# Algebra Formulas and Solutions 50+

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- **Formula**:  $m=y^2-y_1x^2-x_1m = \frac{y_2 y_1}{x_2 x_1}m=x^2-x_1y^2-y_1$
- **Solution**: Find the slope of the line passing through the points (2,3)(2,3)(2,3) and (4,7)(4,7)(4,7).
  - Use the formula:  $m=7-34-2=42=2m = \frac{7-3}{4-2} = \frac{4}{2} = \frac{1}{2}$ 2m=4-27-3=24=2
  - So, the slope is m=2m=2m=2.

## 7. Solving for an Unknown in Proportions

- Formula:  $ab=cd\frac{a}{b} = \frac{c}{d}ba=dc$
- **Solution**: Solve for xxx in the proportion 3x=612/frac{3}{x} =  $\frac{6}{12}x_3=126$ .
  - Cross-multiply:  $3 \times 12 = 6 \times x \Rightarrow 36 = 6 \times 3$  \times 12 = 6 \times x \quad \Rightarrow 0
  - Solve for xxx:  $x=366=6x = \frac{36}{6} = 6x=636=6$

## 8. Exponent Rules

- $c{36}{6} = 6x=636=6$  **COUK COUK COUK** Formula: am×an=am+na^m \times a  $\left| \right|^n = a^{m \left( \min n \right)}$
- Solution: Simplify x3×x2x/2 times x o Apply the  $x5x^3 \text{ times } x^2 = x^{3+2} =$ ist exponent rule  $x3 \times 2$ x2=x3+2=x5  $\circ$  Simplified expression: x5x^5x5.

## 9. Absolute Value Equations

- **Formula**:  $|x|=aimpliesx=aorx=-a|x| = a \quad \text{(uad } text \{ implies \} \quad \text{(uad } x = a \quad \text{(uad } text \{ or \} \}$ quad x = -a|x| = aimpliesx = aorx = -a
- **Solution**: Solve |x|=4|x|=4|x|=4.
  - 0 4x=4 or x=-4

## **10. Sum and Difference of Cubes**

- Formula:
  - Sum of cubes:  $a_{3+b_{3}=(a+b)(a_{2}-a_{b+b_{2}})a_{3}+b_{3}=(a+b)(a_{2}-a_{b+b_{3}})a_{3}+b_{3}=(a+b)(a_{3}-a_{b+b_{3}})a_{3}+b_{3}+b_{3}=(a+b)(a_{3}-a_{b+b_{3}})a_{3}+b_{3}+b_{3}=(a+b)(a_{3}-a_{b+b_{3}})a_{3}+b_{3}+b_{3}=(a+b)(a_{3}-a_{b+b_{3}})a_{3}+b_{$ 0  $b^{2}a^{3+b^{3}}=(a+b)(a^{2}-a^{b+b^{2}})$
  - Difference of cubes:  $a_{3-b_{3}=(a-b)(a_{2}+a_{b}+b_{2})a_{3} b_{3} = (a b)(a_{2}+a_{b}+b_{3})a_{3} b_{3} = (a b)(a_{3}+a_{b}+b_{3})a_{3} b_{3}$ 0  $b^{2}a_{3}-b_{3}=(a-b)(a_{2}+a_{2}+b_{2})$
- **Solution**: For example, simplify  $x3+8x^3 + 8x^3+8$ :
  - Notice that  $8=238 = 2^{3}8=23$ , so this is a sum of cubes.

#### **Reference: Books,**

"Elementary Algebra" by Charles P. McKeague, Algebra for College Students" by Mark Dugopolski, "Higher Algebra" by Hall & Knight, "College Algebra" by James Stewart, Lothar Redlin, and Saleem Watson, "Schaum's Outline of College Algebra" by Murray Spiegel, Khan Academy (www.khanacademy.org), Paul's Online Math Notes (tutorial.math.lamar.edu)

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So, the expanded form of  $(x+2)3(x+2)^3(x+2)3$  is  $x3+6x2+12x+8x^3+6x^2+12x^3+6x^2+12x^3$ 

#### **19. Factor Theorem**

- Formula:
  - If p(x)p(x)p(x) is a polynomial and p(a)=0p(a)=0p(a)=0, then x-ax ax-a is a factor of p(x)p(x)p(x).
- Solution: For the polynomial  $p(x)=x^{2}-5x+6p(x) = x^{2}-5x+6p(x)=x^{2}-5x+6$ , we want to check if x-2x 2x-2 is a factor.
  - Substitute x=2x = 2x=2 into p(x)p(x)p(x):  $p(2)=22-5(2)+6=4-10-6xp(2)=2^2$ - 5(2) + 6 = 4 - 10 + 6 = 0p(2)=22-5(2)+6=4-10+1=6
  - Since p(2)=0p(2) = 0p(2)=0, x-2x 2x-2 is a factor

  - 3)p(x)=x2-5x+6=(x-2)(x-1).

## 20. Law of Exponent Power of a Pover

- Formula:  $(am)n=am \cdot n(a \cdot m)^n = a^{m \cdot 1}(am)n=am \cdot n$
- **Solution**: Simplify (x2)3(x^2)^3(x2)3.

• Apply the law of exponents:  $(x^2)^3 = x^2 \cdot 3 = x^6(x^2)^3 = x^4\{2 \setminus 3\} = x^6(x^2)^3 = x^2 \cdot 3 = x^6$ 

So,  $(x^2)^3 = x^6(x^2)^3 = x^$ 

## **21. Law of Exponents (Multiplying Powers with the Same Base)**

- Formula:  $am \cdot an = am + na^m \setminus cdot a^n = a^{m+n}am \cdot an = am + n$
- **Solution**: Simplify  $x4 \cdot x2x^4 \setminus cdot x^2x4 \cdot x2$ .
  - Apply the law of exponents:  $x4 \cdot x2 = x4 + 2 = x6x^4 \setminus cdot x^2 = x^{4+2} = x^{6x4} \cdot x2 = x4 + 2 = x6$

So,  $x4 \cdot x2 = x6x^{4} \cdot x2 = x^{6}x4 \cdot x2 = x^{6}$ .

## 22. Rationalizing Denominators

#### Reference: Books,

"Elementary Algebra" by Charles P. McKeague, Algebra for College Students" by Mark Dugopolski, "Higher Algebra" by Hall & Knight, "College Algebra" by James Stewart, Lothar Redlin, and Saleem Watson, "Schaum's Outline of College Algebra" by Murray Spiegel, Khan Academy (<u>www.khanacademy.org</u>), Paul's Online Math Notes (tutorial.math.lamar.edu)

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#### Reference: Books:

- 1. "Elementary Algebra" by Charles P. McKeague A comprehensive guide to algebraic principles, covering fundamental to advanced topics with step-by-step explanations. 2. "Algebra for College Students" by Mark Dugopolski A great resource for understanding the applications and deeper concepts of algebra. 3. "Higher Algebra" by Hall & Knight A classic book for advanced algebraic theories, including binomial theorem, series, and roots of equations. 4. "College Algebra" by James Stewart, Lothar Redlin, and Saleem Watson Detailed exploration of algebraic concepts with applications in calculus and leyond. Contains solved examples and practice problems for masterias alcoba. e Resources 5. "Schaum's Outline of College Algebra" by Murray Spiegel **Online Resources** 1. Khan Academy (www.kiao Khan Academy (www.khan.cademy.org) Offers interection events and exercises on the pics like quadratic equations, inequalities, a CSP.3 2. Paul's Online Math Notes (unorial.math.lamar.edu) A reliable resource for algebraic and calculus-based problem-solving. 3. Wolfram MathWorld (mathworld.wolfram.com) Detailed mathematical explanations and derivations for various algebraic topics. 4. **Brilliant.org** (www.brilliant.org) Interactive learning platform for algebra, geometry, and problem-solving techniques. 5. **Purplemath (www.purplemath.com)** 
  - Simplified explanations and tips for understanding algebra concepts and applications.

#### **Research Papers and Journals**

- 1. "Advanced Algebra: Techniques and Applications" Found in journals such as *Mathematics Magazine* and *The American Mathematical Monthly*.
- 2. Papers on polynomial theory and modular arithmetic in journals like *The Journal of Algebra*.

#### **Historical Reference**

For classical algebraic techniques, Isaac Newton's works on polynomials, symmetry, and series are foundational. His contributions are discussed in:

#### Reference: Books,

"Elementary Algebra" by Charles P. McKeague, Algebra for College Students" by Mark Dugopolski, "Higher Algebra" by Hall & Knight, "College Algebra" by James Stewart, Lothar Redlin, and Saleem Watson, "Schaum's Outline of College Algebra" by Murray Spiegel, Khan Academy (<u>www.khanacademy.org</u>), Paul's Online Math Notes (tutorial.math.lamar.edu)