EXAMPLE 6 TAKS REASONING: Multi-Step Problem

SPORTS An athlete throws a shot put with an initial vertical velocity of 40 feet per second as shown.

a. Write an equation that models the height h (in feet) of the shot put as a function of the time t (in seconds) after it is thrown.

b. Use the equation to find the time that the shot put is in the air.

Solution

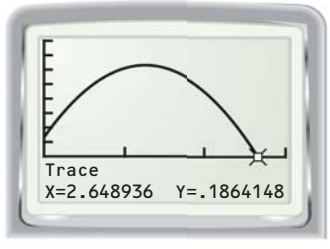
a. Use the initial vertical velocity and the release height to write a vertical motion model.

$h = -16t^2 + vt + s$ **Vertical motion model**

$h = -16t^2 + 40t + 6.5$ **Substitute 40 for v and 6.5 for s.**

b. The shot put lands when $h = 0$. To find the time t when $h = 0$, solve $0 = -16t^2 + 40t + 6.5$ for t.

To solve the equation, graph the related function $h = -16t^2 + 40t + 6.5$ on a graphing calculator. Use the *trace* feature to find the t-intercepts.



▶ There is only one positive t-intercept. The shot put is in the air for about 2.6 seconds.

USE A GRAPHING CALCULATOR

When entering $h = -16t^2 + 40t + 6.5$ in a graphing calculator, use y instead of h and x instead of t.

GUIDED PRACTICE for Example 6

6. WHAT IF? In Example 6, suppose the initial vertical velocity is 30 feet per second. Find the time that the shot put is in the air.

CONCEPT SUMMARY *For Your Notebook*

Relating Solutions of Equations, x-Intercepts of Graphs, and Zeros of Functions

Solutions of an Equation

The solutions of the equation $\boldsymbol{-x^2 + 8x - 12 = 0}$ are 2 and 6.

***x*-Intercepts of a Graph**

The x-intercepts of the graph of $\boldsymbol{y = -x^2 + 8x - 12}$ occur where $\boldsymbol{y = 0}$, so the x-intercepts are 2 and 6, as shown.

Zeros of a Function

The zeros of the function $\boldsymbol{f(x) = -x^2 + 8x - 12}$ are the values of x for which $\boldsymbol{f(x) = 0}$, so the zeros are 2 and 6.