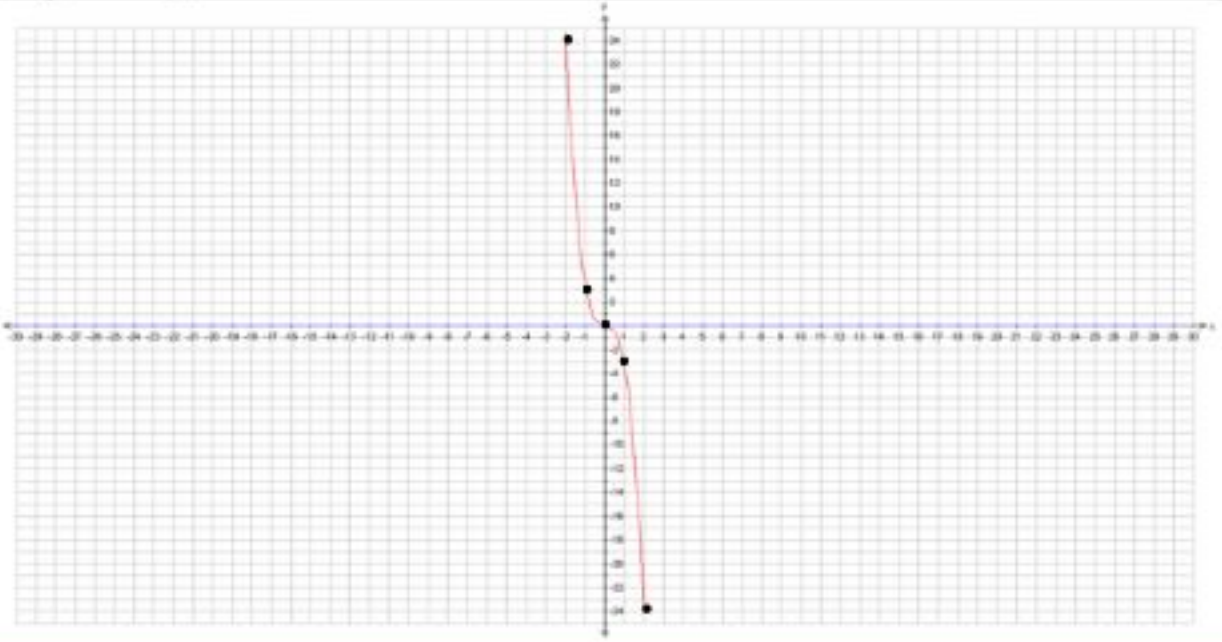
1. How did I/you solve for y?
2. How did I/you plot the ordered pairs?
3. How did I/you connect the points?

4.

x	$y = -3x^3$	y
-2	$y = -3(-2)^3$ $y = -3(-8)$	24
-1	$y = -3(-1)^3$ $y = -3(-1)$	3
0	$y = -3(0)^3$ $y = -3(0)$	0
1	$y = -3(1)^3$ $y = -3(1)$	-3
2	$y = -3(2)^3$ $y = -3(8)$	-24



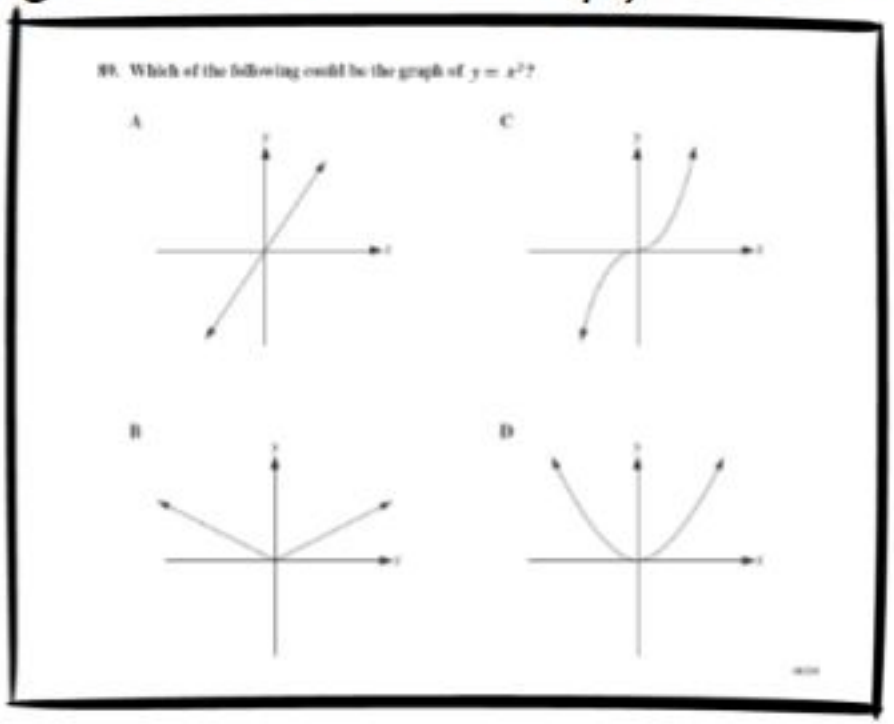
A **cubic function** is a function in which the greatest power of the variable is 3.

- *The most basic cubic function is $y = nx^3$, where n is not 0.*
- *The graphs of all cubic functions have the same basic shape.*

1 *Graphing cubic functions will help you represent problems graphically.*

A town's population increases according to the function $y = x^3 + 300$, where x is the number of years since 2000. By graphing the function, you could find the population at any time.

2 *Graphing cubic functions will help you do well on tests.*



CFU

Does anyone else have another reason why it is relevant to graph cubic functions? (Pair-Share) Why is it relevant to graph cubic functions? You may give one of my reasons or one of your own. Which reason is more relevant to you? Why?

Closure

A cubic function is a function in which the greatest power of the variable is 3.

- *The most basic cubic function is $y = nx^3$, where n is not 0.*
- *The graphs of all cubic functions have the same basic shape.*

Skill Closure

Graph cubic functions.

1. Substitute each value into the cubic equation and solve for y.
2. Plot the ordered pairs.
3. Connect the points using a smooth, curved line.

x	$y = x^3 - 4$	y
-2	$y = (-2)^3 - 4$ $y = -8 - 4$	-12
-1	$y = (-1)^3 - 4$ $y = -1 - 4$	-5
0	$y = (0)^3 - 4$ $y = 0 - 4$	-4
1	$y = (1)^3 - 4$ $y = 1 - 4$	-3
2	$y = (2)^3 - 4$ $y = 8 - 4$	4

Closure (continued)

A cubic function is a function in which the greatest power of the variable is 3.

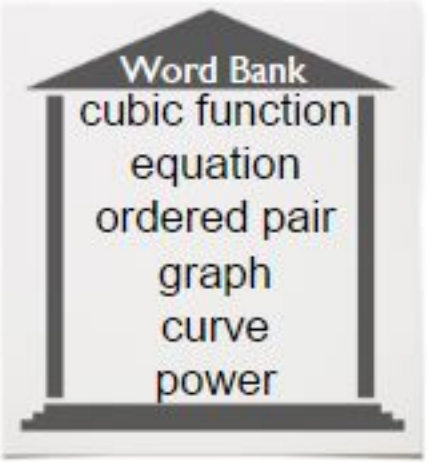
- *The most basic cubic function is $y = nx^3$, where n is not 0.*
- *The graphs of all cubic functions have the same basic shape.*

Constructed Response Closure

Misty made a table to graph $y = -2x^3$. Find her mistakes.

x	$y = -2x^3$	y
-2	$y = -2(-2)^3$ $y = -2(8)$ $y = -2(-8)$	-16 16
-1	$y = -2(-1)^3$ $y = -2(-1)$	2
0	$y = -2(0)^3$ $y = -2(0)$	-2 0
1	$y = -2(1)^3$ $y = -2^3$ $y = -2(1)$	-8 -2
2	$y = -2(2)^3$ $y = -2(8)$	-16

Misty made mistakes on x = -2, x = 0, and x = 1.



Summary Closure

What did you learn today about graphing cubic functions? (Pair-Share)
Use words from the word bank.

A **cubic function** is a function in which the greatest power of the variable is 3.

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Graph cubic functions.

1. Substitute each value into the cubic equation and solve for y.
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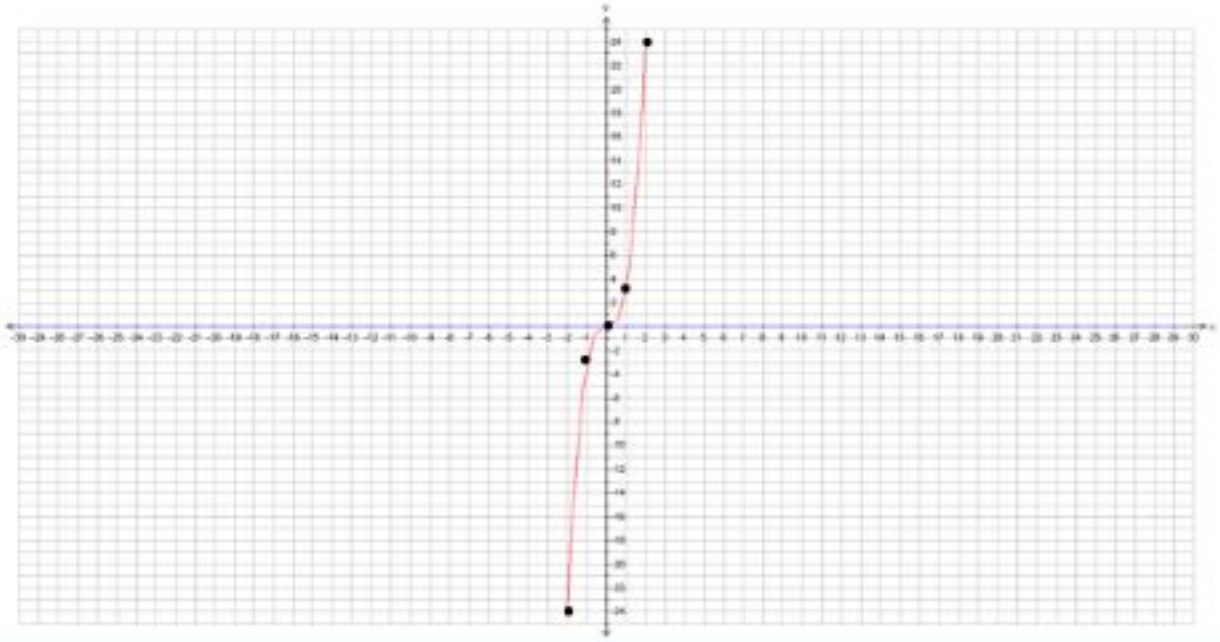
1.

x	$y = 3x^3$	y
-2	$y = 3(-2)^3$ $y = 3(-8)$	-24
-1	$y = 3(-1)^3$ $y = 3(-1)$	-3
0	$y = 3(0)^3$ $y = 3(0)$	0
1	$y = 3(1)^3$ $y = 3(1)$	3
2	$y = 3(2)^3$ $y = 3(8)$	24



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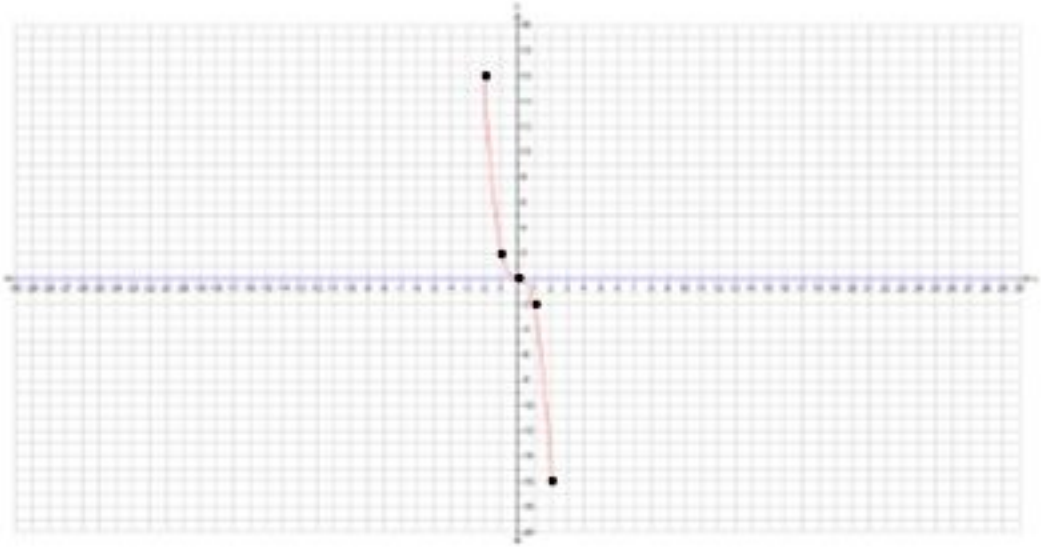

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-1	$y = -\frac{1}{2}(-1)^3$ $y = -\frac{1}{2}(-1)$	$\frac{1}{2}$
0	$y = -\frac{1}{2}(0)^3$ $y = -\frac{1}{2}(0)$	0
1	$y = -\frac{1}{2}(1)^3$ $y = -\frac{1}{2}(1)$	$-\frac{1}{2}$
2	$y = -\frac{1}{2}(2)^3$ $y = -\frac{1}{2}(8)$	-4

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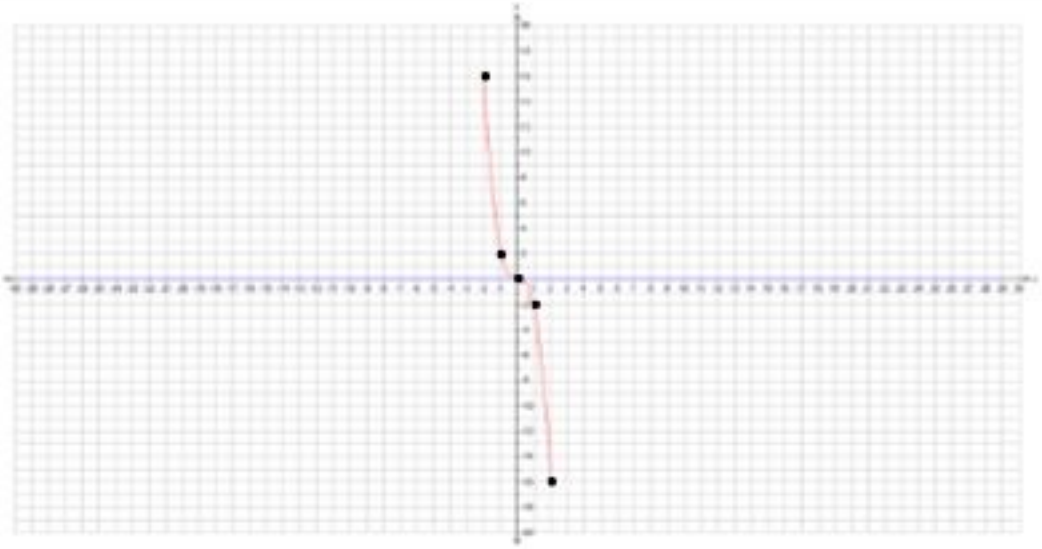
2	$y = -2(2)^3$ $y = -2(8)$	-16



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-1	$y = \frac{1}{3}(-1)^3 \quad y = \frac{1}{3}(-1)$	$-\frac{1}{3}$
0	$y = \frac{1}{3}(0)^3 \quad y = \frac{1}{3}(0)$	0
1	$y = \frac{1}{3}(1)^3 \quad y = \frac{1}{3}(1)$	$\frac{1}{3}$
2	$y = \frac{1}{3}(2)^3 \quad y = \frac{1}{3}(8)$	$2\frac{2}{3}$