



Factor the expression.

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|----------------------------|-----------------------------|
| 1. $4x(x + 5) - 3(x + 5)$ | 2. $12(a - 3) - 2a(a - 3)$ |
| 3. $w^2(w + 8) - 5(w + 8)$ | 4. $2b^2(b + 6) + 3(b + 6)$ |
| 5. $y(15 + x) - (x + 15)$ | 6. $3x(4 + y) - 6(4 + y)$ |

Factor the polynomial by grouping.

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|-----------------------------|----------------------------|
| 7. $x^3 + x^2 + 5x + 5$ | 8. $y^3 - 14y^2 + y - 14$ |
| 9. $m^3 - 6m^2 + 2m - 12$ | 10. $p^3 + 9p^2 + 4p + 36$ |
| 11. $t^3 + 12t^2 - 2t - 24$ | 12. $3n^3 - 3n^2 + n - 1$ |

Factor the polynomial completely.

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|-------------------------|--------------------------|----------------------------|
| 13. $7x^3 + 28x^2$ | 14. $4m^3 - 16m$ | 15. $-16p^3 - 2p$ |
| 16. $48r^3 - 30r^2$ | 17. $15y - 60y^2$ | 18. $18xy - 24x^2$ |
| 19. $5m^2 + 20m + 40$ | 20. $6x^2 + 6x - 120$ | 21. $4z^3 - 4z^2 - 8z$ |
| 22. $9x^3 + 36x^2 + 36$ | 23. $x^3 + x^2 + 5x + 5$ | 24. $d^3 + 4d^2 + 5d + 20$ |

Solve the equation.

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|---------------------------|----------------------------|-----------------------------|
| 25. $3x^2 + 18x + 24 = 0$ | 26. $10x^2 = 250$ | 27. $4m^2 - 28m + 49 = 0$ |
| 28. $12x^2 + 18x + 6 = 0$ | 29. $18x^2 - 48x + 32 = 0$ | 30. $-18x^2 - 60x - 50 = 0$ |

31. **Countertop** A countertop will have a hole drilled in it to hold a cylindrical container that will function as a utensil holder. The area of the entire countertop is given by $5x^2 + 12x + 7$. The area of the hole is given by $x^2 + 2x + 1$. Write an expression for the area in factored form of the countertop that is left after the hole is drilled.



32. **Film Canister** A film canister in the shape of a cylinder has a height of 8 centimeters and a volume of 32π cubic centimeters.
- Write an equation for the volume of the film canister.
 - What is the radius of the film canister?
33. **Badminton** You hit a badminton birdie upward with a racket from a height of 2 feet with an initial vertical velocity of 8 feet per second.
- Write an equation that models this situation.
 - How high is the birdie at 0.1 second?
 - How long will it take the birdie to reach the ground?



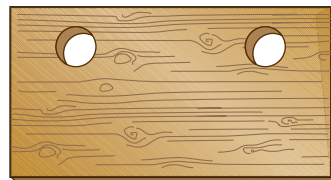
Factor the polynomial completely.

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|---------------------------|----------------------------|---------------------------|
| 1. $13a - 26a^2$ | 2. $30xy - 45x^2$ | 3. $-2m^2 - 16m - 14$ |
| 4. $14p^2 - 35p + 21$ | 5. $r^3 + 10r^2 + 25r$ | 6. $5b^4 + 40b^3 + 80b^2$ |
| 7. $4n^5 + 4n^4 - 120n^3$ | 8. $7c^3 - 28c^2 + 28c$ | 9. $-10t^2 - 5t + 75$ |
| 10. $x^2 + 9x - xy - 9y$ | 11. $x^3 + 5x^2 - 8x - 40$ | 12. $9x^2 - 64y^2$ |
| 13. $3x^5y - 243x^3y$ | 14. $8r^3s^4 - 72rs^4$ | 15. $25x^3y - 100x^2y$ |

Solve the equation.

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|-------------------------------|-------------------------------|----------------------------------|
| 16. $5x^3 + 20x^2 + 15x = 0$ | 17. $-19x^2 + 76 = 0$ | 18. $-18p^3 - 21p^2 + 15p = 0$ |
| 19. $48p^2 - 675 = 0$ | 20. $14x^3 - 68x^2 - 10x = 0$ | 21. $-3n^4 - 36n^3 - 108n^2 = 0$ |
| 22. $20t^4 + 28t^3 = 24t^2$ | 23. $64t = 12t^2 + 45$ | 24. $900x^2 = 625$ |
| 25. $16m^4 - 81m^2 = 0$ | 26. $16x + 280 = 8x^2$ | 27. $2r^2 + 392 = 56r$ |
| 28. $75a^3 + 90a^2 + 27a = 0$ | 29. $2p^2 = 12p + 54$ | 30. $81x^3 = 100x$ |
31. Use factoring by grouping to show that a trinomial of the form $a^2 - 2ab + b^2$ can be factored as $(a - b)^2$. *Justify* your steps.

32. **Work Bench** You are drilling holes into your work bench that will hold caddies for some of your gardening equipment. The area of the entire work bench before the holes are drilled is given by $24x^2 + 5x$. The area of one hole is given by $3x^2 + x + 3$. Write an expression for the area in factored form of the work bench that is left after the holes are drilled.



33. **Poster Tube** A poster tube in the shape of a cylinder has a height of 2 feet and a volume of $\frac{1}{2}\pi$ cubic feet.
- Write an equation for the volume of the poster tube.
 - What is the radius of the poster tube?

34. **Moon** On the moon, the vertical motion model is given by

$$h = -\frac{16}{6}t^2 + vt + s$$

where h is the height (in feet), v is the initial velocity (in feet per second), t is the time (in seconds), and s is the initial height (in feet). On the moon, an astronaut tosses a baseball from a height of 64 feet with an initial upward velocity of $23\frac{2}{3}$ feet per second. How long does it take the ball to reach the ground?