

10.7 The Discriminant TEKS **a.6, A.9.D, A.10.B; 2A.8.B**

QUESTION How can you determine the number of solutions of a quadratic equation?

In the quadratic formula, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, the expression $b^2 - 4ac$ is called the *discriminant*.

EXPLORE Determine how the discriminant is related to the number of solutions of a quadratic equation

STEP 1 Find the number of solutions

Find the number of solutions of the equations below by finding the number of x -intercepts of the graphs of the related functions.

$$0 = x^2 - 6x - 7$$

$$0 = x^2 - 6x + 9$$

$$0 = x^2 - 6x + 12$$

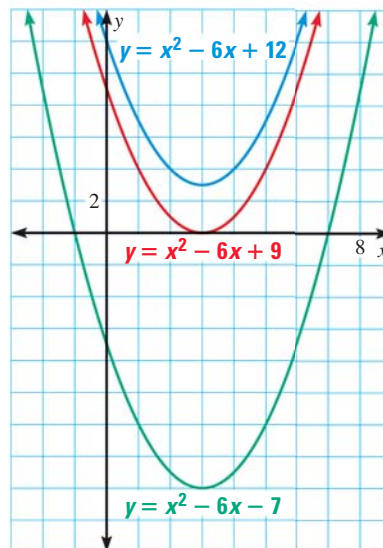
STEP 2 Find the value of $b^2 - 4ac$

For each equation in Step 1, determine whether the value of $b^2 - 4ac$ is positive, negative, or zero.

STEP 3 Make a table

Organize your results from Steps 1 and 2 in a table as shown.

Equation	Number of solutions	Value of $b^2 - 4ac$
$0 = x^2 - 6x - 7$?	?
$0 = x^2 - 6x + 9$?	?
$0 = x^2 - 6x + 12$?	?



STEP 4 Make a conjecture

Make a generalization about the value of the discriminant and the number of solutions of a quadratic equation.

DRAW CONCLUSIONS Use your observations to complete these exercises

- Repeat Steps 1–3 using the following equations: $x^2 + 4x - 5 = 0$, $x^2 + 4x + 4 = 0$, and $x^2 + 4x + 6 = 0$. Is your conjecture still true?
- Notice that the expression $b^2 - 4ac$ is under the radical sign in the quadratic formula. Use this observation to explain why the value of $b^2 - 4ac$ determines the number of solutions of a quadratic equation.