

Algebra 1 8.9

Factor perfect square trinomials

Solve equations involving perfect squares (square root property)

perfect square

zero product property

prime

**SRP**

square root property  $(\ )^2 = (\ )^2 \pm$

whiteboards

speed dating (if time)

25 } PS  
144 }

$$x^2 = 49$$

$$x = 7 \quad x = -7$$

$$\cancel{a^2 + b^2}$$

$$(a + b)^2 = (a + b)(a + b)$$

$$(a - b)^2 = (a - b)(a - b)$$

$\begin{array}{r} a + b \\ a + b \\ \hline a^2 + ab + ab + b^2 \\ \hline a^2 + 2ab + b^2 \end{array}$	$\begin{array}{r} a + b \\ a - b \\ \hline -ab - b^2 \\ a^2 - b^2 \end{array}$	$\begin{array}{r} a - b \\ a - b \\ \hline -ab + b^2 \\ a^2 - ab \\ \hline a^2 - 2ab + b^2 \end{array}$
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What is the pattern?

$$(x+3)^2 = (x+3)(x+3) = x^2 + 6x + 9$$

$$(x+6)^2 \longrightarrow x^2 + 12x + 36$$

$$(x-5)^2 \longrightarrow x^2 + 70x + 25$$

$$\begin{array}{c}
 \text{square} \\
 \downarrow \\
 x^2 + 10x + 25 \\
 \uparrow \\
 \text{double}
 \end{array}
 = (x+5)(x+5)$$

1st thing something squared? What?  
 2nd thing something squared? What?  
 Middle term twice their product?

$$x^2 + 16x + 64 = (x+8)(x+8)$$

$$\begin{array}{c}
 16x^2 + 24x + 9 \\
 \downarrow \quad \quad \downarrow \\
 4x \quad \quad 3
 \end{array}
 = (4x+3)(4x+3)$$

### Example 1 Recognize and Factor Perfect Square Trinomials



Determine whether each trinomial is a perfect square trinomial. Write *yes* or *no*.  
If so, factor it.

a.  $4y^2 + 12y + 9$  <sup>yes</sup>  $= (2y + 3)(2y + 3)$

$\downarrow$   $\downarrow$

$2y$   $3$

$= (2y + 3)^2 \leftarrow$

b.  $9x^2 - 6x + 4$

no

	<u>36</u>
1	36
2	18
3	12
4	9
6	6

### Guided Practice

1A.  $9y^2 + 24y + 16$

$$(3y + 4)^2$$

1B.  $2a^2 + 10a + 25$

5

no

Activ: speed dating (if time)

Solve the problem you chose

Check your answer with me

You are the expert on this problem



**ConceptSummary** Factoring Methods

Steps	Number of Terms	Examples
<b>Step 1</b> Factor out the GCF.	any	$4x^3 + 2x^2 - 6x = 2x(2x^2 + x - 3)$
<b>Step 2</b> Check for a difference of squares or a perfect square trinomial.	2 or 3	$9x^2 - 16 = (3x + 4)(3x - 4)$ $16x^2 + 24x + 9 = (4x + 3)^2$
<b>Step 3</b> Apply the factoring patterns for $x^2 + bx + c$ or $ax^2 + bx + c$ (general trinomials), or factor by grouping.	3 or 4	$x^2 - 8x + 12 = (x - 2)(x - 6)$ $2x^2 + 13x + 6 = (2x + 1)(x + 6)$ $12y^2 + 9y + 8y + 6$ $= (12y^2 + 9y) + (8y + 6)$ $= 3y(4y + 3) + 2(4y + 3)$ $= (4y + 3)(3y + 2)$



GCF?

**Example 2** Factor Completely

Factor each polynomial, if possible. If the polynomial cannot be factored, write *prime*.

$$\begin{aligned} \text{a. } \frac{5x^2}{5} - \frac{80}{5} &= 5(x^2 - 16) \\ &= 5(x-4)(x+4) \end{aligned}$$

b.  $9x^2 - 6x - 35$

$- 315$

$1 \quad 315$

$3 \quad 105$

$5 \quad 63$

$7 \quad 45$

$9 \quad 35$

$15 \quad 21$

$$\left(\frac{9x^2}{3x} - \frac{21x}{3x}\right) + (15x - 35)$$

$$3x(3x - 7) + 5(3x - 7)$$

$$(3x + 5)(3x - 7)$$

**Guided**Practice

**2A.**  $2x^2 - 32$

**2B.**  $12x^2 + 5x - 25$

### Example 3 Solve Equations with Repeated Factors

Solve  $9x^2 - 48x = -64$ .

$$9x^2 - 48x + 64 = 0$$

$$(3x - 8)(3x - 8) = 0$$

$$(3x - 8)^2 = 0$$

$$\begin{aligned} 3x - 8 &= 0 \\ 3x &= 8 \\ \frac{3x}{3} &= \frac{8}{3} \end{aligned}$$

$x = \frac{8}{3}$  double root

Guided Practice

Solve each equation. Check your solutions.

3A.  $a^2 + 12a + 36 = 0$

$(a + 6)^2 = 0$

$a + 6 = 0$     $a + 6 = 0$

$a = -6$     $a = -6$

(DR)

3B.  $y^2 - \frac{4}{3}y + \frac{4}{9} = 0$

$(y - \frac{2}{3})^2 = 0$

$y = \frac{2}{3}$

(DR)

$\sqrt{(a+6)^2} = \sqrt{0}$

$a+6 = \pm 0$

$a = -6$

$\frac{2}{3} \cdot \frac{2}{3}$

$$x^2 - 16 = 0$$

$$x^2 = 16$$

$$x = \pm \sqrt{16}$$

$$\Downarrow x = \pm 4$$

SRP

$$\rightarrow X^2 - 16 = 0$$

$$(X+4)(X-4) = 0$$

$$\begin{array}{cc} \downarrow & \downarrow \\ X+4=0 & X-4=0 \end{array}$$

$$X = -4 \quad X = 4$$

$$X = \pm 4$$

SRP( $\pm$ )

**Example 4** Use the Square Root Property

Solve each equation. Check your solutions.

a)  $(y - 6)^2 = 81$

$$y - 6 = \pm 9$$

$$\begin{array}{r} y - 6 = 9 \\ +6 \quad +6 \\ \hline y = 15 \end{array}$$

$$\begin{array}{r} y - 6 = -9 \\ +6 \quad +6 \\ \hline y = -3 \end{array}$$



### Guided Practice

4A.  $(a - 10)^2 = 121$

$$\begin{array}{r} a - 10 = \pm 11 \\ \underline{10 \quad 10} \\ a = 10 \pm 11 \\ = 21 \\ = -1 \end{array}$$

4B.  $(z + 3)^2 = \underline{49}$

$$\begin{array}{r} z + 3 = \pm 7 \\ \underline{-3 \quad -3} \\ z = -3 \pm 7 \\ z = 4 \\ z = -10 \end{array}$$

8.9 p 526  
13-470

not: 35, 43