

Objective: Solve context problems by completing the square

Concept

**Steps to Solve by Completing the Square when  $a = 1$**

1. From standard form,  $x^2 + bx + c = 0$ , move the constant to write the equation in the form  $x^2 + bx = -c$
2. **Create a perfect square trinomial**  $x^2 + bx + \left(\frac{b}{2}\right)^2$ . **Don't forget to balance the equation by adding  $\left(\frac{b}{2}\right)^2$  to both sides.**
3. **Factor the perfect square trinomial** and **simplify the right side of the equation.**
4. **Use the square root property.** (Don't forget  $\pm$ .)
5. Finish solving for  $x$ . Simplify the solutions as much as possible.
6. Write the final solution set.

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Ex) Solve by completing the square. Give exact solutions in simplest form. State whether the solutions are rational, irrational, or imaginary.

$$x(x-2) = 15$$

① Distribute

$$x^2 - 2x = 15$$

② create a perfect square trinomial

$$x^2 - 2x + \frac{1}{\left(\frac{-2}{2}\right)^2} = 15 + \frac{1}{(-1)^2}$$

$$(x-1)(x-1)$$

$$(x-1)^2 = 16$$

③ square root prop.

$$\sqrt{(x-1)^2} = \pm \sqrt{16}$$

$$x-1 = -4, 4$$

+1                    +1    +1

$x = -3, 5$   
 rational



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Ex) A rectangular floor has an area of 896 square feet. The width of the floor is 4 feet shorter than the length. Find the dimensions of the floor. Solve by completing the square. <sup>minus</sup>

$$\begin{array}{ccc} \text{length} \cdot \text{width} = \text{area} & & \\ \downarrow & \downarrow & \downarrow \\ x \cdot (x-4) = 896 & & \end{array}$$

$$\begin{array}{l} * \text{ length} = x \text{ ft} \\ \text{width} = x - 4 \text{ ft} \end{array}$$

solve.

$$\begin{array}{l} x^2 - 4x = 896 \\ x^2 - 4x + \frac{4}{(-\frac{4}{2})^2} = 896 + \frac{4}{(-2)^2} \end{array}$$

$$(x-2)(x-2)$$

$$(x-2)^2 = 900$$

$$\sqrt{(x-2)^2} = \pm \sqrt{900}$$

$\sqrt{9} \cdot \sqrt{100}$   
3 · 10

$$\begin{array}{l} \text{length} = 32 \text{ ft} \\ \text{width} = 32 - 4 \\ = 28 \text{ ft} \end{array}$$

conclusion

The length of the floor is 32 feet and the width is 28 feet.



$$x - 2 = -30, 30$$

$$\begin{array}{ccc} + 2 & + 2 & + 2 \\ \hline \end{array}$$

$$x = \cancel{-28} \text{ ft}, 32 \text{ ft}$$