


Section 5.4


Factoring Trinomials



Dive In!

Did you know that when you jump upward from a diving board, your height at any given time can be calculated using a trinomial expression?

An application exercise in this section of the textbook will explore this situation in detail.



First Steps:

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 5.4 of your textbook which begins on page 350.
- Complete the *Concept and Vocabulary Check* on page 360 of the textbook.

Guided Practice:

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

Objective #1: Factor a trinomial whose leading coefficient is 1.

Solved Problem #1

1a. Factor: $x^2 + 6x + 8$

Find a factor pair of 8 that has a sum of 6.

factor pair: $4(2) = 8$

sum: $4 + 2 = 6$

$$x^2 + 6x + 8 = (x + 4)(x + 2)$$

Pencil Problem #1

1a. Factor: $x^2 + 5x + 6$

1a. Factor: $x^2 - 9x + 20$

Find a factor pair of 20 that has a sum of -9.

factor pair: $-5(-4) = 20$

sum: $-5 + (-4) = -9$

$$x^2 - 9x + 20 = (x - 5)(x - 4)$$

1b. Factor: $x^2 - 8x + 15$

1c. Factor: $x^2 - 5xy + 6y^2$

Find a factor pair of 6 that has a sum of -5 .

factor pair: $-3(-2) = 6$

sum: $-3 + (-2) = -5$

$$x^2 - 5xy + 6y^2 = (x - 3y)(x - 2y)$$

1c. Factor: $x^2 - 9xy + 14y^2$

1d. Factor: $3x^3 - 15x^2 - 42x$

First, factor out the GCF.

$$3x^3 - 15x^2 - 42x = 3x(x^2 - 5x - 14)$$

Next, factor the trinomial.

$$\begin{aligned} 3x^3 - 15x^2 - 42x &= 3x(x^2 - 5x - 14) \\ &= 3x(x - 7)(x + 2) \end{aligned}$$

1d. Factor: $12x^2y - 34xy^2 + 14y^3$

Objective #2: Factor using a substitution.

 **Solved Problem #2**

2. Factor using substitution: $x^6 - 7x^3 + 10$

Let $u = x^3$.

$$\begin{aligned} x^6 - 7x^3 + 10 &= (x^3)^2 - 7x^3 + 10 \\ &= u^2 - 7u + 10 \\ &= (u - 5)(u - 2) \end{aligned}$$

Now substitute x^3 for u .

$$\begin{aligned} &= (u - 5)(u - 2) \\ &= (x^3 - 5)(x^3 - 2) \end{aligned}$$

 **Pencil Problem #2** 

2. Factor using substitution: $x^4 - 5x^2 - 6$

Objective #3: Factor a trinomial whose leading coefficient is not 1.	
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<p style="text-align: center;"> Solved Problem #3</p> <p>3a. Factor: $3x^2 - 20x + 28$</p> <p>$3x^2 - 20x + 28 = (3x - 14)(x - 2)$</p> <hr/> <p>3b. Factor: $6x^6 + 19x^5 - 7x^4$</p> <p>First, factor out the GCF.</p> $6x^6 + 19x^5 - 7x^4 = x^4(6x^2 + 19x - 7)$ <p>Next, factor the trinomial.</p> $\begin{aligned} 6x^6 + 19x^5 - 7x^4 &= x^4(6x^2 + 19x - 7) \\ &= x^4(3x - 1)(2x + 7) \end{aligned}$ <hr/> <p>3c. Factor: $3y^4 + 10y^2 - 8$</p> <p>Let $u = y^2$.</p> $\begin{aligned} 3y^4 + 10y^2 - 8 &= 3(y^2)^2 + 10y^2 - 8 \\ &= 3u^2 + 10u - 8 \\ &= (3u - 2)(u + 4) \end{aligned}$ <p>Now substitute y^2 for u.</p> $\begin{aligned} &= (3u - 2)(u + 4) \\ &= (3y^2 - 2)(y^2 + 4) \end{aligned}$	<p style="text-align: center;"> Pencil Problem #3</p> <p>3a. Factor: $3x^2 + 8x + 5$</p> <hr/> <p>3b. Factor: $24x^4 + 10x^3 - 4x^2$</p> <hr/> <p>3c. Factor: $2y^{10} + 7y^5 + 3$</p>
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Objective #4: Factor trinomials by grouping.**✓ Solved Problem #4**

4. Factor: $8x^2 - 22x + 5$

$$8x^2 - 22x + 5 = \overset{a}{8}x^2 - \overset{b}{22}x + \overset{c}{5}$$

Multiply a and c . $ac = 8(5) = 40$

Find the factors of ac whose sum is b .

Product: $-20(-2) = 40$

Sum: $-20 + (-2) = -22$

Rewrite the middle term using the factors of -20 and -2 .

$$8x^2 - 22x + 5 = 8x^2 - 20x - 2x + 5$$

$$\begin{aligned} & \underbrace{\quad}_{\text{Find GCF}} \quad \underbrace{\quad}_{\text{Find GCF}} \\ & = 8x^2 - 20x - 2x + 5 \\ & = 4x(2x - 5) - 1(2x - 5) \\ & = (2x - 5)(4x - 1) \end{aligned}$$

✎ Pencil Problem #4

4. Factor: $4y^2 + 9y + 2$

Answers for Pencil Problems (Textbook Exercise references in parentheses):

1a. $(x+3)(x+2)$ (5.4 #1) 1b. $(x-5)(x-3)$ (5.4 #9)

1c. $(x-7y)(x-2y)$ (5.4 #23) 1d. $2y(3x-7y)(2x-y)$ (5.4 #79)

2. $(x^2-6)(x^2+1)$ (5.4 #41)

3a. $(3x+5)(x+1)$ (5.4 #45) 3b. $2x^2(3x+2)(4x-1)$ (5.4 #71) 3c. $(2y^5+1)(y^5+3)$ (5.4 #87)

4. $(y+2)(4y+1)$ (5.4 #51)

Homework:

Review the Section 5.4 summary on page 397 of the textbook.

Insert your homework into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.