Name _____ Date _____

LESSON 8.4

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Study Guide

For use with the lesson "Solve Polynomial Equations in Factored Form"

GOAL **Solve polynomial equations.**

Vocabulary

The zero-product property is used to solve an equation when one side is zero and the other side is a product of polynomial factors. The solutions of such an equation are also called **roots.**

The height of a projectile can be described by the **vertical motion model:** $h = -16t^2 + vt + s$, where t is the time (in seconds) the object has been in the air, v is the initial vertical velocity (in feet per second), and s is the initial height (in feet).

EXAMPLE 1 Use the zero-product property

Solve $(x - 3)(x + 6) = 0$.

Solution

$(x - 3)(x + 6) = 0$ Write original equation.

$x - 3 = 0$ *or* $x + 6 = 0$ Zero-product property

$x = 3$ *or* $x = -6$ Solve for x.

The roots of the equation are 3 and -6.

CHECK Substitute each root into the original equation to check.

$(3 - 3)(3 + 6) \stackrel{?}{=} 0$ $\quad$ $(-6 - 3)(-6 + 6) \stackrel{?}{=} 0$

$0 \cdot 9 \stackrel{?}{=} 0$ $\quad$ $-9 \cdot 0 \stackrel{?}{=} 0$

$0 = 0$ ✓ $\quad$ $0 = 0$ ✓

Exercises for Example 1

Solve the equation.

1. $(m - 7)(m - 9) = 0$

2. $(5n + 10)(4n + 12) = 0$

EXAMPLE 2 Solve an equation by factoring

Solve $6x^2 + 12x = 0$.

$6x^2 + 12x = 0$ Write original equation.

$6x(x + 2) = 0$ Factor left side.

$6x = 0$ *or* $x + 2 = 0$ Zero-product property

$x = 0$ *or* $x = -2$ Solve for x.

The roots of the equation are 0 and -2.

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Study Guide *continued*

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EXAMPLE 3 Solve an equation by factoring

Solve $9y^2 = 21y$.

$9y^2 = 21y$	Write original equation.
$9y^2 - 21y = 0$	Subtract $21y$ from each side.
$3y(3y - 7) = 0$	Factor left side.
$3y = 0$ *or* $3y - 7 = 0$	Zero-product property
$y = 0$ *or* $y = \frac{7}{3}$	Solve for y.

The roots of the equation are 0 and $\frac{7}{3}$.

Exercises for Examples 2 and 3

Solve the equation.

3. $q^2 + 16q = 0$ **4.** $4k^2 - 8k = 0$ **5.** $12h^2 = 36h$

EXAMPLE 4 Solve a multi-step problem

Jump Rope A child jumping rope leaves the ground at an initial vertical velocity of 8 feet per second. After how many seconds does the child land on the ground?

Solution

STEP 1 **Write** a model for the height above the ground.

$h = -16t^2 + vt + s$	Vertical motion model
$h = -16t^2 + 8t + 0$	Substitute 8 for v and 0 for s.
$h = -16t^2 + 8t$	Simplify.

STEP 2 **Substitute** 0 for h. When the child lands, the child's height above the ground is 0 feet. Solve for t.

$0 = -16t^2 + 8t$	Substitute 0 for h.
$0 = 8t(-2t + 1)$	Factor right side.
$8t = 0$ *or* $-2t + 1 = 0$	Zero-product property
$t = 0$ *or* $t = \frac{1}{2}$	Solve for t.

The child lands on the ground $\frac{1}{2}$ second after the child jumps.

Exercise for Example 4

6. In Example 4, suppose the initial velocity is 10 feet per second. After how many seconds will the child land on the ground?