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Algebra - Downing

Unit 8: Solving Quadratics

Lesson 1: Solving by factoring and square roots.

Ex) The height, in feet, of a baseball in x seconds is represented by the function, $f(x) = -3x^2 + 18x$

a) Find the max height $x = \frac{-18}{2(-3)} = \frac{-18}{-6} = 3$ seconds

$$y = -3(3)^2 + 18(3)$$

$$y = -27 + 54$$

$y = 27$ feet \rightarrow it took 3 seconds to get there.

b) How long is the ball in the air? (when $y=0$)

$$-3x^2 + 18x = 0$$

$$-3x(x-6) = 0$$

$$\begin{array}{r} -3x = 0 \\ -3 \quad -3 \\ \hline x = 0 \end{array}$$

$$\begin{array}{r} x - 6 = 0 \\ +6 \quad +6 \\ \hline \end{array}$$

$$\boxed{x = 6 \text{ seconds}}$$

Ex) Solve:

$$\begin{array}{r} 3x^2 - 23x + 6 = -8 \\ +8 \quad +8 \end{array}$$

$$\begin{array}{r} 42 \\ 1 \overline{) 42} \\ \underline{-2 \quad 21} \end{array}$$

$$3x^2 - 23x + 14 = 0$$

$$(3x^2 - 2x) - 7(3x - 2) = 0$$

$$x(3x-2) - 7(3x-2) = 0$$

$$(x-7)(3x-2) = 0$$

$$x = 7 \quad x = \frac{2}{3}$$

$$(7, 0) \quad (\frac{2}{3}, 0)$$

Ex) Find the roots

$$y = x^2 - 36$$

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

$$\text{roots } (6, 0) \quad (-6, 0)$$

Special Case:

Solving $ax^2 + c = 0$
(when bx is not there)

Steps

Example

1. Set equal to zero

$$1. \quad y = x^2 = 36$$

2. Get " x^2 " by itself

$$x^2 - 36 = 0$$

$$\frac{\quad +36 \quad +36}{x^2 = 36}$$

3. Square root both sides

$$\sqrt{x^2} = \sqrt{36}$$

* Don't forget the \pm

$$x = 6, -6 \rightarrow \boxed{\pm 6}$$

Roots: $(6, 0) \quad (-6, 0)$

$$\begin{array}{l} \text{Ex) Solve } h(x) = -16x^2 + 64 \\ -16x^2 + 64 = 0 \\ \underline{-64 \quad -64} \\ -16x^2 = -64 \\ \underline{-16 \quad -16} \\ \sqrt{x^2} = \sqrt{4} \\ x = \pm 2 \\ (2, 0) (-2, 0) \end{array}$$

$$\begin{array}{l} \text{Ex) } f(x) = -5x^2 + 85 \\ -5x^2 + 85 = 0 \\ \underline{-85 \quad -85} \\ -5x^2 = -85 \\ \underline{-5 \quad -5} \\ \sqrt{x^2} = \sqrt{17} \\ x = \pm 4.12 \\ (4.12, 0) (-4.12, 0) \end{array}$$

Ex) A soccer ball is thrown off a building. The height, in feet of the ball after x seconds is expressed by the equation $h(x) = -16x^2 + 96$. How long is the ball in the air? \rightarrow when $h(x) = 0$

$$-16x^2 + 96 = 0$$

$$\underline{-96 \quad -96}$$

$$-16x^2 = -96$$

$$\underline{-16 \quad -16}$$

$$\sqrt{x^2} = \sqrt{6}$$

$$x = \pm 2.45$$

2.45 seconds

Ex) The height in feet of his golf ball after x seconds is represented by $h(x) = -2x^2 + 13x + 24$. How long is his golf ball in the air?

$$-2x^2 + 13x + 24 = 0$$

$$-1(2x^2 - 13x - 24) = 0$$

$$(2x^2 + 3x) \quad (-16x - 24)$$

$$x(2x+3) - 8(2x+3)$$

$$(x-8)(2x+3)$$

$$x = 8, -\frac{3}{2}$$

8 seconds

$$\begin{array}{r|l} -48 & \\ 1 & -48 \\ 2 & -24 \\ \underline{3} & \underline{-16} \\ 4 & -12 \end{array}$$

HW. Worksheet # 2, 4, 6, + all back