Objective: Choose a method of solving given context

Concept

Methods for Solving a Quadratic Equation

Square Root Property: Best method for quadratic equations **of the form** $\boldsymbol{a(x-h)^2+k=0}$ **and** $\boldsymbol{ax^2+c=0}$.

Complete the Square: Best method for quadratic equations of the form $x^2+bx+c=0$ that **cannot be factored and where** $\boldsymbol{b}$ **is an even number**.

Factoring: Best method for quadratic equations of the form $ax^2+bx+c=0$ **that can be factored easily**.
Also, best method for quadratic equations of the **form** $\boldsymbol{ax^2+bx=0}$ **where** $\boldsymbol{x}$ **is a common factor**.
Also a good method for quadratic equations **with a difference of two squares structure**.

Quadratic Formula: Best method for quadratic equations of the form $ax^2+bx+c=0$ that **cannot be factored or cannot be factored easily**.

Objective: Choose a method of solving given context

Recall that the formula for height, in feet, of a projectile under the influence of gravity is given by $h(t) = -16t^2 + vt + h$, where t is time in seconds, v is the starting upward velocity and h is the starting height of the object.

Marco is throwing a tennis ball at a kite that is stuck 42 feet up in a tree, trying to knock it loose. He can throw the ball at an upward velocity of 45 feet per second from a height of 4 feet. Will his throw reach the kite? Explain your reasoning.

1. model $\rightarrow h(t) = -16t^2 + vt + h$

$$42 = -16t^2 + 45t + 4$$

2. solve. Quadratic Formula

$$0 = -16t^2 + 45t - 38$$

$$a = -16, \quad b = 45, \quad c = -38$$

$$t = \frac{-1(45) \pm \sqrt{(45)^2 - 4(-16)(-38)}}{2(-16)}$$

$$t = \frac{-45 \pm \sqrt{-407}}{-32} \rightarrow \text{imaginary}$$

Marco's throw will not reach the kite because the equation doesn't have real solutions.

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Recall that the formula for height, in feet, of a projectile under the influence of gravity is given by $h(t) = -16t^2 + vt + h$, where t is time in seconds, v is the starting upward velocity and h is the starting height of the object.

The wheel of a remote controlled airplane falls off while the airplane is climbing at 40 feet in the air. The wheel starts with an initial upward velocity of 23 feet per second. How long does it take the wheel to fall to the ground?

1. model $\rightarrow h(t) = -16t^2 + vt + h$

$$0 = -16t^2 + 23t + 40$$

2. solve. Quadratic Formula

$$t = \frac{-1(23) \pm \sqrt{(23)^2 - 4(-16)(40)}}{2(-16)}$$

~~$t \approx -1.02$~~ $t \approx 2.46$

It takes the wheel about 2.46 seconds to fall to the ground.

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Recall that the formula for height, in feet, of a projectile under the influence of gravity is given by $h(t) = -16t^2 + vt + h$, where t is time in seconds, v is the starting upward velocity and h is the starting height of the object.

Gary drops a pair of gloves off of a balcony that is 64 feet high. When will the gloves hit the ground?

1. model $\rightarrow h(t) = -16t^2 + vt + h$

$$0 = -16t^2 + 0t + 64$$

$$0 = -16t^2 + 64$$

2. solve. Square Root Property or Factoring or Quadratic Formula

$$\downarrow$$

$$0 = -16t^2 + 64$$

$$+16t^2 \quad +16t^2$$

$$\frac{16t^2}{16} = \frac{64}{16}$$

$$t^2 = 4$$

$$\sqrt{t^2} = \pm\sqrt{4}$$

$$\cancel{t = -2} \qquad t = 2$$

The gloves will hit the ground 2 seconds after being dropped.

Objective: Choose a method of solving given context

Maggie is planting a vegetable garden with an area of 68 square feet. If the length of the garden is 1 foot longer than four times the width, what are the dimensions of Maggie's garden?

1. model $\rightarrow$ area = length $\times$ width let x = width

$4x+1$ = length

$$68 = (4x+1)x$$

$$68 = 4x^2 + x$$

2. solve. Factoring or Quadratic Formula

$\downarrow$

$$68 = 4x^2 + x$$

$$0 = 4x^2 + x - 68$$

$$0 = (4x+17)(x-4)$$

$4x+17=0$ *or* $x-4=0$

$x = -\frac{17}{4} = -4\frac{1}{4}$ $x = 4$

The dimensions of Maggie's garden are 4 feet and 17 feet.

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Recall that the formula for height, in feet, of a projectile under the influence of gravity is given by $h(t) = -16t^2 + vt + h$, where t is time in seconds, v is the starting upward velocity and h is the starting height of the object.

A toy springs up into the air from where it is placed on the ground with an initial upward velocity of 12 feet per second. How long is the toy in the air?

1. model $\rightarrow h(t) = -16t^2 + vt + h$

$0 = -16t^2 + 12t + 0$

$0 = -16t^2 + 12t$

The toy is in the air for 0.75 seconds.

2. solve. Factoring or Quadratic Formula

$\downarrow$

$0 = -16t^2 + 12t$

$0 = -4t(4t - 3)$

$-4t = 0 \quad or \quad 4t - 3 = 0$

~~$t = 0$~~ $\qquad t = \frac{3}{4} = 0.75$