Lesson 9-2

Example 1 Use the Distributive Property
Use the Distributive Property to factor each polynomial.

a. $21xy - 18x^2$

First, find the GCF of $21xy$ and $18x^2$.

$21xy = 3 \cdot 7 \cdot x \cdot y$ — Factor each number.

$18x^2 = 2 \cdot 3 \cdot \textcircled{3} \cdot \textcircled{x} \cdot x$ — Circle the common prime factors.

GCF: $3 \cdot x$ or $3x$

Write each term as the product of the GCF and its remaining factors. Then use the Distributive Property to factor out the GCF.

$21xy - 18x^2 = 3x(7 \cdot y) - 3x(2 \cdot 3 \cdot x)$ — Rewrite each term using the GCF.

$= 3x(7y) - 3x(6x)$ — Simplify remaining factors.

$= 3x(7y - 6x)$ — Distributive Property

Thus, the completely factored form of $21xy - 18x^2$ is $3x(7y - 6x)$.

b. $64r^3s - 32r^2s^3 + 8r^2s^2$

$64r^3s = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot r \cdot r \cdot r \cdot s$ — Factor each number.

$32r^2s^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot r \cdot r \cdot s \cdot s \cdot s$ — Circle the common prime factors.

$8r^2s^2 = \textcircled{2} \cdot \textcircled{2} \cdot \textcircled{2} \cdot \textcircled{r} \cdot \textcircled{r} \cdot \textcircled{s} \cdot s$

GCF: $2 \cdot 2 \cdot 2 \cdot r \cdot r \cdot s$ or $8r^2s$.

$64r^3s - 32r^2s^3 + 8r^2s^2$

$= 8r^2s(8r) - 8r^2s(4s^2) + 8r^2s(s)$ — Rewrite each term using the GCF.

$= 8r^2s(8r - 4s^2 + s)$ — Distributive Property

Example 2 Use Grouping
Factor $2x^2 + x - 8x - 4$.

$2x^2 + x - 8x - 4$

$= (2x^2 + x) + (-8x - 4)$ — Group terms with common factors.

$= x(2x + 1) + -4(2x + 1)$ — Factor the GCF from each grouping.

$= (2x + 1)(x + -4)$ — $2x + 1$ is the common factor.

$= (2x + 1)(x - 4)$ — Simplify.

Check: Use the FOIL method.

$$\begin{aligned}(2x + 1)(x - 4) &= \overset{F}{(2x)(x)} + \overset{O}{(2x)(-4)} + \overset{I}{(1)(x)} + \overset{L}{(1)(-4)} \\ &= 2x^2 - 8x + x - 4\end{aligned}$$

Example 3 Use the Additive Inverse Property
Factor $3a^2 - 3a + 4 - 4a$.

$3a^2 - 3a + 4 - 4a$

$= (3a^2 - 3a) + (4 - 4a)$ — Group terms with common factors.

$= 3a(a - 1) + 4(1 - a)$ — Factor the GCF from each grouping.

$= 3a(a - 1) + 4(-1)(a - 1)$ — $1 - a = -1(a - 1)$

$= 3a(a - 1) + -4(a - 1)$ — $4(-1) = -4$

$= (a - 1)(3a + -4)$ — $a - 1$ is the common factor.

$= (a - 1)(3a - 4)$ — Simplify.

Example 4 Solve an Equation in Factored Form

Solve $(q + 2)(2q – 1) = 0$. Then check the solutions.

If $(q + 2)(2q – 1) = 0$, then according to the Zero Product Property either $q + 2 = 0$ or $2q – 1 = 0$.

$(q + 2)(2q – 1) = 0$		Original equation
$q + 2 = 0$ or	$2q – 1 = 0$	Set each factor equal to zero.
$q = -2$	$2q = 1$	Solve each equation.
	$q = \frac{1}{2}$	

The solution set is $\{-2, \frac{1}{2}\}$.

Check: Substitute –2 and $\frac{1}{2}$ for q in the original equation.

$(q + 2)(2q – 1) = 0$	$(q + 2)(2q – 1) = 0$
$(-2 + 2)[2(-2) – 1] \stackrel{?}{=} 0$	$(\frac{1}{2} + 2)[2(\frac{1}{2}) – 1] \stackrel{?}{=} 0$
$(0)(-5) \stackrel{?}{=} 0$	$(\frac{5}{2})(0) \stackrel{?}{=} 0$
$0 = 0$ ✓	$0 = 0$ ✓

Example 5 Solve an Equation by Factoring

Solve $3x^2 + 9x = 0$. Then check the solutions.

Write the equation so that it is of the form $ab = 0$.

$3x^2 + 9x = 0$		Original equation.
$3x(x + 3) = 0$		Factor the GCF of $3x^2$ and $9x$, which is $3x$.
$3x = 0$ or	$x + 3 = 0$	Zero Product Property
$x = 0$	$x = -3$	Solve each equation.

The solution set is $\{-3, 0\}$.

Check: Substitute -3 and 0 for x in the original equation.

$3x^2 + 9x = 0$	$3x^2 + 9x = 0$
$3(-3)^2 + 9(-3) \stackrel{?}{=} 0$	$3(0)^2 + 9(0) \stackrel{?}{=} 0$
$27 + -27 \stackrel{?}{=} 0$	$0 + 0 \stackrel{?}{=} 0$
$0 = 0$ ✓	$0 = 0$ ✓