NAME

Module 12 Simplifying Algebraic Expressions by Factoring Polynomials
Lesson 2 Factoring by Grouping

Factor.

1. $d(d - 2) + 5(d - 2)$

(d − 2)(d + 5)

2. $m(m^2 + 3) - 2(m^2 + 3)$

$(m^2 + 3)(m - 2)$

3. $(x + 5) + x(x + 5)$

(x + 5)(1 + x)

4. $c(2c - d) - d(2c - d)$

(2c − d)(c − d)

5. $a(b + c) + d(b + c)$

(b + c)(a + d)

6. $x(y^2 - z) - 5(y^2 - z)$

$(y^2 - z)(x - 5)$

7. $y(y - 4) + 3(4 - y)$

(y − 4)(y − 3)

8. $m(m - 7) - 2(7 - m)$

(m − 7)(m + 2)

9. $a^2 + 5a + 2ac + 10c$

(a + 5)(a + 2c)

10. $v^2 + 5v + uv + 5u$

(v + 5)(v + u)

11. $16r + 2rs - 3s - 24$

(s + 8)(2r − 3)

12. $2m - 3 + 6mn - 9n$

(2m − 3)(1 + 3n)

13. $y^2 - 3y + 3y - 9$

(y + 3)(y − 3)

14. $a^2 + ab + ab + b^2$

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

15. $3c^2 + 18c - 5cd - 30d$

(3c − 5d)(c + 6)

16. $g^2 - gh - gh + h^2$

(g − h)(g − h) or $(g - h)^2$

17. $10p^3 - 20p^2 + p - 2$

$(10p^2 + 1)(p - 2)$

18. $6v^3 + 9v^2 + 4v + 6$

$(3v^2 + 2)(2v + 3)$

19. $3x^3 - 10 - 6x^2 + 5x$

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

20. $-4g^3 + 15 - 6g^2 + 10g$

$(2g + 3)(-2g^2 + 5)$

21. $16mn - 12n + 20m - 15$

(4m − 3)(4n + 5)

22. $3x^2 - 4xy - 15x + 20y$

(3x − 4y)(x − 5)

23. $6a^2 + 24ab + 3a + 12b$

$(a + 4b)(6a + 3)$

24. $6m^2 - 15mn - 14mn + 35n^2$

$(2m - 5n)(3m - 7n)$

Journal

1. Explain how to factor the polynomial $6a + 3 + 2a^2 + a$.
2. Lisa and Timothy are factoring the polynomial $10a^2 - 6ab + 35a - 21b$. Lisa wants to factor the polynomial by grouping the first two terms and then, grouping the last two terms. Timothy wants to factor by grouping the first and third terms together and by grouping the second and fourth terms together. Show them that they will both get the same result.
3. Explain, using properties of real numbers, why Lisa and Timothy both arrived at the same answer.
4. Is it possible to factor $2x^3 + 2x^2y - 3x^2 + 3xy$ by grouping? Explain your answer.
5. Explain how to factor the polynomial $3(x - 2) + x(2 - x)$.

Cumulative Review

Simplify.

1. $(x - 2)(x^2 + 3x + 4)$

$x^3 + x^2 - 2x - 8$

2. $(d - 3)(d^2 - d + 1)$

$d^3 - 4d^2 + 4d - 3$

3. $(m + 4)(m^2 - 2m + 6)$

$m^3 + 2m^2 - 2m + 24$

4. $(q + 2)(q^2 + 3q - 1)$

$q^3 + 5q^2 + 5q - 2$

5. $(x^2 + 5x + 6) \div (x + 2)$

$x + 3$

6. $(y^2 - 8y - 33) \div (y - 11)$

$y + 3$

7. $(w^2 - 25) \div (w + 5)$

$w - 5$

8. $(t^3 + 64) \div (t + 4)$

$t^2 - 4t + 16$

Factor, if possible.

9. $14x^2y + 21xy^3 - 35y^2$

$7y(2x^2 + 3xy^2 - 5y)$

10. $a^3b^4 - a^2b^5 + a^4b^2c^2$

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

Possible Journal Answers

1. Begin by grouping the terms in pairs: $(6a + 3) + (2a^2 + a)$. Next, factor each pair by removing the GCF: $3(2a + 1) + a(2a + 1)$. Find the GCF of this new polynomial and factor: $(2a + 1)(3 + a)$.
2. Lisa's Method
   $10a^2 - 6ab + 35a - 21b$
   $(10a^2 - 6ab) + (35a - 21b)$
   $2a(5a - 3b) + 7(5a - 3b)$
   $(5a - 3b)(2a + 7)$

   Timothy's Method
   $10a^2 + 35a - 6ab - 21b$
   $(10a^2 + 35a) - (6ab + 21b)$
   $5a(2a + 7) - 3b(2a + 7)$
   $(2a + 7)(5a - 3b)$
3. The Commutative Property of Addition states that order does not matter when performing addition. This property allowed Timothy to rearrange the polynomial as $10a^2 + 35a - 6ab - 21b$. The Associative Property of Addition states that grouping does not matter when performing addition. These properties allowed Timothy to group the terms differently than Lisa and still get the same result. Although the final answers look different, they are equivalent by the Commutative Property of Multiplication.
4. No, it is not possible to factor $2x^3 + 2x^2y - 3x^2 + 3xy$ by grouping. It factors to $2x^2(x + y) - 3x(x - y)$, but the binomials in parentheses are not the same. Other grouping arrangements produce a similar non-factorable result.
5. Begin by rewriting the polynomial as $3(x - 2) + x(-x + 2)$. Then, factor out a negative one from the second term: $3(x - 2) + (-x)(x - 2)$. Finally, finish factoring: $(x - 2)(3 - x)$.