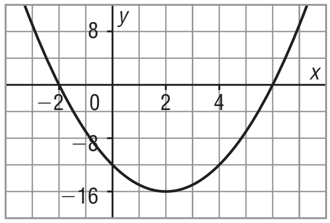
Lesson 4.2 Math Lab: Assess Your Understanding, pages 265–267

1. Use the graph of $y = x^2 - 4x - 12$ to determine the roots of $x^2 - 4x - 12 = 0$. Explain your strategy.



$y = x^2 - 4x - 12$

The roots of the equation are the *x*-intercepts of the graph. These are: $x = -2$ and $x = 6$

2. Use graphing technology to solve each equation. Verify the solution.

a) $-4x^2 - 13x - 12 = 0$ **b)** $-2x^2 - 9x + 35 = 0$

a) For $-4x^2 - 13x - 12 = 0$, graph $y = -4x^2 - 13x - 12$. The graph does not intersect the x-axis, so the equation $-4x^2 - 13x - 12 = 0$ does not have any real roots.

b) For $-2x^2 - 9x + 35 = 0$, graph $y = -2x^2 - 9x + 35$. On a graphing calculator, press: [2nd] [TRACE] [2]. Move the cursor to the left of the 1st x-intercept, then press [ENTER]; move the cursor to the right of the intercept and press [ENTER] [ENTER]. The screen displays $X = -7$. Repeat the process for the 2nd x-intercept to get $X = 2.5$. The roots are $x = -7$ and $x = 2.5$.

3. Use graphing technology to approximate the solution of each equation. Write the roots to 1 decimal place.

a) $x^2 - 3x + 1 = 0$ **b)** $-x^2 + 7x - 1 = 0$

a) For $x^2 - 3x + 1 = 0$, graph $y = x^2 - 3x + 1$. Use the strategy of question 2b to display $X = .38196601$ and $X = 2.618034$. The roots are approximately $x = 0.4$ and $x = 2.6$.

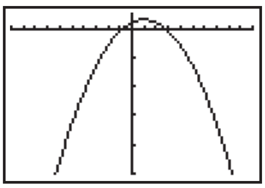
b) For $-x^2 + 7x - 1 = 0$, graph $y = -x^2 + 7x - 1$. Use the strategy of question 2b to display $X = .14589803$ and $X = 6.854102$. The roots are approximately $x = 0.1$ and $x = 6.9$.

c) $2x^2 + 6x - 3 = 0$ **d)** $-3x^2 - 7x + 1 = 0$

c) For $2x^2 + 6x - 3 = 0$, graph $y = 2x^2 + 6x - 3$. Use the strategy of question 2b to display $X = -3.436492$ and $X = .43649167$. The roots are approximately $x = -3.4$ and $x = 0.4$.

d) For $-3x^2 - 7x + 1 = 0$, graph $y = -3x^2 - 7x + 1$. Use the strategy of question 2b to display $X = -2.468375$ and $X = .13504161$. The roots are approximately $x = -2.5$ and $x = 0.1$.

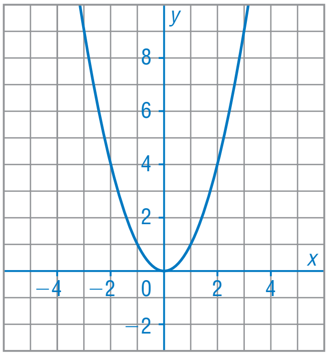
4. The graph of a quadratic function is shown. What can you say about the discriminant of the corresponding quadratic equation? Justify your response.



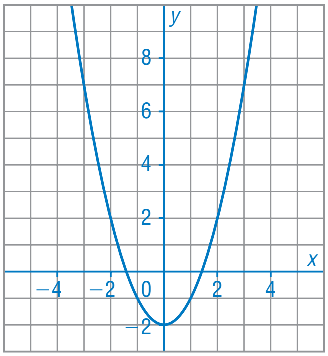
The graph intersects the x-axis in two points, so the related quadratic equation has 2 real roots. This means that the discriminant is greater than 0. In the quadratic formula, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, there are two values for x because the square root of the discriminant is added to and subtracted from $-b$.

5. a) Sketch graphs to show why a quadratic equation may have 1, 2, or no real roots. Explain why a quadratic equation cannot have 3 or more roots.

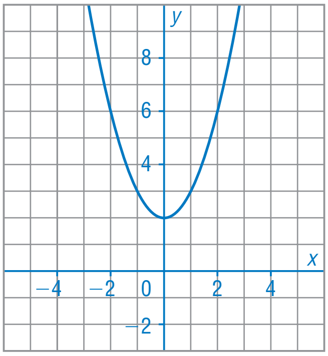
This graph touches the *x*-axis at 1 point, so the related quadratic equation has 1 real root.



This graph intersects the *x*-axis at 2 points, so the related quadratic equation has 2 real roots.



This graph does not intersect the *x*-axis, so the related quadratic equation has no real roots.



A quadratic equation cannot have 3 or more roots because its related quadratic function intersects the *x*-axis in no more than 2 points.

b) How can the discriminant be used to determine the number of roots of a quadratic equation?

When the discriminant is 0, there is exactly 1 real root.
When the discriminant is positive, there are 2 real roots.
When the discriminant is negative, there are no real roots.

