4. The graph of \( y = 3(x + 1)^2 - 2 \) is congruent to that for \( y = 3x^2 \) but is
   (a) shifted 1 unit to the right and 2 units down
   (b) shifted 1 unit to the left and 2 units down
   (c) shifted 1 unit to the right and 2 units up
   (d) shifted 1 unit to the left and 2 units up
   (e) None of the preceding

5. The function \( f(x) = x^2 - 8x + 10 \) has
   (a) the minimum value \(-6\) when \( x = 4 \)
   (b) the minimum value \(6\) when \( x = -4 \)
   (c) the minimum value \(26\) when \( x = 4 \)
   (d) the minimum value \(10\) when \( x = 8 \)
   (e) None of the preceding

6. When a border of uniform width is put around a 6 foot by 10 foot rectangle, the area is
   enlarged by 80 square feet. Which equation can be used to find the uniform width \( x \)?
   (a) \( x(10 + 2x) + x(6 + 2x) = 80 \)
   (b) \( x^2 + 16x - 20 = 0 \)
   (c) \( x^2 + 16x - 80 = 0 \)
   (d) \( x^2 + 8x - 20 = 0 \)
   (e) None of the preceding

7. Which of the following is true for the parabola \( y = -4x^2 + 20x - 25 \)?
   (a) It opens downward and has two \( x \)-intercepts.
   (b) It opens downward and has no \( x \)-intercepts.
   (c) It opens downward and has one \( x \)-intercept.
   (d) It opens to the left and has two \( y \)-intercepts.
   (e) None of the preceding

8. The solutions of \( 3x^2 + 6x + 2 = 0 \) are:
   (a) \( \frac{-3 \pm \sqrt{3}}{3} \)
   (b) \( \frac{-18 \pm \sqrt{3}}{3} \)
   (c) \(-1 \pm \sqrt{2} \)
   (d) \(-6 \pm 2\sqrt{3}i \)
   (e) None of the preceding

EXERCISES 4.1

For Exercises 1–8, graph each set of curves in the same coordinate system. For each exercise
use a dashed curve for the first equation and a solid curve for each of the others. For the last
function given, state the domain and range, find where it is increasing or decreasing, and
describe the concavity.

1. \( y = x^2, y = (x - 3)^2 \)
2. \( y = x^3, y = (x + 2)^3 \)
3. \( y = x^3, y = -x^3 \)
4. \( y = x^4, y = (x - 4)^4 \)
5. \( f(x) = x^2, g(x) = \frac{1}{2}x^2, h(x) = \frac{1}{3}x^3 \)
6. \( f(x) = x^3, g(x) = (x - 3)^3 - 3, \)
   \( h(x) = (x + 3)^3 + 3 \)
7. \( f(x) = x^4, g(x) = (x - 1)^4 - 1, \)
   \( h(x) = (x - 2)^4 - 2 \)
8. \( f(x) = x^4, g(x) = -\frac{1}{4}x^4, h(x) = -x^4 - 4 \)
9. Graph \( y = |(x + 1)| \).
10. Graph \( y = |x| \) for \(-3 \leq x < 4 \).
11. Graph \( y = f(x) = |x|, y = g(x) = |x - 3|, \) and \( y = h(x) = |x - 3| + 2 \), on the same axes.

Graph each of the following by using translations and reflections.

12. \( y = f(x) = (x + 1)^2 - 2 \)
13. \( y = f(x) = (x - 1)^3 + 2 \)
14. \( y = f(x) = 2(x - 3)^3 + 3 \)
15. \( y = f(x) = 2(x + 3)^3 - 3 \)
16. \( y = f(x) = -(x - 1)^3 + 1 \)
17. \( y = f(x) = -(x + 1)^3 - 1 \)