9.4 Solve Polynomial Equations in Factored Form

Goal • Solve polynomial equations.

Your Notes

VOCABULARY

Roots

Vertical motion model

ZERO-PRODUCT PROPERTY

Let a and b be real numbers. If $ab = 0$, then ___ $= 0$ or ___ $= 0$.

Example 1 ***Use the zero-product property***

Solve $(x - 5)(x + 4) = 0$.

Solution

$(x - 5)(x + 4) = 0$ **Write original equation.**

_____ $= 0$ *or* _____ $= 0$ _____ **property**

$x =$ ___ *or* $x =$ _____ **Solve for x.**

The solutions of the equation are _____.

CHECK Substitute each solution into the original equation to check.

(___ $-$ 5)(___ $+$ 4) $\stackrel{?}{=} 0$ (_____ $-$ 5)(_____ $+$ 4) $\stackrel{?}{=} 0$

_____ $\stackrel{?}{=} 0$ _____ $\stackrel{?}{=} 0$

___ $= 0$ ___ $= 0$

Your Notes

Example 2 ***Find the greatest common monomial factor***

Factor out the greatest common monomial factor.

a. $16x + 40y$ **b.** $6x^2 + 30x^3$

Solution

a. The GCF of 16 and 40 is ___. The variables x and y have _____. So, the greatest common monomial factor of the terms is ___.

$16x + 40y =$ _____

b. The GCF of 6 and 30 is ___. The GCF of x^2 and x^3 is _____. So, the greatest common monomial factor of the terms is _____.

$6x^2 + 30x^3 =$ _____

Example 3 ***Solve an equation by factoring***

Solve the equation.

a. $3x^2 + 15x = 0$ **Original equation**

_____ $= 0$ **Factor left side.**

_____ $= 0$ *or* _____ $= 0$ **Zero-product property**

$x =$ ___ *or* $x =$ _____ **Solve for x.**

The solutions of the equation are _____.

To use the zero-product property, you must write the equation so that one side is 0. For this reason, _____ must be subtracted from each side of the equation.

b. $9b^2 = 24b$ **Original equation**

_____ $= 0$ **Subtract _____ from each side.**

_____ $= 0$ **Factor left side.**

_____ $= 0$ *or* _____ $= 0$ **Zero-product property**

$b =$ ___ *or* $b =$ ___ **Solve for b.**

The solutions of the equation are _____.

Your Notes

✔ *Checkpoint* Solve the equation.

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

2. $(x - 8)(x - 5) = 0$

✔ *Checkpoint* Factor out the greatest common monomial factor.

3. $10x^2 - 24y^2$

4. $3t^6 + 8t^4$

The vertical motion model takes into account the effect of gravity but ignores other, less significant, factors such as air resistance.

VERTICAL MOTION MODEL

The height h (in feet) of a projectile can be modeled by

$h = -16t^2 + vt + s$

where t is the _____ (in seconds) the object has been in the air, v is the _____ (in feet per second), and s is the _____ (in feet).

Your Notes

Example 4 ***Solve a multi-step problem***

Fountain A fountain sprays water into the air with an initial vertical velocity of 20 feet per second. After how many seconds does it land on the ground?

Solution

Step 1 **Write** a model for the water's height above ground.

$h = -16t^2 + vt + s$ **Vertical motion model**

$h = -16t^2 + \_\_\_\_t + \_\_\_$ **$v =$ ____ and $s =$ ___**

$h = -16t^2 + \_\_\_\_$ **Simplify.**

Step 2 **Substitute** ___ for h. When the water lands, its height above the ground is ___ feet. Solve for t.

___ $= -16t^2 + \_\_\_\_$ **Substitute ___ for h.**

___ $=$ _____ **Factor right side.**

_____ *or* _____ **Zero-product property**

_____ *or* _____ **Solve for t.**

The water lands on the ground _____ seconds after it is sprayed.

The solution $t = 0$ means that before the water is sprayed, its height above the ground is 0 feet.

Checkpoint **Complete the following exercises.**

5. Solve $d^2 - 7d = 0$.

6. Solve $8b^2 = 2b$.

7. What If? In Example 4, suppose the initial vertical velocity is 18 feet per second. After how many seconds does the water land on the ground?

Homework