Objective: Solve context problems by factoring.

Concept

Steps to Solve a Quadratic Equation by Factoring

1. Write the equation is standard form, $ax^2 + bx + c = 0$.

2. Factor the polynomial completely, including any greatest common factor.

3. Use the Zero Product Property.

4. Solve for the values of the variable, x.

5. State the solution.

Zero Product Property

If the product of two factors is zero, then at least one of the factors must be equal to zero.

If $a \cdot b = 0$, then either $a = 0$ or $b = 0$.

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Ex) The area of a room is 143 square feet. The length is $(2x + 1)$ feet and the width is $(3x - 7)$ feet. Find the dimensions of the room.

① set up Area = length × width

$143 = (2x+1)(3x-7)$

② solve $143 = 6x^2 - 14x + 3x - 7$

$-143 \quad\quad -143$

$0 = 6x^2 - 11x - 150$

$3x \cdot 2x$

$6x \cdot x$

$15 \cdot -10$
$-15 \cdot 10$
$2 \cdot -75$
$-2 \cdot 75$
$3 \cdot -50$
$-3 \cdot 50$
$6 \cdot -25$
$-6 \cdot 25$
$5 \cdot -30$
$-5 \cdot 30$

$0 = (6x + 25)(x - 6)$

$6x^2 - 36x + 25x - 150$

$-11x$

$6x + 25 = 0$ or $x - 6 = 0$

$-25 \quad -25 \quad\quad +6 \quad +6$

$\frac{6x}{6} = \frac{-25}{6} \quad\quad x = 6$

$x = -\frac{25}{6}$

③ find length and width

$x = 6$

length $= 2x+1 \rightarrow 2(6)+1 = 13$ feet

$12+1$

width $= 3x-7 \rightarrow 3(6)-7 = 11$ feet

$18-7$

The dimensions of the room are 13 feet and 11 feet.

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Ex) The height, in feet, of an object launched into the air can be modeled by the function $h(t) = -16t^2 + 16t + 96$ where t is in seconds. When does the object hit the ground? → height = 0 feet $t = ?$

① $h(t) = -16t^2 + 16t + 96$

$-1 \cdot [0 = -16t^2 + 16t + 96]$

② solve.

$0 = 16t^2 - 16t - 96$

$0 = 16(t^2 - t - 6)$

$0 = 16(t-3)(t+2)$

$16 \neq 0$, $t - 3 = 0$ or $t + 2 = 0$

$+3 \quad +3$ $\quad -2 \quad -2$

$t = 3$ sec $\quad t = -2$ sec

③ The object hits the ground after 3 seconds.

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Ex) A race car driving under the caution flag at a speed of 80 feet per second begins to accelerate at a constant rate once the warning flag is waved. The distance traveled in feet is characterized by the function, $d(t) = 30t^2 + 80t$ where t is the time in seconds after the car starts accelerating. How long does it take the race car to travel 30 feet after the warning flag is waved?

distance = $d(t)$ time

① set up $d(t) = 30t^2 + 80t$

② solve. $30 = 30t^2 + 80t$

$-30 \quad -30$

$0 = 30t^2 + 80t - 30$

$0 = 10(3t^2 + 8t - 3)$ $-3 \cdot 1$, $3 \cdot -1$

$0 = 10(3t - 1)(t + 3)$

$3t^2 + 9t - 1t - 3$

$+8t$

$10 \neq 0$ $3t - 1 = 0$ or $t + 3 = 0$

$+1 \quad +1$ $\quad -3 \quad -3$

$\frac{3t}{3} = \frac{1}{3}$

$t = \frac{1}{3}$ sec $\quad t = -3$ sec

③ It will take the race car $\frac{1}{3}$ seconds to travel 30 feet after the warning flag is waved.

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Closure

Peter solved the following problem. His work is shown. Why isn't Peter's answer valid? What are the correct dimensions of the shed?

The width and length of a storage shed can be modeled by $(x-3)$ feet and $(x-10)$ feet. The area of the shed is 60 square feet. What are the dimensions of the shed?

$$(x-3)(x-10)=60$$
$$x^2-13x+30=60$$
$$x^2-13x-30=0$$
$$(x-15)(x+2)=0$$
$$x-15=0 \quad or \quad x+2=0$$
$$x=15 \quad or \quad \cancel{x=-2}$$

The dimensions of the shed are 15 feet.

Peter's answer isn't valid because he forgot to plug the x value of 15 back into the expressions for the dimensions. He also only has one dimension when there should be two. The correct dimensions of the shed are 5 feet and 12 feet.