Practice Book

3 Practice and Apply

Use Practice Book pp. 199–200

Assignment Guide	
Decelerated	1–8, 13–18
Average	9–26 Even
Accelerated	9–12, 19–28

■ Before assigning the exercises, discuss the example in the teaching display at the top of Practice Book page 199. Refer to the Think box to reinforce the process of factoring.

Errors Commonly Made
Students sometimes mistakenly believe that the first set of factors they try ought to "work." Encourage them to make an organized list to be sure they have tried all possible combinations.

■ In exercises 1–12, remind students to check their answers using the FOIL method.

■ When students factor the trinomials in exercises 13–24, stress the need to work systematically, so that they do not overlook the one pair of factors that is correct.

■ Make the connection between the area models in exercises 25–27 and the product of two binomials. After students have factored the polynomial, have them write the binomials on each side of the rectangle to reinforce the concept.

CHALLENGE

■ Suggest that students first write the trinomial in exercise 28 as an equivalent expression that is the product of the greatest common monomial factor and a trinomial.

8-3 Factor Trinomials $ax^2 + bx + c$ with $a \neq 1$

Name _____ Date _____

Factor: $5a^2 + 16a + 3$

Think
$a = 5$, $b = 16$, $c = 3$; $ac = 15$

Find two positive factors of 15 that sum to 16.

Factors of 15	Sum of factors
1, 15	16 ←
3, 5	8

$5a^2 + 16a + 3 = 5a^2 + (15 + 1)a + 3$ ← Select the factors 15 and 1.
$= 5a^2 + 15a + a + 3$ ← Use the Distributive Property.
$= (5a^2 + 15a) + (a + 3)$ ← Group terms that have a common monomial factor.
$= 5a(a + 3) + 1(a + 3)$ ← Factor each binomial using the greatest common monomial factor.
$= (5a + 1)(a + 3)$ ← Use the Distributive Property.

So in factored form, $5a^2 + 16a + 3 = (5a + 1)(a + 3)$.

Multiply to check: $(5a + 1)(a + 3) = 5a^2 + 15a + a + 3$
$= 5a^2 + 16a + 3$ ✓

Factor each trinomial. Check by multiplying the factors.
If the polynomial cannot be factored, write *prime*. Check students' work.

1. $2x^2 + 11x + 5$
$ac = 10$; $1 + 10 = 11$
$2x^2 + 10x + x + 5$
$2x(x + 5) + 1(x + 5)$
$(2x + 1)(x + 5)$
Check:
$= 2x^2 + 10x + x + 5$
$= 2x^2 + 11x + 5$

2. $2r^2 + 15r + 7$
$ac = 14$; $1 + 14 = 15$
$2r^2 + 14r + r + 7$
$2r(r + 7) + 1(r + 7)$
$(2r + 1)(r + 7)$

3. $2c^2 - 5c + 3$
$ac = 6$; $-2 + (-3) = -5$
$2c^2 - 2c - 3c + 3$
$2c(c - 1) - 3(c - 1)$
$(2c - 3)(c - 1)$

4. $2p^2 - 9p + 7$
$ac = 14$; $-2 + (-7) = -9$
$2p^2 - 2p - 7p + 7$
$2p(p - 1) - 7(p - 1)$
$(2p - 7)(p - 1)$

5. $3t^2 + 14t - 8$
$ac = -24$; $-1 + 24 = 23$
$-2 + 12 = 10$; $-3 + 8 = 5$
$-4 + 6 = 2$
prime

6. $4q^2 + 29q - 25$
$ac = -100$; $-1 + 100 = 99$
$-2 + 50 = 48$; $-4 + 25 = 21$
$-5 + 20 = 15$; $-10 + 10 = 0$
prime

7. $5a^2 + 13a - 6$
$ac = -30$
$15 + (-2) = 13$
$5a^2 + 15a - 2a - 6$
$5a(a + 3) - 2(a + 3)$
$(5a - 2)(a + 3)$

8. $11x^2 + 9x - 2$
$ac = -22$; $11 + (-2) = 9$
$11x^2 + 11x - 2x - 2$
$11x(x + 1) - 2(x + 1)$
$(11x - 2)(x + 1)$

9. $3n^2 - n - 10$
$ac = -30$; $-6 + 5 = -1$
$3n^2 - 6n + 5n - 10$
$3n(n - 2) + 5(n - 2)$
$(3n + 5)(n - 2)$

10. $7x^2 - 5x - 12$
$ac = -84$; $-12 + 7 = -5$
$7x^2 + 7x - 12x - 12$
$7x(x + 1) - 12(x + 1)$
$(7x - 12)(x + 1)$

11. $19y^2 - 138y + 35$
$ac = 665$
$-133 + (-5) = -138$
$19y^2 - 133y - 5y + 35$
$19y(y - 7) - 5(y - 7)$
$(19y - 5)(y - 7)$

12. $19a^2 - 82a + 24$
$ac = 456$; $-76 + (-6) = -82$
$19a^2 - 76a - 6a + 24$
$19a(a - 4) - 6(a - 4)$
$(19a - 6)(a - 4)$

Use with SOURCEBOOK Lesson 8-3, pages 206–209.

Factor each trinomial. Check by multiplying the factors. If the polynomial cannot be factored, write *prime*. Check students' work.

13. $5x^2 + 12x + 7$

Find the value of the linear term:
$(5x + 7)(x + 1) \longrightarrow 12x$
$(5x + 1)(x + 7) \longrightarrow 36x$
$(5x + 7)(x + 1)$
Check: $= 5x^2 + 5x + 7x + 7$
$= 5x^2 + 12x + 7$

14. $3a^2 + 34a + 11$

$(3a + 1)(a + 11) \longrightarrow 34a$
$(3a + 11)(a + 1) \longrightarrow 14a$
$(3a + 1)(a + 11)$

15. $11g^2 - 36g + 9$

$(11g - 1)(g - 9) \longrightarrow -100g$
$(11g - 9)(g - 1) \longrightarrow -20g$
$(11g - 3)(g - 3) \longrightarrow -36g$
$(11g - 3)(g - 3)$

16. $13c^2 - 70c + 25$

$(13c - 1)(c - 25) \longrightarrow -326g$
$(13c - 25)(c - 1) \longrightarrow -38c$
$(13c - 5)(c - 5) \longrightarrow -70g$
$(13c - 5)(c - 5)$

17. $8n^2 + 10n - 3$

$(8n - 1)(n + 3) \longrightarrow 23n$
$(8n - 3)(n + 1) \longrightarrow 5n$
$(2n - 3)(4n + 1) \longrightarrow -10n$
$(2n + 3)(4n - 1) \longrightarrow 10n$
$(2n + 3)(4n - 1)$

18. $12b^2 + 17b - 7$

$(12b - 1)(b + 7) \longrightarrow 83b$
$(12b - 7)(b + 1) \longrightarrow 5b$
$(4b - 1)(3b + 7) \longrightarrow 25b$
$(4b + 7)(3b - 1) \longrightarrow 17b$
$(4b + 7)(3b - 1)$

19. $8x^2 - 2x - 15$

$(8x - 15)(x + 1) \longrightarrow -7x$
$(4x - 15)(2x + 1) \longrightarrow -26x$
$(4x - 1)(2x + 15) \longrightarrow -58x$
$(4x + 3)(2x - 5) \longrightarrow -14x$
$(4x + 5)(2x - 3) \longrightarrow -2x$
$(4x + 5)(2x - 3)$

20. $12z^2 - 16z - 16$

$(12z - 16)(z + 1) \longrightarrow -4z$
$(2z - 1)(6z + 16) \longrightarrow 26z$
$(2z - 2)(6z + 8) \longrightarrow 4z$
$(4z - 2)(3z + 8) \longrightarrow 26z$
$(4z - 8)(3z + 2) \longrightarrow -16z$
$(4z - 8)(3z + 2)$

21. $10m^2 - 31m + 63$

$(10m - 63)(m - 1) \longrightarrow -73m$
$(10m - 9)(m - 7) \longrightarrow -79m$
$(5m - 7)(2m - 9) \longrightarrow -59m$
$(5m - 9)(2m - 7) \longrightarrow -53m$
prime

22. $45y^2 + 56y - 45$

$(15y + 5)(3y - 9) \longrightarrow -120y$
$(15y - 15)(3y + 3) \longrightarrow 0y$
$(9y + 5)(5y - 9) \longrightarrow -56y$
$(9y - 5)(5y + 9) \longrightarrow 56y$
$(9y - 5)(5y + 9)$

23. $15t^2 + 13t - 72$

$(15t - 9)(t + 8) \longrightarrow 111t$
$(15t + 12)(t - 6) \longrightarrow -78t$
$(5t + 9)(3t - 8) \longrightarrow -13t$
$(5t - 9)(3t + 8) \longrightarrow 13t$
$(5t - 9)(3t + 8)$

24. $39s^2 + 19s + 2$

$(39s + 1)(s + 2) \longrightarrow 79s$
$(39s + 2)(s + 1) \longrightarrow 41s$
$(13s + 1)(3s + 2) \longrightarrow 29s$
$(13s + 2)(3s + 1) \longrightarrow 19s$
$(13s + 2)(3s + 1)$

Write the polynomial shown by each area model, and then factor.

25.

$8g^2$	$12g$
$6g$	9

$8g^2 + 12g + 6g + 9$
$8g^2 + 18g + 9$
$ac = 72$; $6 + 12 = 18$
$8g^2 + 12g + 6g + 9$
$4g(2g + 3) + 3(2g + 3)$
$(4g + 3)(2g + 3)$

26.

$12b^2$	$18b$
$10b$	15

$12b^2 + 18b + 10b + 15$
$12b^2 + 28b + 15$
$12b^2 + 18b + 10b + 15$
$6b(2b + 3) + 5(2b + 3)$
$(6b + 5)(2b + 3)$

27.

$11m^2$	$4m$
$77m$	28

$11m^2 + 4m + 77m + 28$
$11m^2 + 81m + 28$
$11m^2 + 77m + 4m + 28$
$11m(m + 7) + 4(m + 7)$
$(11m + 4)(m + 7)$

CHALLENGE

28. Factor the trinomial $8y^4 + 32y^3 + 30y^2$. Explain your steps.

$2y^2(2y + 5)(2y + 3)$; Possible response: Factor out the greatest common monomial factor of the trinomial, then factor the trinomial. The GCF of 8, 32, and 30 is 2
The GCF of y^4, y^3, and y^2 is y^2. So the greatest common monomial factor of the trinomial is $2y^2$
so $8y^4 + 32y^3 + 30y^2 = 2y^2(4y^2) + 2y^2(16y) + 2y^2(15) = 2y^2(4y^2 + 16y + 15)$
$a = 4$, $b = 16$, $c = 15$; $ac = 60$, factors of 60 / sum: 1, 60 / 61; 2, 30 / 32; 3, 20 / 23; 4, 15 / 19
5, 12 / 17; 6, 10 / 16; so $2y^2(4y^2 + 16y + 15) = 2y^2(4y^2 + 6y + 10y + 15) = 2y^2[2y(2y + 3) + 5(2y + 3)]$
$= 2y^2(2y + 5)(2y + 3)$.

Additional Resources

ONLINE www.progressinmathematics.com

- Meeting Individual Needs Activities
- Alternative Teaching Models
- Vocabulary Activities
- Audio Glossary
- Virtual Manipulatives
- Check Your Progress I
- Practice Activities (Lessons 1–3)

Meeting Individual Needs
See page 199F.

4 Summarize/Assess

Conceptual Thinking

■ To assess whether students have conceptualized the lesson concepts, have them discuss how using a table can help them factor trinomials of the form $ax^2 + bx + c$. Have them explain the steps in factoring trinomials such as $3x^2 + 5x + 2$ and $4x^2 - 4x - 15$.

$ac = 6$ and $b = 5$, so in this instance, try 2 and 3: $(3x + 2)(x + 1)$; $ac = -60$ and $b = -4$, so try combinations of factors that have a sum of -4: $(2x - 5)(2x + 3)$

In their *Math Journals*, have students describe the similarities and differences between factoring trinomials of the form $ax^2 + bx + c$, when $a = 1$ and when $a \neq 1$.

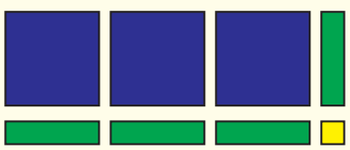
ONLINE **Check Your Progress I**

Administer Check Your Progress I to assess understanding of Lessons 1–3. For additional practice, assign the online Practice Activities.

5 Follow-Up

Reteaching

■ Have students work in pairs. Provide them with algebra tiles, and have them create the following rectangle.



Ask, "What trinomial does the large rectangle represent?" $3x^2 + 4x + 1$ "What is its length?" $3x + 1$ "What is its width?" $x + 1$ Elicit that the area of the rectangle is $(3x + 1)(x + 1)$, which is the factored form of the trinomial.

Have students create other rectangles with the algebra tiles and factor the trinomials they represent.

ONLINE **See Chapter 8 Alternative Teaching Models.**

End of Lesson