

8.2 Parabolas and Modeling

Vertical and Horizontal Translations Vertex Form Modeling with Quadratic Functions (Optional)

Key Terms

Use the vocabulary terms and expressions listed below to complete the statements in exercises 1-7.

vertex

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

completing the square

$$y = x^2 - k$$

downward

$$y = (x - h)^2$$

translations

$$y = x^2 + k$$

upward

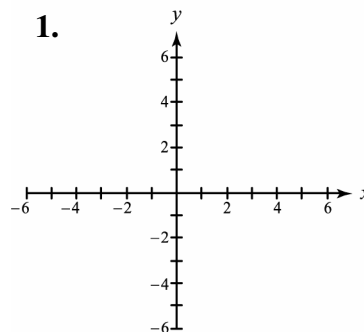
$$y = (x + h)^2$$

- Shifts that change the position of the graph, but not its shape, are called _____.
- Let h and k be positive numbers. To graph _____, shift the graph of $y = x^2$ by k units upward.
- Let h and k be positive numbers. To graph _____, shift the graph of $y = x^2$ by k units downward.
- Let h and k be positive numbers. To graph _____, shift the graph of $y = x^2$ by h units right.
- Let h and k be positive numbers. To graph _____, shift the graph of $y = x^2$ by h units left.
- The _____ form of the equation of a parabola with vertex (h, k) is _____, where $a \neq 0$ is constant. If $a > 0$, the parabola opens _____, and if $a < 0$, the parabola opens _____.
- We can write the equation of a parabola in vertex form using the _____ method.

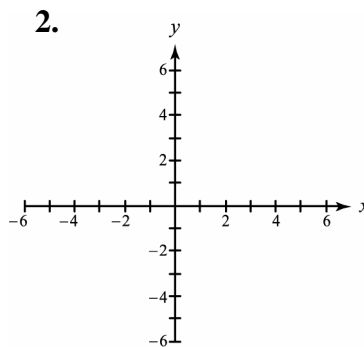
Vertical and Horizontal Translations

Exercises 1-5: Sketch the graph of the equation and identify the vertex.

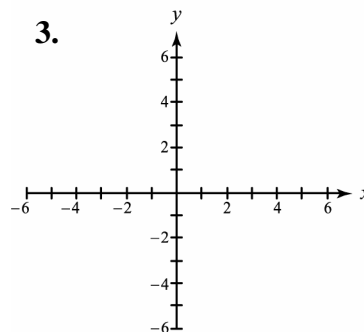
1. $f(x) = x^2 + 3$



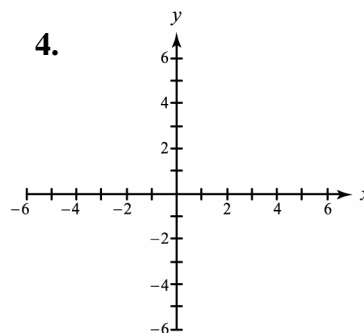
2. $f(x) = x^2 - 2$



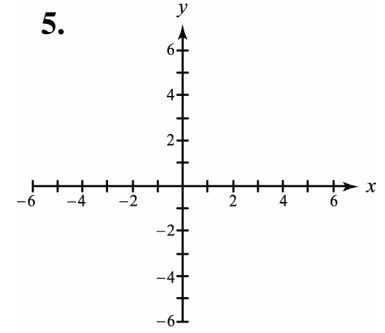
3. $f(x) = (x + 4)^2$



4. $f(x) = (x - 3)^2$



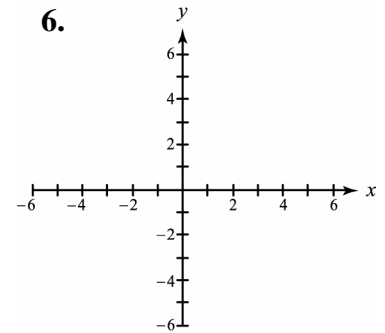
5. $f(x) = (x+2)^2 - 4$



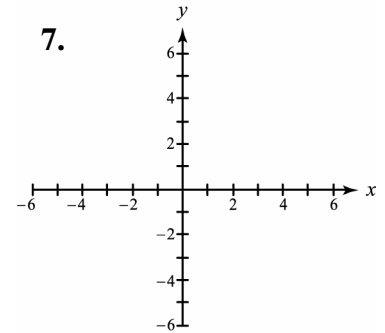
Vertex Form

Exercises 6-10: Sketch a graph of $y = f(x)$ and $y = x^2$ in the same x - y plane.

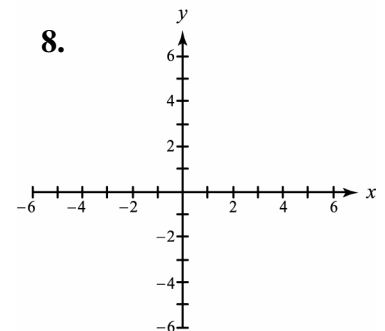
6. $f(x) = 2(x-1)^2 - 3$



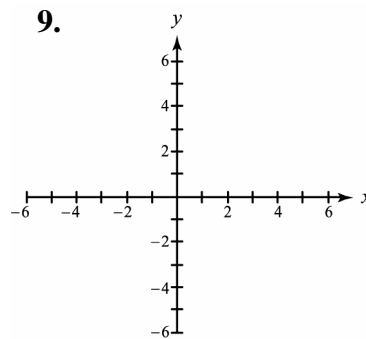
7. $f(x) = -\frac{1}{2}(x+2)^2 - 4$



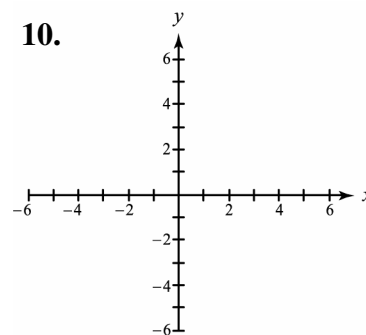
8. $f(x) = -3(x+1)^2$



9. $f(x) = \frac{1}{2}(x-4)^2 + 1$



10. $f(x) = 2(x-2)^2 - 5$



Exercises 11-15: For each problem, do the following.

(a) Write the vertex form of a parabola that satisfies the given criteria.

(b) Express this equation in the form $y = ax^2 + bx + c$.

11. $a = -2$; vertex $(1,1)$

11. (a) _____

(b) _____

12. $a = \frac{1}{2}$; vertex $(-2,4)$

12. (a) _____

(b) _____

13. $a = -1$; vertex $(-3, -1)$

13. (a) _____

(b) _____

14. $a = 3$; vertex $(2, 0)$

14. (a) _____

(b) _____

15. $a = -\frac{1}{2}$; vertex $(-5, -3)$

15. (a) _____

(b) _____

Exercises 16-20: For each problem, do the following.

(a) Write each equation in vertex form.

(b) Identify the vertex.

16. $y = x^2 + 4x + 5$

16. (a) _____

(b) _____

17. $y = x^2 + 5x - 2$

17. (a) _____

(b) _____

18. $y = 2x^2 - 4x - 1$

18. (a) _____

(b) _____

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

19. (a) _____

(b) _____

20. $y = \frac{1}{2}x^2 - x + \frac{1}{2}$

20. (a) _____

(b) _____