## Lesson 4: Solving Quadratic Equations with the Zero Product Property

* Let’s find solutions to equations that contain products that equal zero.

### 4.1: Math Talk: Solve These Equations

What values of the variables make each equation true?

$6+2a=0$

$7b=0$

$7\left(c−5\right)=0$

$g⋅h=0$

### 4.2: Take the Zero Product Property Out for a Spin

For each equation, find its solution or solutions. Be prepared to explain your reasoning.

1. $x−3=0$
2. $x+11=0$
3. $2x+11=0$
4. $x\left(2x+11\right)=0$
5. $\left(x−3\right)\left(x+11\right)=0$
6. $\left(x−3\right)\left(2x+11\right)=0$
7. $x\left(x+3\right)\left(3x−4\right)=0$

#### Are you ready for more?

1. Use factors of 48 to find as many solutions as you can to the equation $\left(x−3\right)\left(x+5\right)=48$.
2. Once you think you have all the solutions, explain why these must be the only solutions.

### 4.3: Revisiting a Projectile

We have seen quadratic functions modeling the height of a projectile as a function of time.

Here are two ways to define the same function that approximates the height of a projectile in meters, $t$ seconds after launch:

$h\left(t\right)=-5t^{2}+27t+18    h\left(t\right)=\left(-5t−3\right)\left(t−6\right)$

1. Which way of defining the function allows us to use the zero product property to find out when the height of the object is 0 meters?
2. Without graphing, determine at what time the height of the object is 0 meters. Show your reasoning.

### Lesson 4 Summary

The **zero product property** says that if the product of two numbers is 0, then one of the numbers must be 0. In other words, if $a⋅b=0,$ then either $a=0$ or $b=0$. This property is handy when an equation we want to solve states that the product of two factors is 0.

Suppose we want to solve $m\left(m+9\right)=0$. This equation says that the product of $m$ and $\left(m+9\right)$ is 0. For this to be true, either $m=0$ or $m+9=0$, so both 0 and -9 are solutions.

Here is another equation: $\left(u−2.345\right)\left(14u+2\right)=0$. The equation says the product of $\left(u−2.345\right)$ and $\left(14u+2\right)$ is 0, so we can use the zero product property to help us find the values of $u$. For the equation to be true, one of the factors must be 0.

* For $u−2.345=0$ to be true, $u$ would have to be 2.345.
* For $14u+2=0$ or $14u=-2$ to be true, $u$ would have to be $-\frac{2}{14}$ or $-\frac{1}{7}$.

The solutions are 2.345 and $-\frac{1}{7}$.

In general, when a quadratic expression in factored form is on one side of an equation and 0 is on the other side, we can use the zero product property to find its solutions.



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