Name _____ Period _____

Translating Parabolas

Big Idea

Vocabulary

Prerequisite

- coordinate
- line of symmetry
- square
- square root
- parabola
- quadratic
- reflection
- vertex
- x-intercept

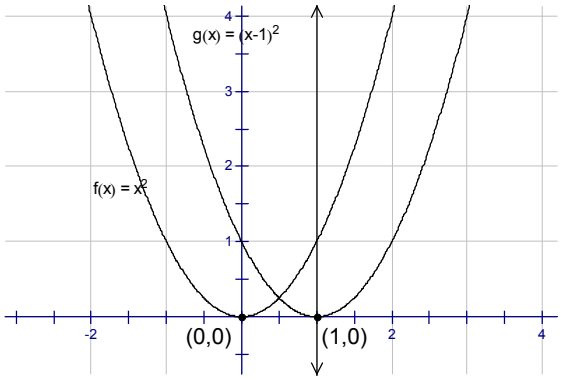
New

- intercept form
- maximum value
- minimum value
- vertex form
- translate

Discovery

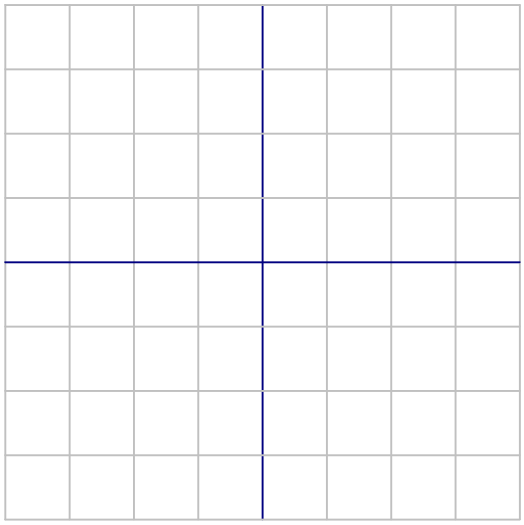
Translating Parabolas

Example: Graph the equations A. $y = x^2$ and B. $y = (x-1)^2$. How is the graph of equation A geometrically related to the graph of equation B?

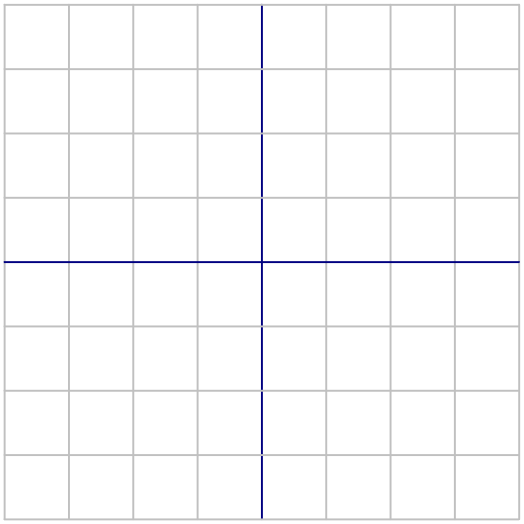


Graph B is translated one unit to the right.

6. Graph the equations A. $y = x^2$ and B. $y = x^2 + 1$. How is the graph of equation 6A geometrically related to the graph of equation 6B?



7. Graph the equations A. $y = x^2$ and B. $y = x^2 - 1$. How is the graph of equation 7A geometrically related to the graph of equation 7B?



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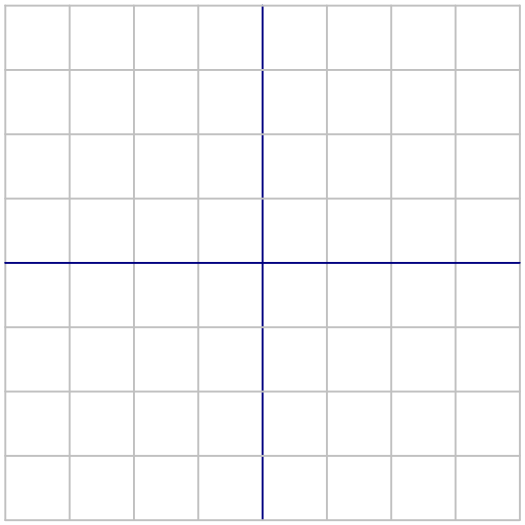
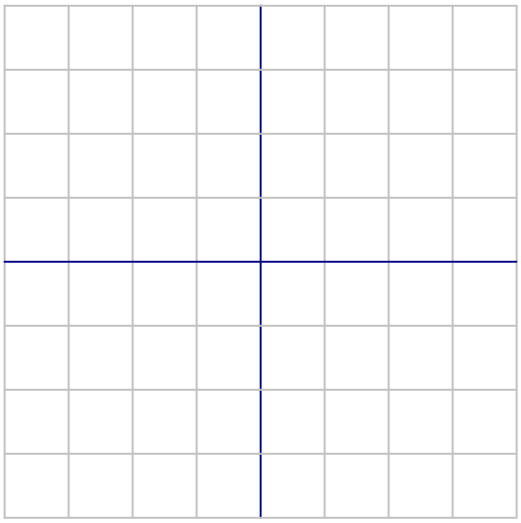
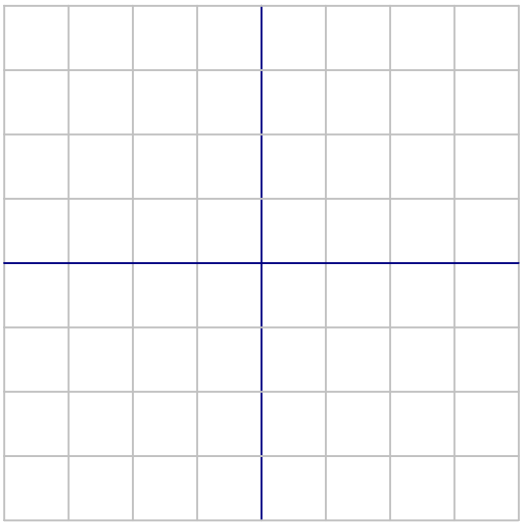
8. Graph the equations A. $y = x^2$ and B. $y = 2x$. How is the graph of equation 8A geometrically related to the graph of equation 8B?



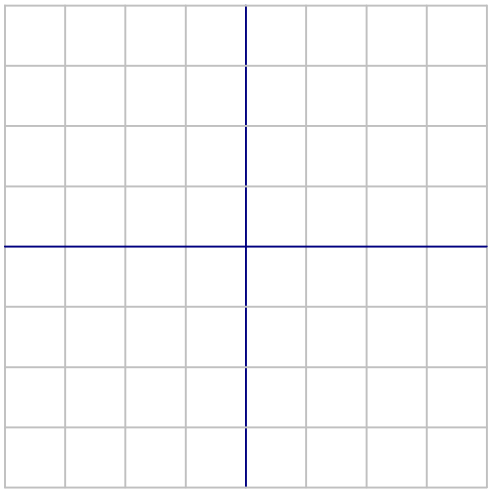
9. Graph the equations A. $y = x^2$ and B. $y = \frac{1}{2}x$. How is the graph of equation 9A geometrically related to the graph of equation 9B?



10. Graph the equations A. $y = 2x^2$ and B. $y = 2(x-1)^2$. How is the graph of equation 10A geometrically related to the graph of equation 10B?

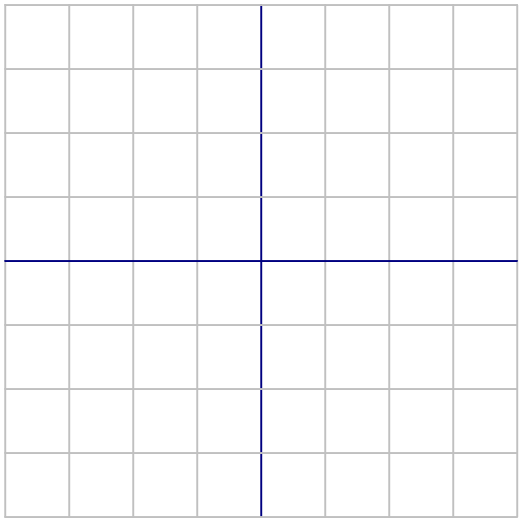


11. Graph the equations A. $y = x^2$ and B. $y = -x^2$. How is the graph of equation 11A geometrically related to the graph of equation 11B?

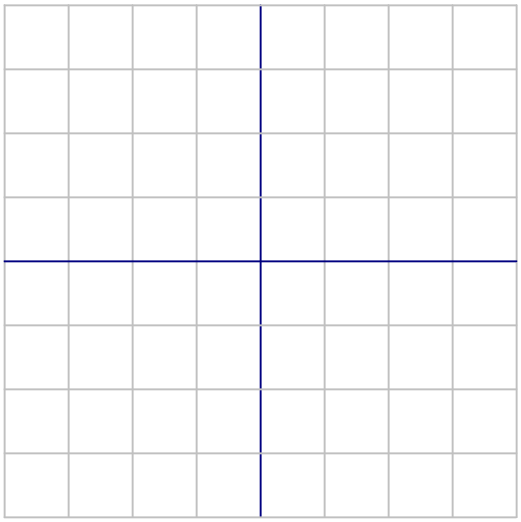


Translating Parabolas

12. Graph the equations A. $y = -x^2$ and $y = -(x-1)^2$. How is the graph of equation 6A geometrically related to the graph of equation 6B?

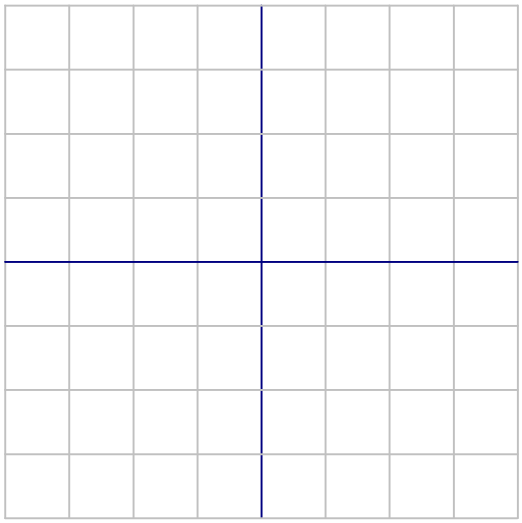


13. Graph the equations A. $y = 2(x-1)^2$ and $y = 2x^2 - 1$. How is the graph if equation 13A geometrically related to the graph of 13 B?

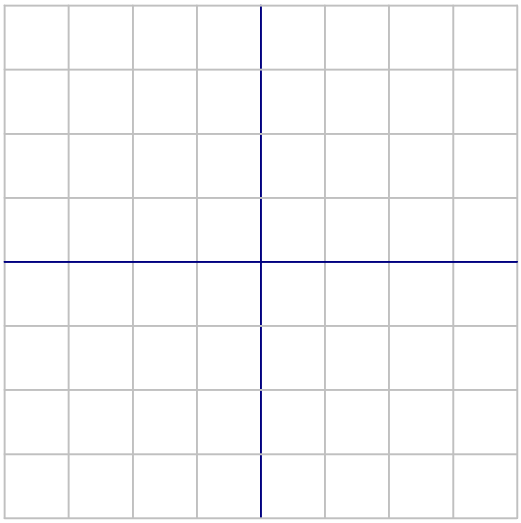


Predict what the graphs of each of the following equations will look like by sketching it. Then use a graphing calculator to verify your graph.

14. $y = x^2 - 2$

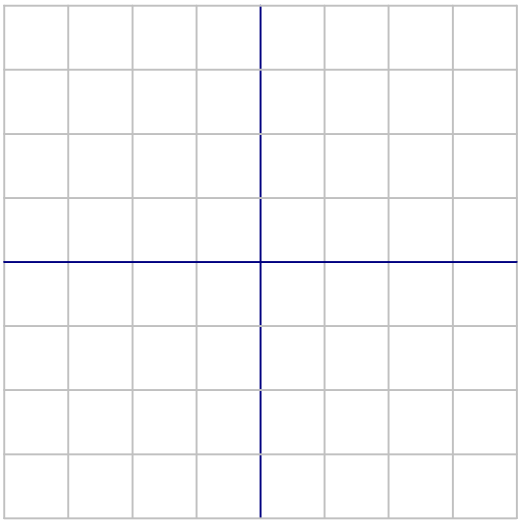


15. $y = 3x^2$

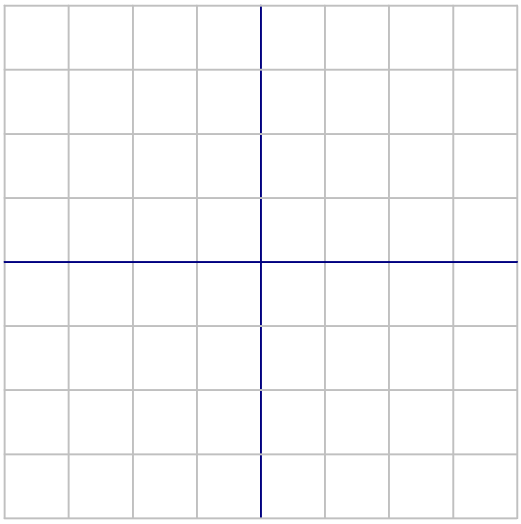


Translating Parabolas

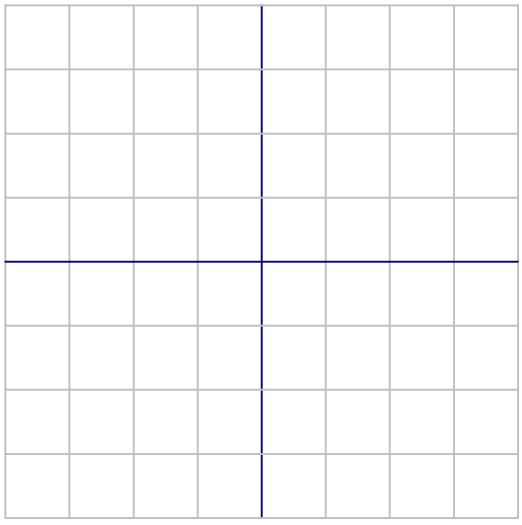
16. $y = \frac{1}{3}(x-1)^2$



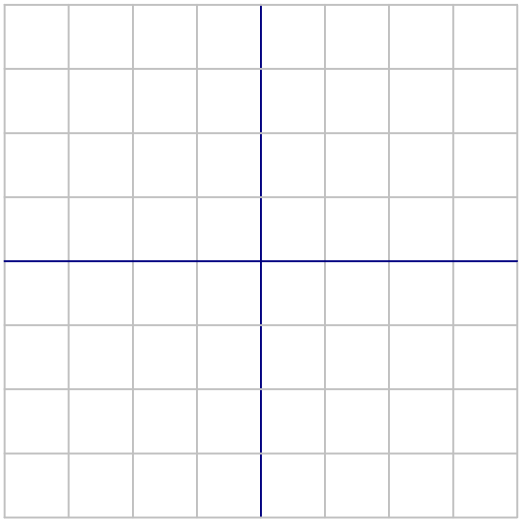
17. $y = 3x + 1$



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



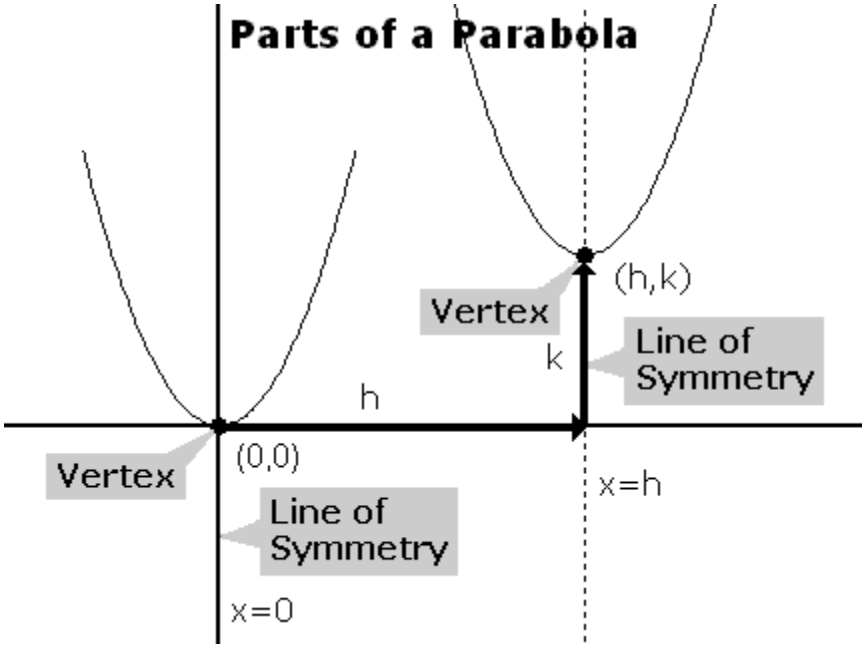
19. $y = -(x+1) - 1$



Vertex Form of a Quadratic Equation

Vertex

The vertex of a parabola is the point where the parabola reaches a maximum (for parabolas that opens downwards), or a minimum (for parabolas that open upwards).



Line of Symmetry

For every parabola, a line can be drawn through the *vertex* that is equidistant from corresponding parts of the parabola. Look figure 1. Line segment A goes from the parabola to the line of symmetry. Line segment A' goes from the line of symmetry to the opposite side of the parabola. Line A and A' are the same length.

20. If we reflect the parabola around its line of symmetry, what will we get?

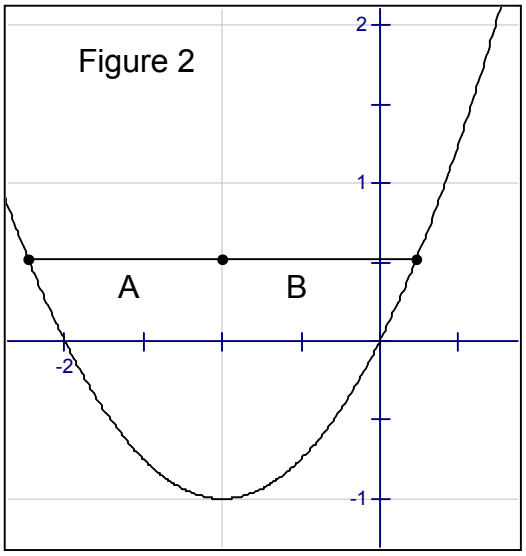
    _____

21. The vertex of a parabola is at the _____ or _____ of the parabola.

22. If the length of the line segment A in figure 2 is 14, what is the length of line segment B?

23. What is the vertex of the parabola in figure 2?

24. Does the parabola in figure 2 open upwards or downwards?



Describe the effect that each change has on the graph of each original equation.

Example: changing $y = 3(x-1)^2 + 2$ to $y = 3(x-1)^2 - 1$.

Changing $y = 3(x-1)^2 + 2$ to $y = 3(x-1)^2 - 1$ ***translates the parabola down 3.***

25. changing $y = 3(x+1)^2 + 1$ to $y = 3(x+2)^2 + 1$

26. changing $y = 3(x-1)^2 + 1$ to $y = 6(x-1)^2 + 1$

27. changing $y = 1(x+1)^2 + 1$ to $y = 1(x-1)^2 - 1$

28. changing $y = 1(x-1)^2 + 2$ to $y = 1(x-2)^2 + 1$

Complete the following.

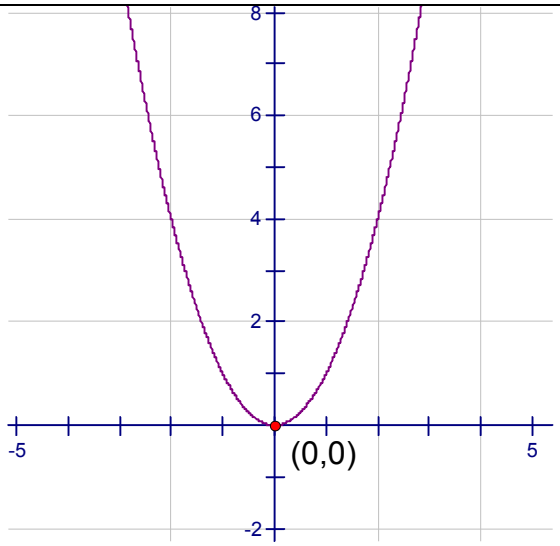
29. When a quadratic equation is in the form $y = a(x-h) + k$, the point (h, k) is

the _____ of the parabola.

The form $y = a(x-h) + k$ is called the *vertex form* of a quadratic equation. This is because the point (h, k) is the vertex of the parabola.

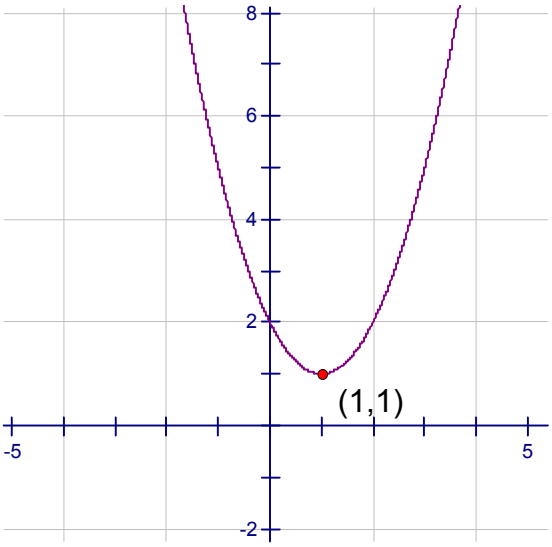
Translating Parabolas

Give the equation of the following parabolas in vertex form.



Example: $y = (x-0)^2 + 0$

30.



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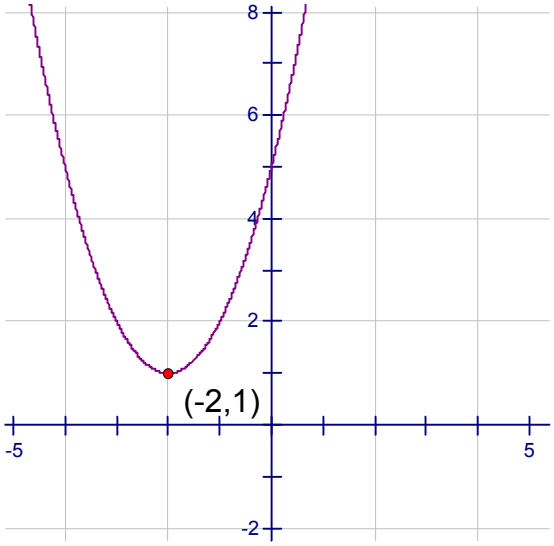

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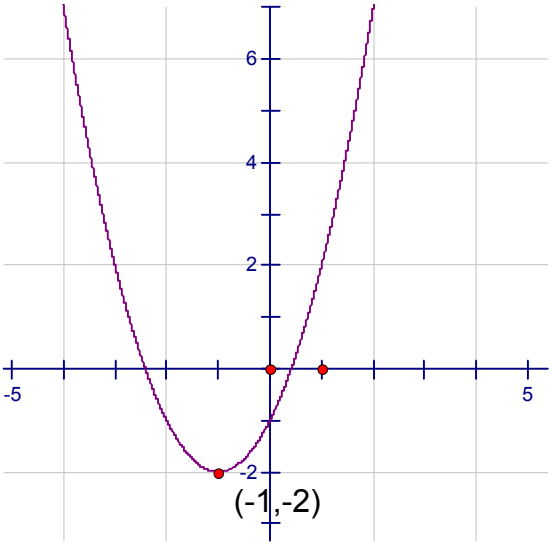
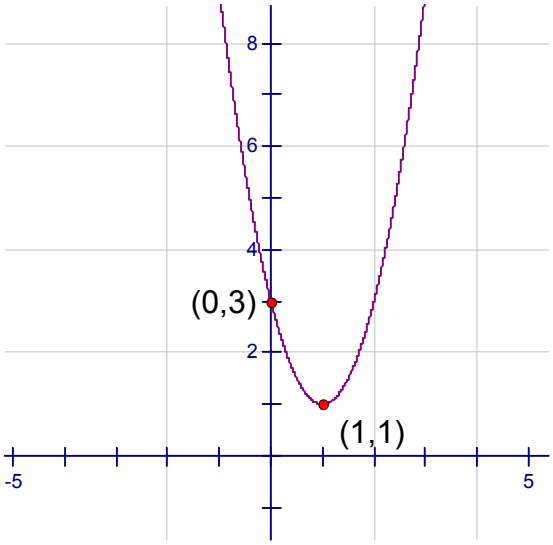


Translating Parabolas

Give the equation of the following parabolas in vertex form.



Example:

Step 1: Write down the general vertex form of a quadratic equation.	$y = a(x-h)^2 + k$
Step 2: Substitute the vertex for h and k.	$y = a(x-1)^2 + 1$
Step 3: Substitute the other point for x and y.	$3 = a(0-1)^2 + 1$
Step 4: Solve for a.	$3 = a(-1)^2 + 1$ $3 = a(1) + 1$ $3 = a + 1$ $3 - 1 = a + 1 - 1$ $2 = a$
Step 5 Rewrite the equation.	$y = 2(x-1) + 1$

Translating Parabolas

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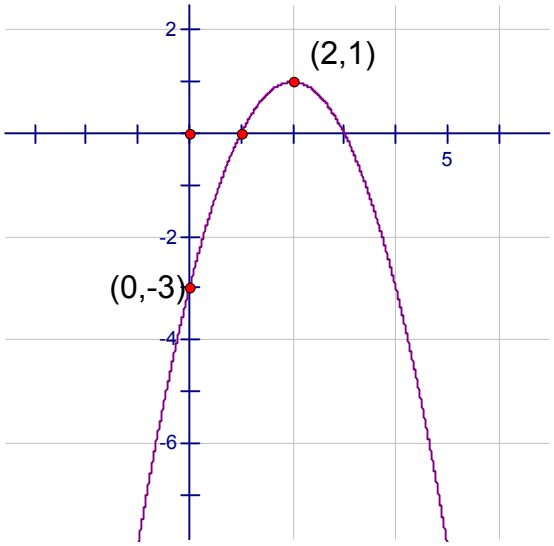

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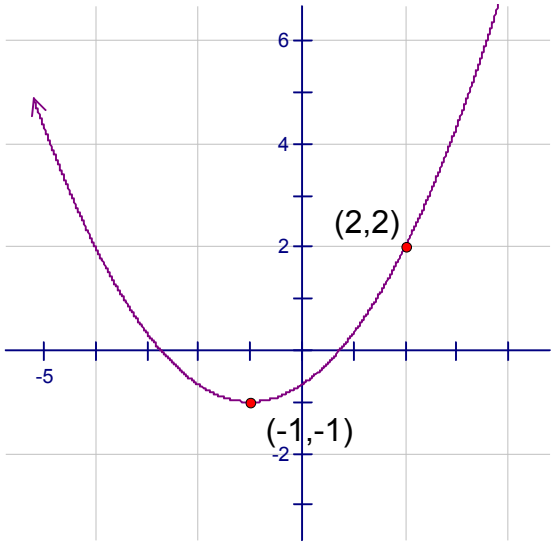

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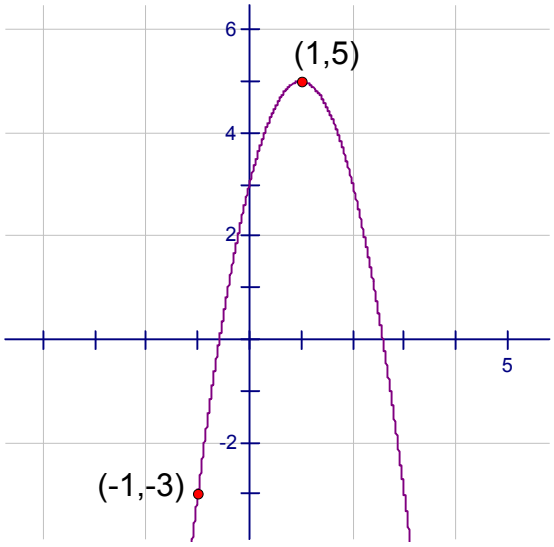

36.