

Factoring Practice

I. Greatest Common Factor (GCF)

Find the GCF of the numbers.

$$\begin{aligned} &18, 30 \\ &18 = 2 \cdot 3 \cdot 3 \\ &30 = 2 \cdot 3 \cdot 5 \\ &2 \cdot 3 = 6 \\ &6 = \text{GCF} \end{aligned}$$

1. 12, 18
2. 10, 35
3. 8, 30
4. 16, 24

5. 28, 49
6. 27, 63
7. 30, 45
8. 48, 72

II. Greatest Common Monomial Factor

Factor, write prime if prime.

$$12a^3b + 15ab^3 = 3ab(4a^2 + 5b^2)$$

1. $6x + 3$
2. $24x^2 - 8x$
3. $6x - 12$
4. $2x^2 + 8x$
5. $4x + 10$
6. $10x^2 + 35x$
7. $10x^2y - 15xy^2$

8. $12x^2 - 9x + 15$
9. $3n^3 - 12n^2 - 30n$
10. $9m^2 - 4n + 12$
11. $2x^3 - 3x^2 + 5x$
12. $13m + 26m^2 - 39m^3$
13. $17x^2 + 34x + 51$
14. $18m^2n^4 - 12m^2n^3 + 24m^2n^2$

III. Factoring the Difference of Two Squares

$$\begin{aligned} &a^2 - 36 = (a + 6)(a - 6) \\ &3x^2 - 48 = 3(x^2 - 16) = 3(x + 4)(x - 4) \end{aligned}$$

Factor, write prime if prime.

1. $x^2 - 1$
2. $x^2 - 9$
3. $x^2 + 4$
4. $x^2 - 25$
5. $9y^2 - 16$
6. $4x^2 - 25$
7. $9x^2 - 1$
8. $a^2 - x^2$
9. $25 - m^2$
10. $x^2 - 16y^2$
11. $25m^2 - n^2$

12. $-x^2 + 16$
13. $36m^2 - 121$
14. $2x^2 - 8$
15. $25 + 4x^2$
16. $4a^2 - 81b^2$
17. $12x^2 - 75$
18. $a^2b - b^3$
19. $-98 + 2x^2$
20. $5x^2 - 45y^2$
21. $9x^4 - 4$
22. $16x^4 - y^2$

IV. Factoring Perfect Square Trinomials

$$x^2 - 14x + 49 = (x - 7)^2$$

Factor, write prime if prime.

- $x^2 + 8x + 16$
- $x^2 - 16x + 64$
- $y^2 + 12y + 36$
- $a^2 - 10a + 25$
- $16y^2 + 8y + 1$
- $25a^2 + 60a + 36$
- $16 + 40x + 25x^2$
- $16x^2 + 24x + 9$
- $49x^2 - 14x + 1$
- $9y^2 - 30y + 25$
- $9x^2 - 6x + 1$
- $25x^2 + 10x + 1$
- $n^2 - 14n + 49$
- $81x^2 - 90x + 25$
- $4y^2 - 20y + 25$
- $n^2 + 2n + 4$
- $b^2 + 2b + 1$
- $36x^2 + 84x + 49$
- $81 - 18x + x^2$
- $4 - 12y + 9y^2$

V. Special Factoring - Challenge

Factor, write prime if prime.

- $a^2 - 36$
- $9x^2 - 49$
- $169m^2 - 4u^2$
- $x^2y^2 - 9z^4$
- $\frac{1}{4}x^2 - 25y^2$
- $\frac{1}{9}x^2 - 16$
- $64 - a^4b^4$
- $y^6 - 100$
- $\frac{4}{9}x^2y^2 - \frac{25}{36}z^2$
- $y^8 - 81$
- $1 - 8u + 16u^2$
- $a^2b^2 + 6ab + 9$
- $x^2 + 2xy + y^2$
- $4x^2 + 12xy + 9y^2$
- $100h^2 + 20h + 1$
- $9a^2 - 24a + 16$
- $4a^3 + 8a^2 + 4a$
- $5c + 20c^2 + 20c^3$
- $(x + 4)^2 - (y + 1)^2$
- $(x - 1)^2 - 10(x - 1) + 25$

VI. Factoring Trinomials: $x^2 + bx + c$

$$x^2 + 7x + 10 = (x)^2 + (2 + 5)x + (2)(5) = (x + 2)(x + 5)$$

Factor, write prime if prime.

- $x^2 + 6x + 8$
- $c^2 + 5c + 6$
- $y^2 - 9y + 14$
- $x^2 - 10x + 16$
- $a^2 + 12a + 27$
- $x^2 - 14x + 24$
- $x^2 - 15x + 36$
- $y^2 + 21y + 54$
- $m^2 + 13m - 36$
- $x^2 - 8x + 15$
- $y^2 - 4y - 32$
- $x^2 - x - 6$
- $y^2 + 3y - 18$
- $b^2 + 7b - 18$
- $a^2 + a - 56$
- $c^2 - 4c - 12$
- $x^2 - 9x - 36$
- $y^2 + 4y - 21$
- $x^2 - 22x - 75$
- $x^2 - 3x - 40$
- $45 + 14y + y^2$
- $x^2 - 13x + 36$

VII. ...More Factoring Trinomials: $x^2 + bx + c$

$$k^2 - k - 20 = (k)^2 + (4 + -5)k + (4)(-5) = (k + 4)(k - 5)$$

Factor, write prime if prime.

1. $x^2 + 7x + 12$
2. $m^2 + 10m + 21$
3. $y^2 - 7y - 8$
4. $x^2 - 6x + 5$
5. $x^2 + 4x - 32$
6. $x^2 - 2x - 15$
7. $x^2 - 6x + 8$
8. $y^2 + 9y + 18$
9. $3 - 4t + t^2$
10. $v^2 + 12v + 20$

11. $51 - 20k + k^2$
12. $a^2 - 14ab + 24b^2$
13. $y^2 + 6y - 72$
14. $x^2 - 11xy - 60y^2$
15. $15r^2 + 2rs - s^2$
16. $3x^2 + 21xy - 54y^2$ (Hint: Check for GCF)
17. $x^2 - 5xy - 6y^2$
18. $x^2 + 8xy + 12y^2$
19. $y^2 - 7xy + 10x^2$
20. $a^2 - 11ab - 60b^2$

VIII. Factoring Trinomials: $ax^2 + bx + c$

$$2x^2 - 5x - 3 = (2x + 1)(x - 3)$$

Factor, write prime if prime.

1. $2x^2 - 5x - 3$
2. $3x^2 + 10x - 8$
3. $2y^2 + 15y + 7$
4. $7a^2 - 11a + 4$
5. $5n^2 + 17n + 6$
6. $4y^2 + 8y + 3$
7. $3x^2 + 4x - 7$
8. $2x^2 + 13x + 15$
9. $9y^2 + 6y - 8$
10. $6x^2 - 7x - 20$

11. $2n^2 - 3n - 14$
12. $5n^2 + 2n + 7$
13. $10x^2 + 13x - 30$
14. $12y^2 + 7y + 1$
15. $2n^2 + 9n - 5$
16. $2x^2 + 7x + 6$
17. $5a^2 - 42a - 27$
18. $15x^2 - 28x - 32$
19. $8a^2 - 10a + 3$
20. $2y^2 - 3y - 20$

IX. ...More Factoring Trinomials: $ax^2 + bx + c$

Factor, write prime if prime.

1. $3x^2 + 4x + x$
2. $5z^2 + 7z + 2$
3. $2n^2 - 11n + 5$
4. $3z^2 + z - 2$
5. $5h^2 - 2h - 7$
6. $8s^2 - 10st + 3t^2$
7. $6x^2 + 19x + 15$
8. $28a^2 + 5ab - 12b^2$

9. $2a^2 + 7ab - 15b^2$
10. $12x^2 + 17x + 6$
11. $4a^2 - 4ab - 5b^2$
12. $56y^2 + 15y - 56$
13. $12x^2 - 29xy + 14y^2$
14. $64x^2 + 32xy - 21y^2$
15. $16x^2 + 56xy + 49y^2$
16. $18x^2 - 57x + 35$

X. Factoring: Putting It All Together

$$5x^2 + 20x - 60 = 5(x^2 + 4x - 12) = 5(x + 6)(x - 2)$$

Factor Completely, write prime if prime.

- $2x^2 - 8$
- $2x^2 + 8x + 6$
- $3n^2 + 9n - 30$
- $6x^2 - 26x - 20$
- $2x^2 + 12x - 80$
- $5t^2 + 15t + 10$
- $8n^2 - 18$
- $14x^2 + 7x - 21$
- $4x^2 + 16x + 16$
- $18x + 12x^2 + 2x^3$
- $2x - 2xy^2$
- $3t^3 - 27t$
- $24a^2 - 30a + 9$
- $10x^2 + 15x - 10$
- $3x^2 - 42x + 147$
- $4x^4 - 4x^2$

XI. ...More Factoring: Putting It All Together

- $16x^2 - 40x - 24$
- $27x^2 - 36x + 12$
- $5x^2 - 60x - 140$
- $6m^3 + 54m^2 - 6m$
- $5k^4 + 8k^3 - 4k^2$
- $x^2y^4 - x^6$
- $y^4 - 6y^2 - 16$
- $x^4 - 3x^2 - 4$
- $h^2 - (a^2 - 6a + 9)$
- $81x^4 - 16y^4$
- $4mn^2 - 4m^2n^2 + m^3n^2$
- $(2a + 3)^2 - (a - 1)^2$
- $16d^8 - 8d^4 + 1$
- $x^2(x^2 - 4) + 4x(x^2 - 4) + 4(x^2 - 4)$

XII. Extra: Factoring by Grouping

$$\begin{aligned} 6ax - 2b - 3a + 4bx &= 6ax - 3a + 4bx - 2b \\ &= 3a(2x - 1) + 2b(2x - 1) \\ &= (2x - 1)(3a + 2b) \end{aligned}$$

- $x^2 + 2x + xy + 2y$
- $3a^2 - 2b - 6a + ab$
- $t^3 - t^2 + t - 1$ Hint: $t - 1 = 1(t - 1)$
- $10 + 2t - 5s - st$
- $\frac{2}{3}bc - \frac{14}{3}b + c - 7$
- $4u^2 + v + 2uv + 2u$
- $ad + 3a - d^2 - 3d$
- $n^2 + 2n + 3mn + 6m$
- $2ax^2 + bx^2 - 2ay^2 - by^2$
- $yz^2 - y^3 + z^3 - y^2z$
- $y^3 - y^2 - 4y + 4$
- $x^2a + x^2b - 16a - 16b$
- $x^3 + x^2 - x - 1$
- $a^3 - a^2 - 8a + 8$

Factoring Practice Key

I. Greatest Common Factor

- 6
- 5
- 2
- 8
- 7
- 9
- 15
- 24

II. Greatest Common Monomial Factor

- $3(2x + 1)$
- $8x(3x - 1)$
- $6(x - 2)$
- $2x(x + 4)$
- $2(2x + 5)$
- $5x(2x + 7)$
- $5xy(2x - 3y)$
- $3(4x^2 - 3x + 5)$
- $3n(n^2 - 4n - 10)$
- prime
- $x(2x^2 - 3x + 5)$
- $13m(1 + 2m - 3m^2)$
- $17(x^2 + 2x + 3)$
- $6m^2n^2(3n^2 - 2n + 4)$

III. Factoring the Difference of Two Squares

- $(x + 1)(x - 1)$
- $(x + 3)(x - 3)$
- prime
- $(x + 5)(x - 5)$
- $(3y + 4)(3y - 4)$
- $(2x + 5)(2x - 5)$
- $(3x + 1)(3x - 1)$
- $(a + x)(a - x)$
- $(5 + m)(5 - m)$
- $(x + 4y)(x - 4y)$
- $(5m + n)(5m - n)$
- $(4 + x)(4 - x)$
- $(6m + 11)(6m - 11)$
- $2(x + 2)(x - 2)$
- prime
- $(2a + 9b)(2a - 9b)$
- $3(2x + 5)(2x - 5)$
- $b(a + b)(a - b)$
- $-2(7 + x)(7 - x)$ or $2(x + 7)(x - 7)$
- $5(x + 3y)(x - 3y)$
- $(3x^2 + 2)(3x^2 - 2)$
- $(4x^2 + y)(4x^2 - y)$

IV. Factoring Perfect Square Trinomials

- $(x + 4)^2$
- $(x - 8)^2$
- $(y + 6)^2$
- $(a - 5)^2$
- $(4y + 1)^2$
- $(3x - 1)^2$
- $(5x + 1)^2$

- $(n - 7)^2$
- $(9x - 5)^2$
- $(2y - 5)^2$
- $(5a + 6)^2$
- $(4 + 5x)^2$
- $(4x + 3)^2$
- $(7x - 1)^2$
- $(3y - 5)^2$
- prime
- $(b + 1)^2$
- $(6x + 7)^2$
- $(x - 9)^2$
- $(3y - 2)^2$

V. Special Factoring - Challenge

- $(a + 6)(a - 6)$
- $(3x + 7)(3x - 7)$
- $(13m + 2u)(13m - 2u)$
- $(xy + 3z^2)(xy - 3z^2)$
- $(\frac{1}{2}x + 5y)(\frac{1}{2}x - 5y)$
- $(\frac{1}{3}x + 4)(\frac{1}{3}x - 4)$
- $(8 + a^2b^2)(8 - a^2b^2)$
- $(y^3 + 10)(y^3 - 10)$
- $(\frac{2}{3}xy + \frac{5}{6}z)(\frac{2}{3}xy - \frac{5}{6}z)$
- $(y^4 + 9)(y^2 + 3)(y^2 - 3)$
- $(1 - 4u)^2$ or $(4u - 1)^2$
- $(ab + 3)^2$
- $(x + y)^2$
- $(2x + 3y)^2$
- $(10h + 1)^2$
- $(3a - 4)^2$
- $4a(a + 1)^2$
- $5c(2c + 1)^2$
- $[(x + 4) + (y + 1)][(x + 4) - (y + 1)]$ or $(x + y + 5)(x - y + 3)$
- $[(x - 1) - 5]^2$ or $(x - 6)^2$

VI. Factoring Trinomials: $x^2 + bx + c$

- $(x + 4)(x + 2)$
- $(c + 2)(c + 3)$
- $(y - 7)(y - 2)$
- $(x - 8)(x - 2)$
- $(a + 9)(a + 3)$
- $(x - 12)(x - 2)$
- $(x - 12)(x - 3)$
- $(y + 18)(y + 3)$
- prime
- $(x - 5)(x - 3)$
- $(y - 8)(y + 4)$
- $(x - 3)(x + 2)$
- $(y + 6)(y - 3)$
- $(b + 9)(b - 2)$
- $(a + 8)(a - 7)$
- $(c - 6)(c + 2)$
- $(x - 12)(x + 3)$
- $(y + 7)(y - 3)$
- $(x - 25)(x + 3)$
- $(x - 8)(x + 5)$

21. $(y + 9)(y + 5)$

22. $(x - 9)(x - 4)$

VII. ...More Factoring Trinomials: $x^2 + bx + c$

1. $(x + 4)(x + 3)$

2. $(m + 3)(m + 7)$

3. $(y - 8)(y + 1)$

4. $(x - 1)(x - 5)$

5. $(x + 8)(x - 4)$

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

7. $(x - 2)(x - 4)$

8. $(y + 3)(y + 6)$

9. $(t - 1)(t - 3)$

10. $(v + 2)(v + 10)$

11. $(3 - k)(17 - k)$ or $(k - 3)(k - 17)$

12. $(a - 2b)(a - 12b)$

13. $(y - 6)(y + 12)$

14. $(x - 15y)(x + 4y)$

15. $(5r - s)(3r + s)$

16. $3(x - 2y)(x + 9y)$

17. $(x - 6y)(x + y)$

18. $(x + 6y)(x + 2y)$

19. $(y - 5x)(y - 2x)$

20. $(a - 15b)(a + 4b)$

VIII. Factoring Trinomials: $ax^2 + bx + c$

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

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

3. $(2y + 1)(y + 7)$

4. $(7a - 4)(a - 1)$

5. $(5n + 2)(n + 3)$

6. $(2y + 3)(2y + 1)$

7. $(3x + 7)(x - 1)$

8. $(2x + 3)(x + 5)$

9. $(3y - 2)(3y + 4)$

10. $(3x + 4)(2x - 5)$

11. $(2n - 7)(n + 2)$

12. prime

13. $(2x + 5)(5x - 6)$

14. $(3y + 1)(4y + 1)$

15. $(2n - 1)(n + 5)$

16. $(2x + 3)(x + 2)$

17. $(5a + 3)(a - 9)$

18. $(3x - 8)(5x + 4)$

19. $(2a - 1)(4a - 3)$

20. $(2y + 5)(y - 4)$

IX. ...More Factoring Trinomials: $ax^2 + bx + c$

1. $(3x + 1)(x + 1)$

2. $(5z + 2)(z + 1)$

3. $(2n - 1)(n - 5)$

4. $(3z - 2)(z + 1)$

5. $(5h - 7)(h + 1)$

6. $(4s - 3t)(2s - t)$

7. $(2x + 3)(3x + 5)$

8. $(7a - 4b)(4a + 3b)$

9. $(2a - 3b)(a + 5b)$

10. $(3x + 2)(4x + 3)$

11. prime

12. $(7y + 8)(8y - 7)$

13. $(4x - 7y)(3x - 2y)$

14. $(8x + 7y)(8x - 3y)$

15. $(4x + 7y)^2$

16. $(6x - 5)(3x - 7)$

X. Factoring: Putting It All Together

1. $2(x + 2)(x - 2)$

2. $2(x + 3)(x + 1)$

3. $3(n + 5)(n - 2)$

4. $2(3x + 2)(x - 5)$

5. $2(x + 10)(x - 4)$

6. $5(t + 1)(t + 2)$

7. $2(2n + 3)(2n - 3)$

8. $7(2x + 3)(x - 1)$

9. $4(x + 2)^2$

10. $2x(3 + x)^2$ or $2x(x + 3)^2$

11. $2x(1 + y)(1 - y)$

12. $3t(t + 3)(t - 3)$

13. $3(2a - 1)(4a - 3)$

14. $5(2x - 1)(x + 2)$

15. $3(x - 7)^2$

16. $4x^2(x + 1)(x - 1)$

XI. ...More Factoring: Putting It All Together

1. $8(2x + 1)(x - 3)$

2. $3(3x - 2)^2$

3. $5(x - 14)(x + 2)$

4. $6m(m^2 + 9m - 1)$

5. $k^2(5k - 2)(k + 2)$

6. $x^2(y^2 + x^2)(y + x)(y - x)$

7. $(y^2 - 8)(y^2 + 2)$

8. $(x^2 + 1)(x + 2)(x - 2)$

9. $[h + (a - 3)][h - (a - 3)]$ or $(h + a - 3)(h - a - 3)$

10. $(9x^2 + 4y^2)(3x + 2y)(3x - 2y)$

11. $mn^2(2 - m)^2$ or $mn^2(m - 2)^2$

12. $[(2a + 3) + (a - 1)][(2a + 3) - (a - 1)]$ or $(3a + 2)(a + 4)$

13. $(2d^2 + 1)^2(2d^2 - 1)^2$

14. $(x + 2)^3(x - 2)$

XII. Extra: Factoring by Grouping

1. $(x + 2)(x + y)$

2. $(a - 2)(3a + b)$

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

4. $(5 + t)(2 - s)$

5. $(c + 7)\left(\frac{2}{3}b + 1\right)$

6. $(2u + 1)(2u + v)$

7. $(d + 3)(a - d)$

8. $(n + 2)(n + 3m)$

9. $(x - y)(x + y)(2a + b)$

10. $(z - y)(z + y)^2$

11. $(y - 1)(y + 2)(y - 2)$

12. $(a + b)(x + 4)(x - 4)$

13. $(x + 1)^2(x - 1)$

14. $(a - 1)(a^2 - 8)$