

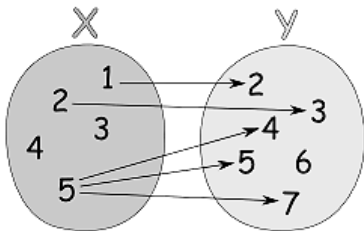
FUNCTION INTRODUCTION

Vocabulary

- Relation** – pairings, often represented as _____ or _____ between _____ and _____.
- Function** – a relation between two variables in which each _____ gives exactly one _____.
- Domain** – the set of all _____ values (x's)
- Range** – the set of all _____ values (y's)
- Independent Variable** – the input variable which an experimenter has _____ over or which is not _____ by anything.
- Dependent Variable** – the output variable which is found as a _____ of the independent variable.

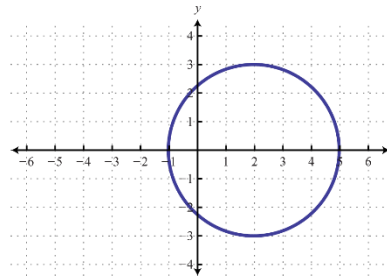
Examples

1. Is this a function? What's the domain and range?



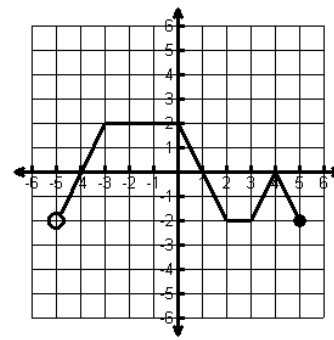
- yes
domain: {1, 2, 3, 4, 5}
range: {2, 3, 4, 5, 6, 7}
- no
domain: {1, 2, 5}
range: {2, 3, 4, 5, 7}
- no
domain: {2, 3, 4, 5, 7}
range: {1, 2, 5}

5. Is this graph a function? What's the domain and range?



- yes
domain: {-1, 0, 1, 2, 3, 4, 5}
range: {-3, -2, -1, 0, 1, 2, 3}
- no
domain: $-1 \leq x \leq 5$
range: $-3 \leq y \leq 3$
- no
domain: $-3 < x < 3$
range: $-1 < y < 5$

6. Is this graph a function? What's the domain and range?



- no
domain: $-5 < x \leq 5$
range: $-2 < y \leq 2$
- yes
domain: $-5 < x \leq 5$
range: $-2 \leq y \leq 2$
- yes
domain: $-2 \leq x \leq 2$
range: $-5 \leq y \leq 5$

7. Is this table a function? What's the domain and range?

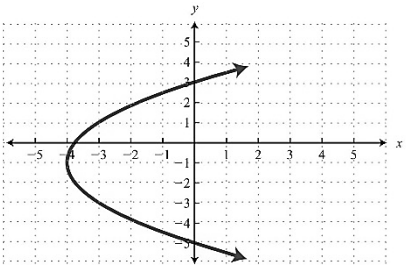
x	y
-2	2
-1	2
0	2
1	2
2	2

- yes
domain: {-2, -1, 0, 1, 2}
range: {2}
- no
domain: {2}
range: {-2, -1, 0, 1, 2}
- yes
domain: $-2 \leq x \leq 2$
range: {2}

2. Is the set $\{(-2, 12), (-1, 3), (0, 0), (1, 3), (2, 12)\}$ a function?
What's the domain and range?

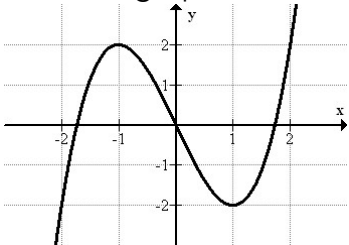
- a. yes
domain: $\{-2, -1, 0, 1, 2\}$
range: $\{0, 3, 12\}$
- b. no
domain: $\{0, 3, 12\}$
range: $\{-2, -1, 0, 1, 12\}$
- c. yes
domain: $-2 \leq x \leq 2$
range: $0 \leq y \leq 12$

3. Is this graph a function? What's the domain and range?



- a. yes
domain: $\{-4, -3, -2, -1, 0, 1\}$
range: $\{-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4\}$
- b. no
domain: $x \geq -4$
range: all real numbers
- c. no
domain: $x \leq -4$
range: $-6 \leq y \leq 4$

4. Is this graph a function? What's the domain and range?



- a. yes
domain: all real numbers
range: all real numbers
- b. no
domain: all real numbers
range: all real numbers
- c. yes
domain: $-2 \leq x \leq 2$
range: $-3 \leq y \leq 3$

FUNCTION NOTATION

Using function notation is like replacing _____ with _____, so that we have $f(x)=mx+b$ instead of $y=mx+b$, but it's slightly more than that.

It shows the input (x) and output (y) pair of values of a functional relationship at the same time.

$$f(x) = 4x - 3$$

Consider $y = 2x + 1$ versus $f(x) = 2x + 1$. Find y when x is 4.

Examples

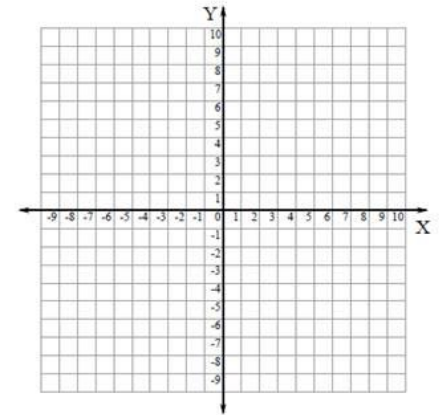
If $f(x) = 4 - 5x$, $g(x) = 2x^2 + 14x - 16$, and $p(t) = 3(2)^t - 1$, evaluate the following using understanding of function notation.

- | | |
|------------|------------|
| 1. $f(-2)$ | 2. $g(-1)$ |
| 3. $p(0)$ | 4. $g(-2)$ |
| 5. $p(2)$ | 6. $f(-3)$ |

PARENT FUNCTION OF QUADRATICS

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

x	y
-3	
-2	
-1	
0	
1	
2	
3	



Vocabulary

Parabola

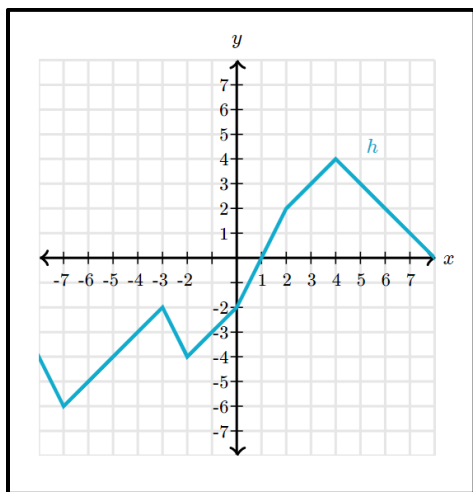
Vertex

Axis of symmetry

Maximum/minimum

Roots/Zeros/X-Intercepts

Here's a function h . Evaluate h for the given inputs and find all the possible inputs for which h results in the given outputs.



7. $h(5) =$

8. $h(-1) =$

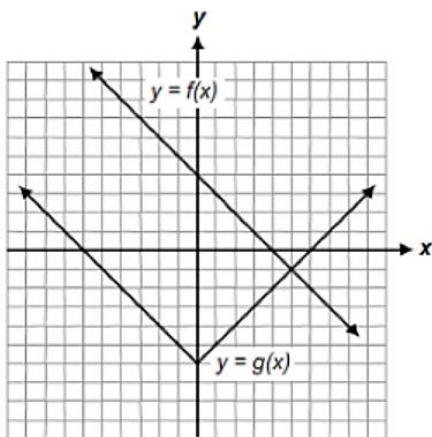
9. $h(0) =$

10. $h(-3) =$

11. x such that $h(x) = -2$

12. x such that $h(x) = 2$

The graph below represents a linear function and an absolute value function. $f(x) = -x + 4$ and $g(x) = |x| - 6$. Find the solutions to the equation $f(x) = g(x)$.



Vertex Form	Standard Form	Intercept Form
$y = a(x - h)^2 + k$	$y = ax^2 + bx + c$	$y = a(x - p)(x - q)$
<p>If $a < 0$, the parabola is upside down.</p> <p>If $a > 0$, the parabola is right side up.</p>		
Vertex	Y-intercept	X-intercept(s)
(h, k)	$(0, c)$	$(p, 0)$ and $(q, 0)$
$y = 2(x - 3)^2 - 1$	$y = 2x^2 - 3x - 1$	$y = 2(x - 3)(x - 1)$

Graphing Quadratic Functions

Vertex Form

$$y = a(x - h)^2 + k$$

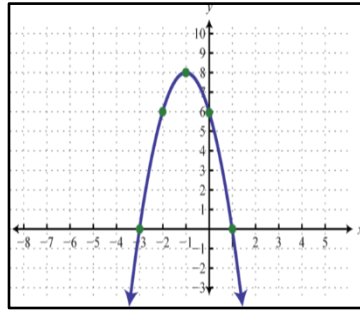
Example:

$$y = -2(x + 1)^2 + 8$$

$$a = \quad h = \quad k =$$

Vertex:

Axis of Symmetry:



This graph is a parabola that has been reflected over the x-axis, stretched vertically, and translated left 1 unit and up 8 units.

Practice

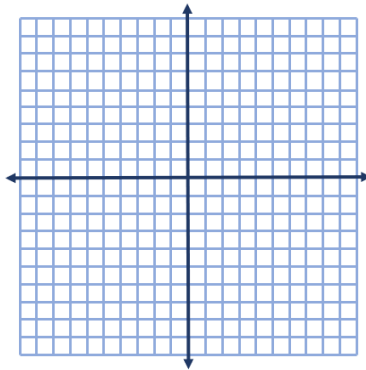
1. $y = (x + 3)^2 - 5$

$$a = \quad h = \quad k =$$

Vertex?

Axis of Symmetry?

Maximum or minimum?



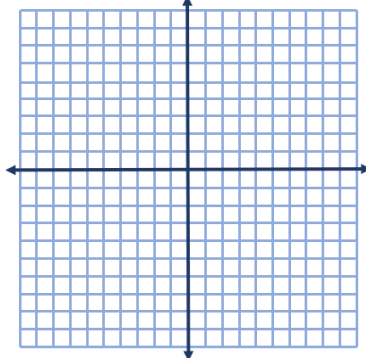
2. $y = -(x - 2)^2 - 5$

$$a = \quad h = \quad k =$$

Vertex?

Axis of Symmetry?

Maximum or minimum?



CONVERTING FROM STANDARD FORM TO VERTEX FORM

Completing the Square Steps for Functions and Expressions

- ✓ Check to see function is in standard form, separating _____ from _____ .
- ✓ _____ a from variable terms.
- ✓ Take _____ the coefficient of x, _____ it, _____ it inside and _____ it outside.
 - ✗ Or vice versa
 - ✗ Don't forget what's out front!
- ✓ Factor the _____ and rewrite as a factor squared.

Examples

1. $f(x) = 2x^2 + 20x + 49$

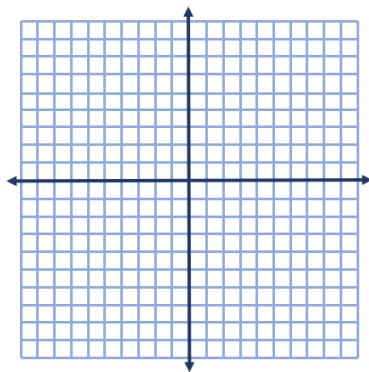
3. $y = -2(x - 7)^2 + 8$

a = h = k =

Vertex?

Axis of Symmetry?

Maximum or minimum?



2. $g(x) = -3x^2 + 24x - 41$

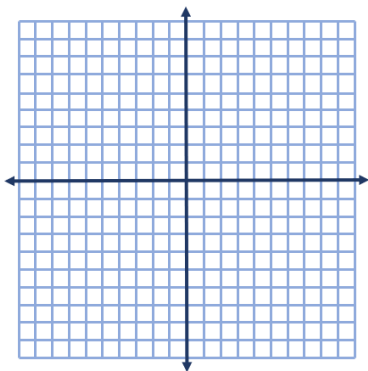
4. $y = -(x + 2)^2$

a = h = k =

Vertex?

Axis of Symmetry?

Maximum or minimum?



3. $h(x) = 6x^2 - 84x + 290$

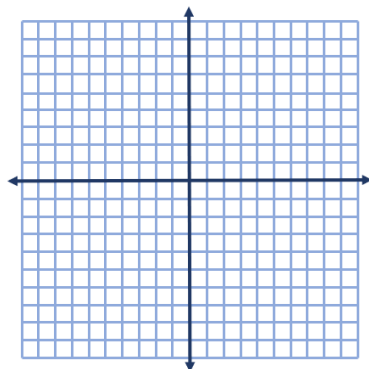
5. $y = 2(x + 3)^2 - 6$

a = h = k =

Vertex?

Axis of Symmetry?

Maximum or minimum?



4. $p(x) = -4x^2 - 8x - 9$

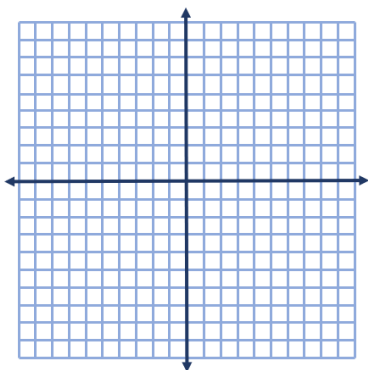
6. $y = -\frac{1}{2}(x + 4)^2 + 7$

a = h = k =

Vertex?

Axis of Symmetry?

Maximum or minimum?



Graphing Quadratic Functions

Standard Form

$$y = ax^2 + bx + c$$

Example:

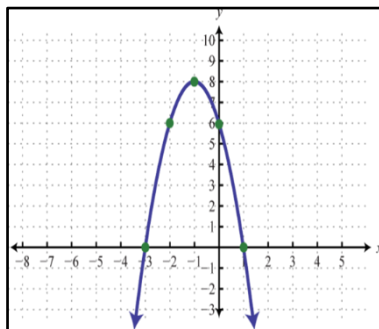
$$y = -2x^2 - 4x + 6$$

$$a = \quad c =$$

Maximum or minimum?

Y-intercept?

Vertex form?



This parabola has an AXIS OF SYMMETRY at $x =$, a VERTEX at (,) which is also considered a MAXIMUM, a Y-INTERCEPT at (,).

Practice

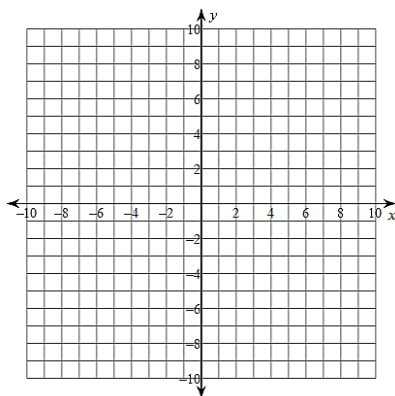
1. $y = x^2 - 2x - 3$

$$a = \quad c =$$

Maximum or minimum?

Y-intercept?

Vertex form?



Graphing Quadratic Functions

Intercept/Factored Form

$$y = a(x - p)(x - q)$$

Example:

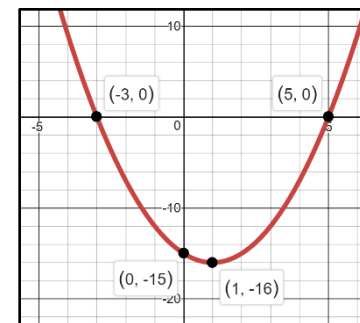
$$y = (x + 3)(x - 5)$$

$$a = \quad p = \quad q =$$

x-intercept(s)?

Vertex?

Standard form?



This parabola has X-INTERCEPTS at (,) and (,). The AXIS OF SYMMETRY is half-way in between at $x =$, with a VERTEX at (,). The y-intercept is at (,).

Practice

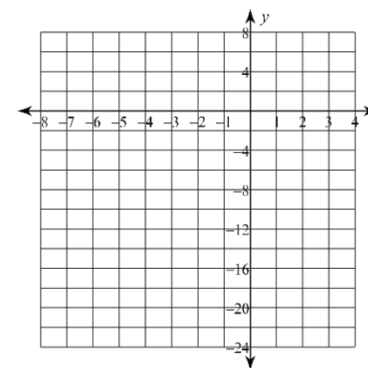
1. $y = -2(x + 2)(x + 4)$

$$a = \quad p = \quad q =$$

x-intercept(s)?

Vertex?

Standard form?



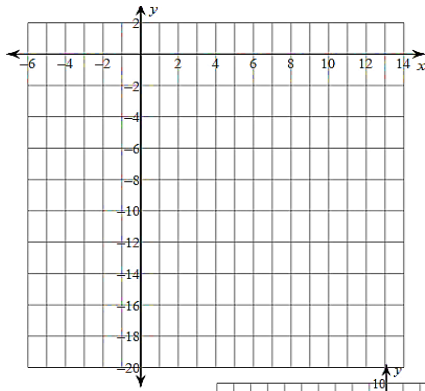
2. $y = -2x^2 + 12x - 18$

$a = \quad c =$

Maximum or minimum?

Y-intercept?

Vertex form?



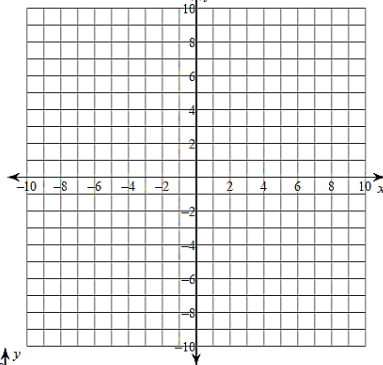
3. $y = -x^2 + 6x - 5$

$a = \quad c =$

Maximum or minimum?

Y-intercept?

Vertex form?



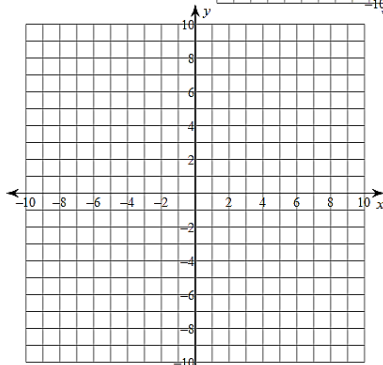
4. $y = 2x^2 - 8$

$a = \quad c =$

Maximum or minimum?

Y-intercept?

Vertex form?



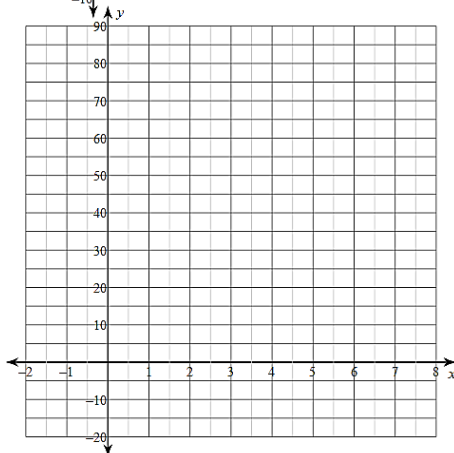
5. $y = 5x^2 - 40x + 75$

$a = \quad c =$

Maximum or minimum?

Y-intercept?

Vertex form?



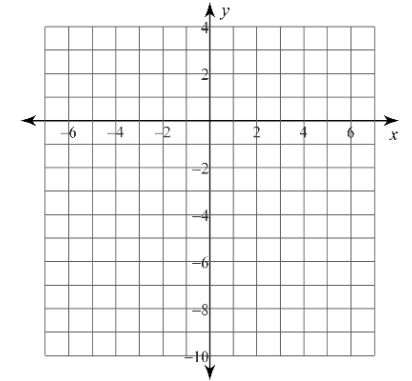
2. $y = \frac{1}{2}(x + 2)(x - 6)$

$a = \quad p = \quad q =$

x-intercept(s)?

Vertex?

Standard form?



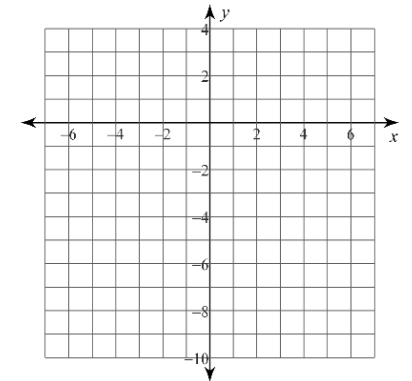
3. $y = -(x - 5)(x - 1)$

$a = \quad p = \quad q =$

x-intercept(s)?

Vertex?

Standard form?



4. $y = (x + 7)(x - 3)$

$a = \quad p = \quad q =$

x-intercept(s)?

Vertex?

Standard form?

