35. $5x^4 - 405$

Take out GCF

$5(x^4 - 81)$

$5(x^2 - 9)(x^2 + 9)$

$5(x+3)(x-3)(x^2 + 9)$

Section 5.5

Difference of 2 Squares

Con't Factor
Sum of 2 Squares
Sum of 2 Cubes

41. $x^3 + 64$

$(x^3 + (4^3))$

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

$= (x + 4)(x^2 - 4x + 16)$

$= (x + 4)(x^2 - 4x + 16)$
49. \( 27a^3 - 125 \)

\[
27a^3 - 125 = (3a)^3 - 5^3
\]

\[
a^3 - b^3 = (a - b)(a^2 + ab + b^2)
\]

\[
= (3a - 5)(9a^2 + 15a + 25)
\]
59. $50x^2 - 10x - 12$

Take Out $GCF$

$-150x^2$

1. 150
2. 75
3. 50
5. 30
6. 25
10. 15
10 (-15) = -5
10 (-15) = 15

$2 (25x^2 - 5x - 6)$

$25x^2 - 15x + 10x - 6$

$5x (5x - 3) + 2 (5x - 3)$

$2 (5x - 3)(5x + 2)$
87. \( a^5b^2 - 4a^3b^4 \)

Take GCF

\[ a^2b^2 \]

\[ (a+b)(a-b) \]

\[ \cdot a^5b^2 - 4a^3b^4 \]

\[ a^3b^2 [a^2 - 4b^2] \]

\[ \text{Difference of 2 Squares} \]

\[ a^3b^2 (a+2b)(a-2b) \]
79. \(6x^2 - 4x + 24x - 16\)

\(\text{GCF} = 2\)

\(6x^2 - 4x + 24x - 16\) \(\xrightarrow{\text{Factor By Grouping}}\)

\(2 \left[ \frac{3x^2 - 2x + 12x - 8}{\text{GCF}} \right]\)

\(x(3x - 2) + 4(3x - 2)\)

\(2 \left(3x - 2\right) \left(x + 4\right)\)

\(3x^2 + 4x - 8\)

\(6x^2 - 4x + 24x - 16\)

\(2x(3x - 2) + 8(3x - 2)\)

\(\left(3x - 2\right) \left(2x + 8\right)\)
5.6 Solving Quadratic Equations Using Factoring

1. Recognize quadratic equations.
2. Solve quadratic equations using factoring.

1. Recognize Quadratic Equations

In this section, we introduce quadratic equations, which are equations that contain a second-degree term and no term of a higher degree.

Quadratic Equation

Quadratic equations have the form

\[ ax^2 + bx + c = 0 \]

where \( a, b, \) and \( c \) are real numbers, \( a \neq 0 \).

Examples of Quadratic Equations

\[ x^2 + 4x - 12 = 0 \]
\[ 2x^2 - 5x = 0 \]
\[ 3x^2 - 2 = 0 \]

Quadratic equations like these, in which one side of the equation is written in descending order of the variable and the other side of the equation is 0, are said to be in standard form.

Some quadratic equations can be solved by factoring. Two methods for solving quadratic equations that cannot be solved by factoring are given in Chapter 10. To solve a quadratic equation by factoring, we use the zero-factor property.

You know that if you multiply by 0, the product is 0. That is, if \( a = 0 \) or \( b = 0 \), then \( ab = 0 \). The reverse is also true. If a product equals 0, at least one of its factors must be 0.

Zero-Factor Property

If \( ab = 0 \), then \( a = 0 \) or \( b = 0 \).

Zero Product Property

If \( \text{If } a \cdot b = 0 \)
Then \( a = 0 \) or \( b = 0 \).
8. \[-2x(x + 9) = 0\]

\[
-2x = 0 \quad \text{or} \quad x + 9 = 0
\]

\[
\frac{-2x}{-2} = \frac{-9}{-9}
\]

\[
x = 0 \quad \text{or} \quad x = -9
\]

12. \[(3x - 2)(x - 5) = 0\]

\[
3x - 2 = 0
\]

\[
\frac{3x}{3} = \frac{2}{3}
\]

\[
x = \frac{2}{3}
\]

or

\[
x = 5
\]
2 Solve Quadratic Equations Using Factoring

Now we give a general procedure for solving quadratic equations using factoring.

**To Solve a Quadratic Equation Using Factoring**

1. Write the equation in standard form with the squared term having a positive coefficient. This will result in one side of the equation being 0.
2. Factor the side of the equation that is not 0.
3. Set each factor containing a variable equal to 0 and solve each equation.
4. Check each solution found in step 3 in the original equation.

**EXAMPLE 3** Solve the equation $3x^2 = 12x$.

**Solution** To make the right side of the equation equal to 0, we subtract $12x$ from both sides of the equation. Then we factor out $3x$ from both terms. Why did we make the right side of the equation equal to 0 instead of the left side?

$$3x^2 = 12x$$

$$3x^2 - 12x = 12x - 12x$$

$$3x^2 - 12x = 0$$

$$3x(x - 4) = 0$$

47. $2x^2 = 50x$

20. $x^2 + 12x + 36 = 0$

![Quadratic Equation](image)
47. \( 2x^2 = 50x \)

Factoring Polynomials

\[
2x^2 - 50x = 0
\]

\[
2x(x - 25) = 0
\]

\[
x = 0 \quad \text{or} \quad x - 25 = 0
\]

\[
x = 0 \quad \text{or} \quad x = 25
\]

20. \( x^2 + 12x + 36 = 0 \)
20. \( x^2 + 12x + 36 = 0 \)

\[
(x + 6)(x + 6) = 0
\]

Factors of 36

\[
x + 6 = 0 \quad \text{or} \quad x + 6 = 0
\]

That means

\[
x = -6 \quad \text{or} \quad x = -6
\]

Double root

Add to 12

1 - 36
2 - 18
3 - 12
4 - 9
5 - 6
6 - 0
28. $3x^2 - 9x - 30 = 0$

33. $-x^2 + 29x + 30 = 0$

\[ -x^2 + 29x + 30 = 0 \]
\[ -1(x^2 - 29x - 30) = 0 \]
\[ -1(x - 30)(x + 1) = 0 \]
\[ x = 30 \quad x = -1 \]

48. $4x^2 - 25 = 0$

54. $(x - 1)(2x - 5) = 9$

\[ 1 + (-30) = -29 \]
\[ 1(-30) = -30 \]
\[ -1(x - 30)(x + 1) = 0 \]
\[ x - 30 = 0 \quad \text{or} \quad x + 1 = 0 \]
\[ x = 30 \quad x = -1 \]
Difference of 2 squares

\[ 4x^2 - 25 = 0 \]

\[ (2x+5)(2x-5) = 0 \]

\[ 2x+5 = 0 \quad \text{or} \quad 2x-5 = 0 \]

\[ 2x = -5 \quad \text{or} \quad 2x = 5 \]

\[ x = -\frac{5}{2} \quad \text{or} \quad x = \frac{5}{2} \]

\[ a^2 - b^2 = (a+b)(a-b) \]
54. \((x - 1)(2x - 5) = 9\)

\[
(x-1)(2x-5) = 9
\]

Set Equal To Zero

\[
2x^2 - 5x - 2x + 5 = 9
\]

\[
2x^2 - 7x - 4 = 0
\]

\[
2x^2 - 8x + 1x - 4 = 0
\]

\[
2x (x-4) + 1(x-4) = 0
\]

\[
(x-4)(2x+1) = 0
\]

\[
x - 4 = 0 \quad \text{or} \quad 2x + 1 = 0
\]

\[
x = 4 \quad \text{OR} \quad x = -\frac{1}{2}
\]
26. \( x^2 = 4x + 21 \)

Set equation equal to zero:

\[
\begin{align*}
X^2 &= 4x + 21 \\
-4x &= -21
\end{align*}
\]

\[
X^2 - 4x - 21 = 0
\]

\[
(x - 7)(x + 3) = 0
\]

\[
x - 7 = 0 \quad \text{or} \quad x + 3 = 0
\]

\[
x = 7 \quad \text{or} \quad x = -3
\]
40. $3x^2 = 7x + 20$