Quadratic Functions and Transformations

TRANSLATIONS OF FUNCTIONS

Vertical stretch of 5

Shift right 3 units
(when you take it out the
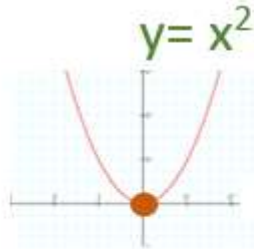parenthesis it changes the sign)

$$f(x) = -5(x-3)^2 + 7$$
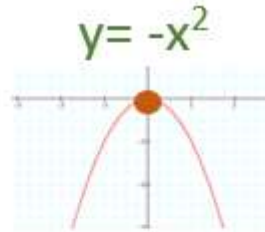
Negative in front
reflects across the x-axis

Shifts up 7 units

$f(x) = \sqrt{-x}$ means it reflects across the $y - axis$
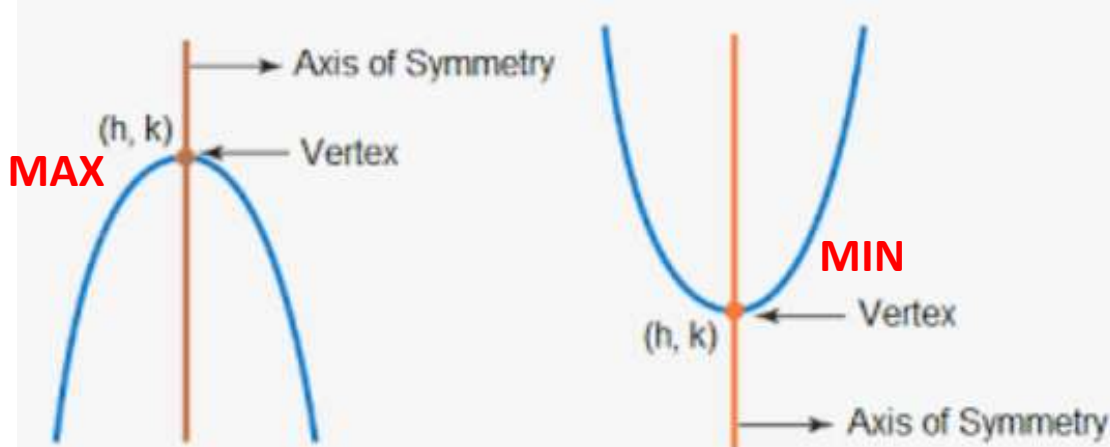
**EXTREMELY IMPORTANT TO FIND DOMAIN AND RANGE ACCORDING TO THE DIRECTION OF THE GRAPH

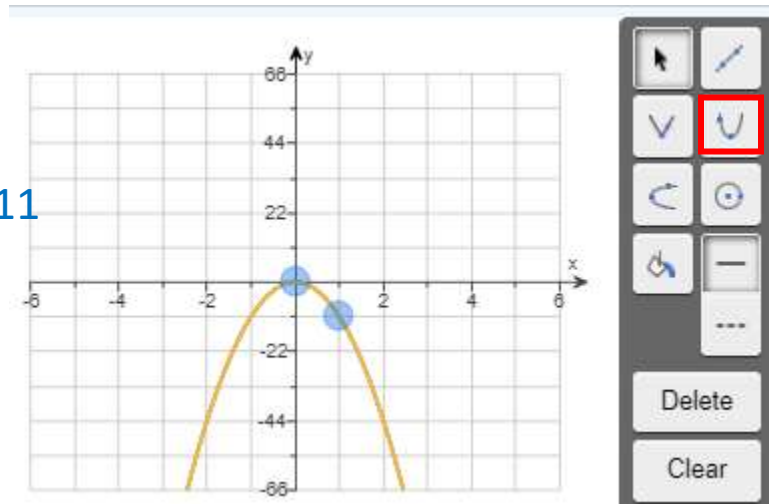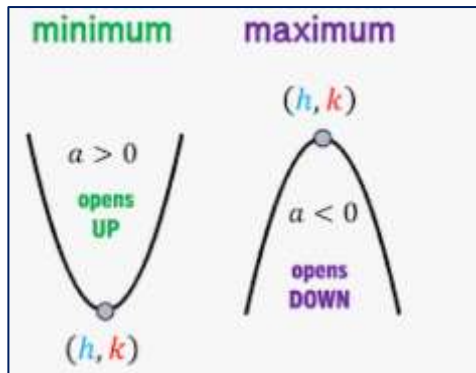$y = x^2$

Domain: all real numbers
Range: y ≥

$y = -x^2$

Domain: all real numbers
Range y ≤

Axis of Symmetry

(h, k)

MAX   Vertex

MIN

(h, k)   Vertex

Axis of Symmetry

1) Graph the function $f(x) = -11x^2$.

Plot vertex (0,0) FIRST

Then plug in x=1 y= -11(1)² - 11
plot (1,-11)

minimum	maximum
	(h, k)
$a > 0$	$a < 0$
opens UP	opens DOWN
(h, k)	

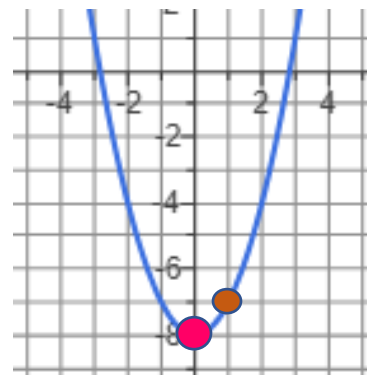2) Graph the function. Decsribe how it was translated from $f(x) = x^2$.

Down 8 units

$f(x) = x^2 - 8$

Plot vertex (-8,0) FIRST

Then plug in shift up 1 and right 1

The graph of $f(x) = x^2$ was translated 8 units down.

3-5) Graph the function. Decsribe how it was translated from $f(x) = x^2$.
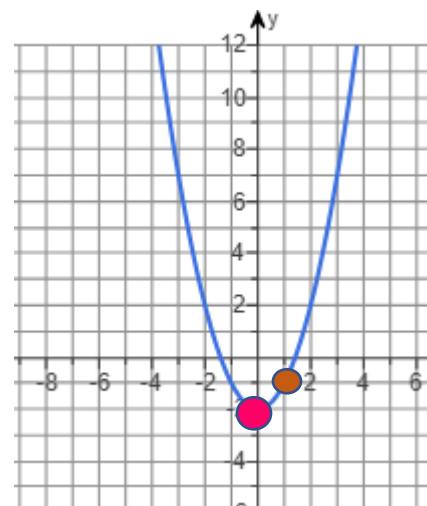
$f(x) = x^2 - 2$

Down 2 units

Plot vertex (-2,0) FIRST

Then plug in shift up 1 and right 1

The graph of $f(x) = x^2$ was translated 2 units down.

6,7) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

$y = (x + 6)^2$ left and right position changes sign

Describe the transformation. Choose the correct answer below.

- ○ A translation of the graph to the right by 6 units
- ○ A translation of the graph down by 6 units
- ✔ A translation of the graph to the left by 6 units
- ○ A translation of the graph up by 6 units

8,9) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

$y = (x - 5)^2 + 7$

Describe the transformation. Choose the correct answer below.

- ○ A translation of the graph to the left by 5 units and up by 7 units
- ○ A translation of the graph to the left by 7 units and up by 5 units
- ✔ A translation of the graph to the right by 5 units and up by 7 units
- ○ A translation of the graph to the right by 7 units and down by 5 units
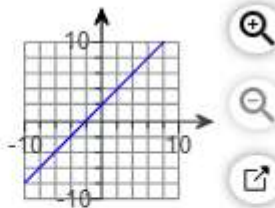
10,11) Sketch the graph of the parabola.
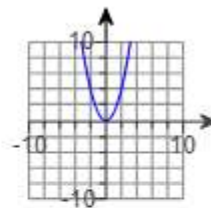
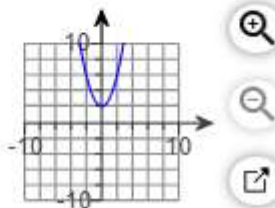$f(x) = x^2 - 2$

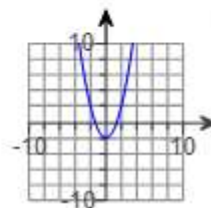Down 2

Choose the correct graph.

- ○ A.
- ○ B.
- ○ C.
- ✔ D.

12,13) Identify the vertex and the axis of symmetry of the quadratic function. Then, graph the quadratic function.

$$f(x) = (x - 15)^2$$
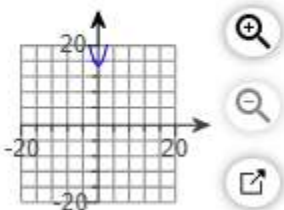
$y = (x - h)^2 + k$ vertex is (h,k)

change the h sign

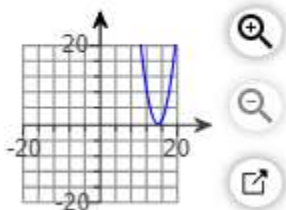The vertex is (15,0). (Type an ordered pair.)

axis of symmetry is x = h

The axis of symmetry is x = 15. (Type an equation.)
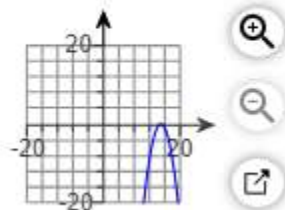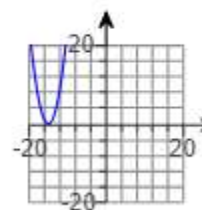
Choose the correct graph of $f(x) = (x - 15)^2$.

○ **A.**   ● **B.**   ○ **C.**   ○ **D.**

14,15) Determine the graph of the quadratic function, find the vertex and determine the axis of symmetry.

$$f(x) = (x + 2)^2 + 3$$

$y = (x - h)^2 + k$ vertex is (h,k)   axis of symmetry is x = h
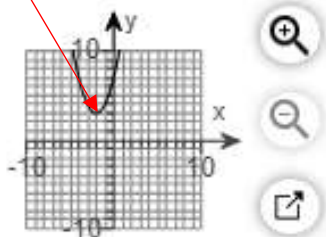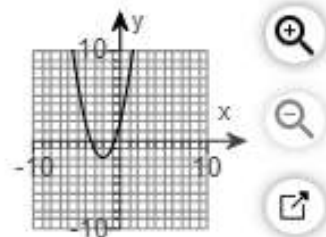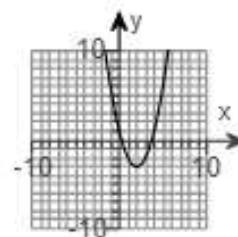
Find the vertex of the parabola.

The vertex is (-2 , 3).

Find the equation of the axis of symmetry.

x = -2
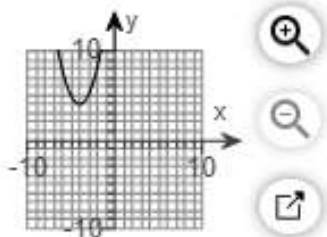
○ **A.**   ● **B.**   ○ **C.**   ○ **D.**

16,17) Identify the vertex and the axis of symmetry of the quadratic function. Then, graph the quadratic function.
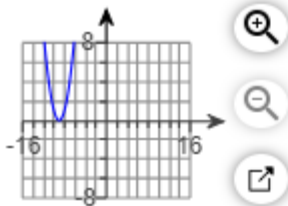
$f(x) = (x + 9)^2 - 5$

The vertex is $(-9, -5)$. (Type an ordered pair.) $y = (x - h)^2 + k$ vertex is (h,k)

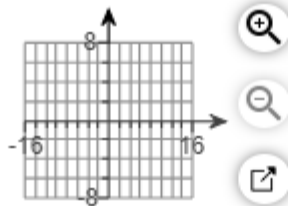The axis of symmetry is $x = -9$. (Type an equation.)

axis of symmetry is x = h
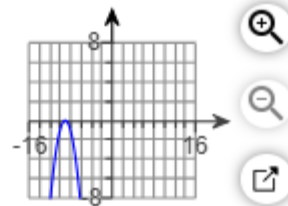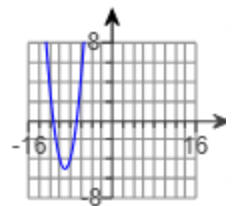
Choose the correct graph of $f(x) = (x + 9)^2 - 5$.

A.   B.   C.   D.

18,19) Determine the graph of the quadratic function, find the vertex and determine the axis of symmetry.

$f(x) = 4(x - 5)^2$

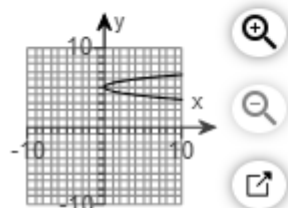The vertex is $(5,0)$. $y = (x - h)^2 + k$ vertex is (h,k)

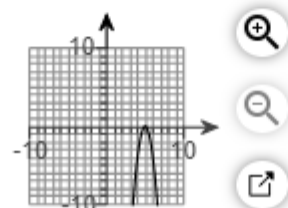Find the equation of the axis of symmetry.

$x = 5$ axis of symmetry is x = h
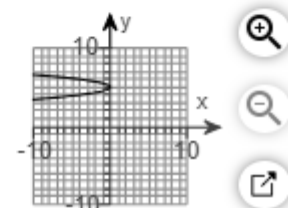
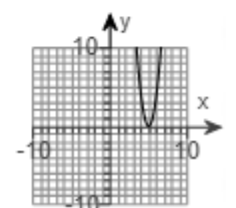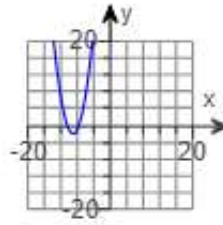Choose the correct graph of the function below.

A.   B.   C.   D.

20,21) Choose the graph that represents the function.
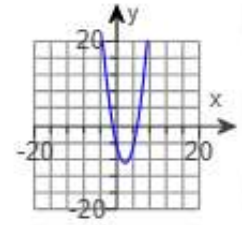
$$f(x) = (x - 2)^2 - 9$$

shifts right 2 and down 9

...

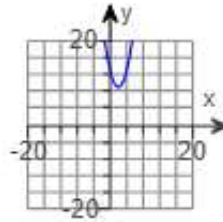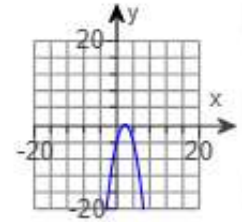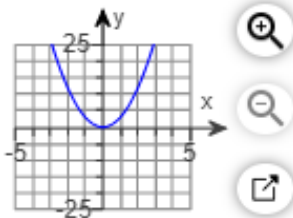Choose the correct graph from the choices on the right.

○ A.

● B.

○ C.

○ D.

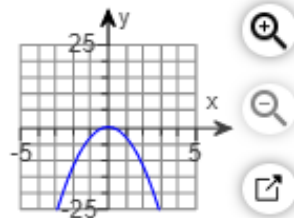**22)** Graph the parabola. Identify the vertex.

$$y = 3x^2$$ Vertical stretch of 3 VERTEX (0,0)

...

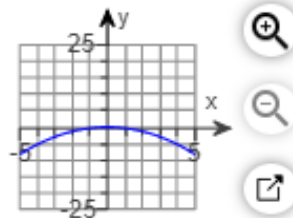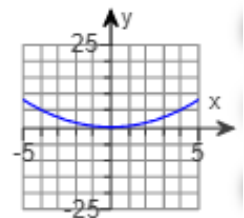Choose the correct graph below.

● A.

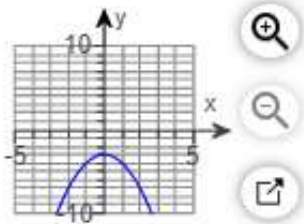

○ B.

○ C.

○ D.

What is the vertex?

(0,0) (Type an ordered pair.)

23) Graph the function.   reflects across the x and shifts up 3
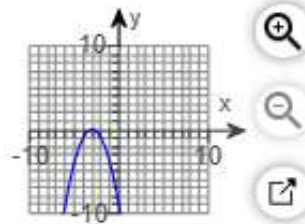
$$f(x) = -x^2 + 3$$
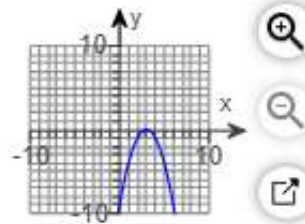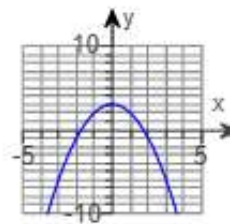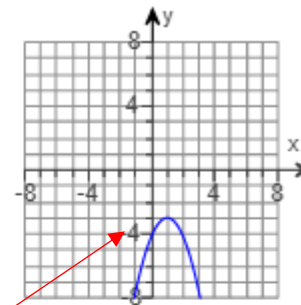
Choose the correct graph below.

A.

B.

C.

★ D.

24) Identify the vertex of the graph. Tell whether it is a minimum or a maximum.

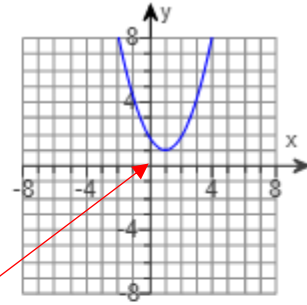What is the vertex of the graph?

(1, − 3) (Type an ordered pair.)

Is the vertex a minimum or a maximum?

○ Minimum

★ Maximum

25) Identify the vertex of the graph. Tell whether it is a minimum or a maximum.

What is the vertex of the graph?

(1,1) (Type an ordered pair.)

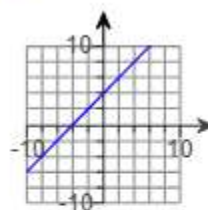Is the vertex a minimum or a maximum?

○ Maximum

⭐ Minimum
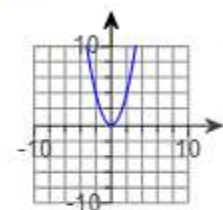
EXTRA EXAMPLES

a) Sketch the graph of the parabola.

$f(x) = x^2 - 4$
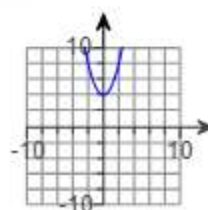
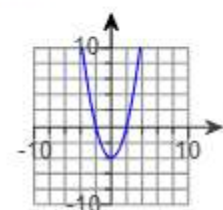### Down 4 units

○ **A.**

○ **B.**

○ **C.**

● **D.**

b) Identify the vertex and the axis of symmetry of the quadratic function. Then, graph the quadratic function.

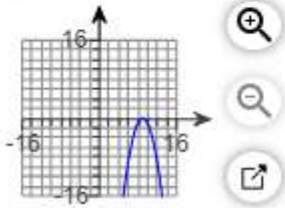$f(x) = (x - 9)^2$

The vertex is (9,0). (Type an ordered pair.)

$y = (x - h)^2 + k$ vertex is (h,k)

The axis of symmetry is x = 9. (Type an equation.)

axis of symmetry is x = h

Choose the correct graph of $f(x) = (x - 9)^2$.

○ A.   ● B.   ○ C.   ○ D.

c) Determine the graph of the quadratic function, find the vertex and determine the axis of symmetry.

$f(x) = (x + 5)^2 + 4$
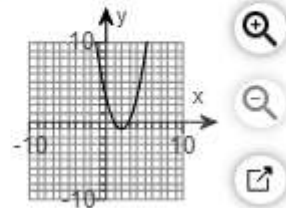
○ A.   ● B.   ○ C.   ○ D.
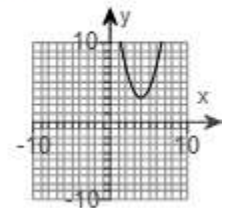
$y = (x - h)^2 + k$ vertex is (h,k)

axis of symmetry is x = h

Find the vertex of the parabola.

The vertex is (-5 , 4).

Find the equation of the axis of symmetry.

x = -5

d) Identify the vertex and the axis of symmetry of the quadratic function. Then, graph the quadratic function.

$$f(x) = (x + 7)^2 - 2$$

The vertex is $(-7, -2)$. (Type an ordered pair.)

$y = (x - h)^2 + k$ vertex is (h,k)

The axis of symmetry is $x = -7$. (Type an equation.)

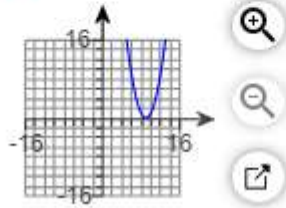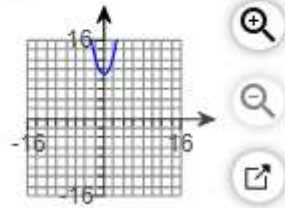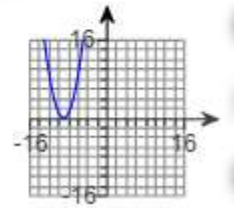axis of symmetry is x = h

Choose the correct graph of $f(x) = (x + 7)^2 - 2$.

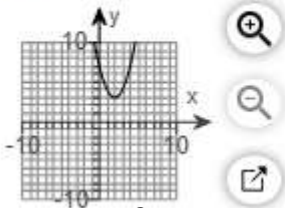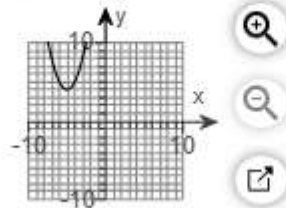○ A.   ● B.   ○ C.   ○ D.

e) Determine the graph of the quadratic function, find the vertex and determine the axis of symmetry.

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

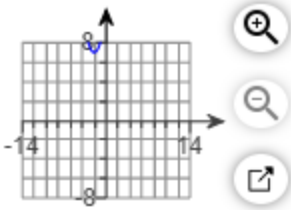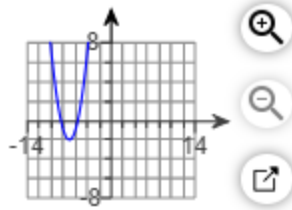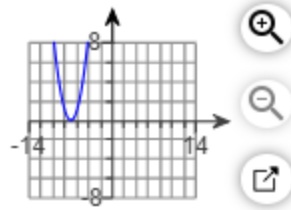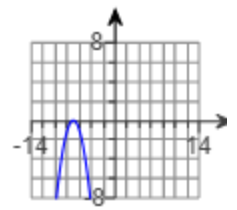Reflects across the x-axis with vertical stretch of 2

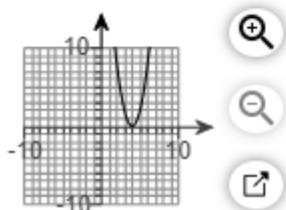
The vertex is $(4, 0)$.

$y = (x - h)^2 + k$ vertex is (h,k)

Find the equation of the axis of symmetry.

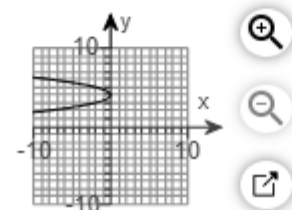axis of symmetry is x = h

$x = 4$

Choose the correct graph of the function below.
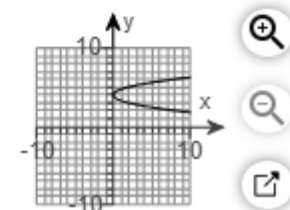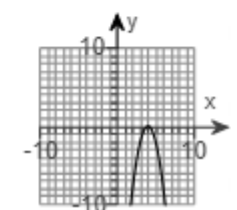
○ A.   ○ B.   ○ C.   ● D.

f) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

$y = (x - 7)^2$

· · ·

Describe the transformation. Choose the correct answer below.

○ A translation of the graph up by 7 units

○ A translation of the graph down by 7 units

○ A translation of the graph to the left by 7 units

✔ A translation of the graph to the right by 7 units

g) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

$y = (x - 9)^2 + 6$

· · ·

Describe the transformation. Choose the correct answer below.

○ A translation of the graph to the left by 6 units and up by 9 units

✔ A translation of the graph to the right by 9 units and up by 6 units

○ A translation of the graph to the left by 9 units and up by 6 units

○ A translation of the graph to the right by 6 units and down by 9 units

h) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

$y = (x + 8)^2$

· · ·

Describe the transformation. Choose the correct answer below.

✔ A translation of the graph to the left by 8 units

○ A translation of the graph up by 8 units

○ A translation of the graph down by 8 units

○ A translation of the graph to the right by 8 units

i) Describe how the graph of $y = x^2$ can be transformed to the graph of the given equation.

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

Describe the transformation. Choose the correct answer below.

○ A translation of the graph to the right by 4 units and down by 2 units

○ A translation of the graph to the left by 4 units and up by 2 units

○ A translation of the graph to the left by 2 units and up by 4 units

✔ A translation of the graph to the right by 2 units and up by 4 units
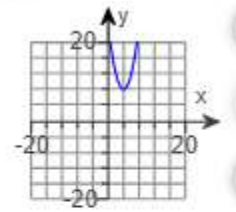
j) Choose the graph that represents the function.

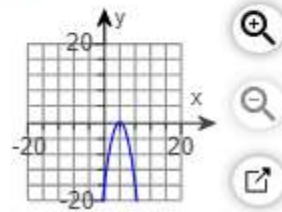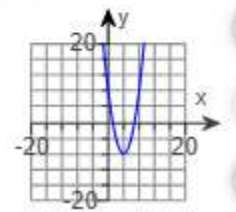$$f(x) = (x - 4)^2 - 8$$

$y = (x - h)^2 + k$ vertex is (4,-8)
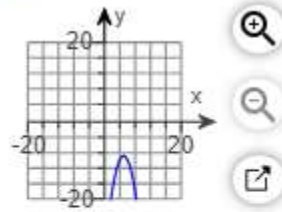
○ A.
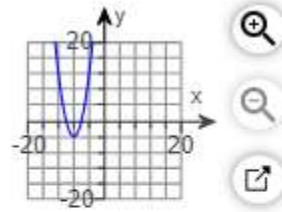
○ B.

○ C.

● D.

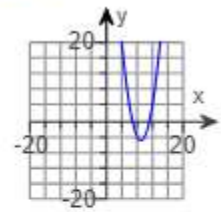**k)** Choose the graph that correctly represents the function.

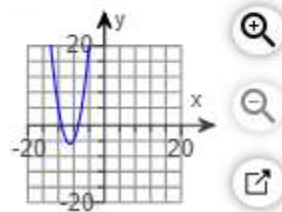$$f(x) = (x + 9)^2 - 5$$

$y = (x - h)^2 + k$ vertex is (-9,-5)

○ A.

○ B.

● C.

○ D.