

**Explain how the graphs of  $f$  and  $g$  are related.**

1.  $f(x) = x^3, g(x) = x^3 - 7$
2.  $f(x) = x^4, g(x) = (x + 6)^4$
3.  $f(x) = \frac{1}{4}x^3, g(x) = \frac{1}{4}(x + 3)^3 - 1$
4.  $f(x) = -4x^4, g(x) = -4(x - 1)^4 + 0.5$

**Graph the function. Compare the graph with the graph of  $f(x) = -x^3$ .**

5.  $g(x) = -x^3 + 4$
6.  $g(x) = -(x + 2)^3$
7.  $g(x) = -(x - 5)^3 + 1$

**Graph the function. Compare the graph with the graph of  $f(x) = \frac{3}{2}x^3$ .**

8.  $g(x) = \frac{3}{2}x^3 - 2$
9.  $g(x) = \frac{3}{2}(x - 4)^3$
10.  $g(x) = \frac{3}{2}(x + 1)^3 - 3$

**Graph the function. Compare the graph with the graph of  $f(x) = x^4$ .**

11.  $g(x) = (x - 3)^4$
12.  $g(x) = x^4 + 4$
13.  $g(x) = (x + 3)^4 - 5$

**Graph the function. Compare the graph with the graph of  $f(x) = 0.5x^4$ .**

14.  $g(x) = 0.5x^4 + 1$
15.  $g(x) = 0.5(x - 6)^4$
16.  $g(x) = 0.5(x - 2)^4 + 3$

17. **Error Analysis** A student tried to explain how the graphs of  $f(x) = -2x^3$  and  $g(x) = -2(x - 5)^3 + 4$  are related. Describe and correct the error.

The graph of  $g(x) = -2(x - 5)^3 + 4$  is the graph of  $f(x) = -2x^3$  translated left 5 units and down 4 units.



**Write an equation for the function that is described by the given characteristics.**

18. The shape of  $f(x) = -x^3$ , but moved 4 units to the right and 6 units down.
19. The shape of  $f(x) = 3x^4$ , but moved 7 units to the left and 1 unit up.
20. **Multiple Representations** The volume of a ball with radius  $r$  inches is given by  $V_1 = \frac{4}{3}\pi r^3$ . The radius of a second ball is 1 inch greater than the radius of the first ball.
  - a. **Writing a Function** Write a function that represents the volume  $V_2$  of the second ball.
  - b. **Graphing Functions** Graph  $V_1$  and  $V_2$ .
  - c. **Analyzing Graphs** Explain how the graphs are related.
  - d. **Calculating a Value** Find the volume of each ball when  $r = 4.5$  inches.