

Algebra Formula Cheat Sheet

Key Terms, Steps, Rules and Identities at a Glance

Key Terms

Variable: a letter for an unknown, like x
Coefficient: number before a variable (3 in $3x$)
Constant: a fixed number, like 5 or 20
Expression: no equals sign, e.g. $3x + 5$
Equation: has an equals sign, e.g. $3x + 5 = 17$

4 Steps to Solve Any Equation

1. Simplify each side
 2. Gather x terms on one side
 3. Use inverse operations to isolate x
 4. Check by substituting the answer
- Example:** $4x + 10 = 30$, so $4x = 20$ and $x = 5$

Quadratic Formula

For $ax^2 + bx + c = 0$ ($a \neq 0$):

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Discriminant: $D = b^2 - 4ac$

$D > 0$: two real solutions

$D = 0$: one real solution

$D < 0$: no real solutions

5 Basic Rules of Algebra

Commutative: $a + b = b + a$, $ab = ba$

Associative: $(a + b) + c = a + (b + c)$

Distributive: $a(b + c) = ab + ac$

Identity: $a + 0 = a$, $a \times 1 = a$

Inverse: $a + (-a) = 0$, $a \times (1/a) = 1$

Algebraic Identities

Square of a sum	$(a + b)^2 = a^2 + 2ab + b^2$
Square of a difference	$(a - b)^2 = a^2 - 2ab + b^2$
Difference of squares	$a^2 - b^2 = (a + b)(a - b)$
Cube of a sum	$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
Cube of a difference	$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
Sum of cubes	$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
Difference of cubes	$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
Square of three terms	$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
Product of binomials	$(x + a)(x + b) = x^2 + (a + b)x + ab$

Word Problem Key Words

Add (+): sum, more than, increased by, total
Subtract (-): difference, less than, decreased by
Multiply (×): product, times, twice, of
Divide (÷): quotient, per, shared equally
Equals (=): is, equals, gives, will be



Algebra Equations Worksheet

20 Practice Questions in 4 Levels

Name: _____ Class: _____ Date: _____

Show your working in the space below each question, then check every answer by substituting it back.

A. Basic

1 $x + 23 = 41$

2 $x - 14 = 9$

3 $6x = 54$

4 $x \div 8 = 5$

5 $4x + 3 = 31$

6 $5x - 9 = 16$

B. Intermediate

7 $7x - 4 = 3x + 20$

8 $3(x - 2) = 21$

9 $x/4 + 6 = 11$

10 $12 - 3x = 3$

11 $(3x + 1) \div 2 = 8$

12 $2(x + 4) = x + 15$

C. Challenge

13 $x^2 - 9x + 20 = 0$

14 $x^2 - 4x = 0$

15 $2x^2 - 7x + 3 = 0$

16 $x + y = 20$ and $x - y = 6$

17 $2x + 3y = 13$ and $x + y = 5$

D. Word Problems

18 Three times a number minus 7 is 20. Find the number.

19 A pen costs ₹15 more than a pencil, and together they cost ₹35. Find the price of each.

20 A rectangle has a perimeter of 46 cm and a length of 15 cm. Find its breadth.

Answer Key With Working

Check Your Answers After Solving Every Question

A. Basic

1. $x = 41 - 23$, so $x = 18$
2. $x = 9 + 14$, so $x = 23$
3. $x = 54 \div 6$, so $x = 9$
4. $x = 5 \times 8$, so $x = 40$
5. $4x = 28$, so $x = 7$
6. $5x = 25$, so $x = 5$

B. Intermediate

7. $4x - 4 = 20$, so $4x = 24$ and $x = 6$
8. $x - 2 = 7$, so $x = 9$
9. $x/4 = 5$, so $x = 20$
10. $-3x = -9$, so $x = 3$
11. $3x + 1 = 16$, so $3x = 15$ and $x = 5$
12. $2x + 8 = x + 15$, so $x = 7$

C. Challenge

13. $(x - 4)(x - 5) = 0$, so $x = 4$ or $x = 5$
14. $x(x - 4) = 0$, so $x = 0$ or $x = 4$
15. $(2x - 1)(x - 3) = 0$, so $x = \frac{1}{2}$ or $x = 3$
16. Add: $2x = 26$, so $x = 13$ and $y = 7$
17. $x = 5 - y$, so $10 - 2y + 3y = 13$, giving $y = 3$ and $x = 2$

D. Word Problems

18. $3x - 7 = 20$, so $3x = 27$ and the number is 9
19. $x + (x + 15) = 35$, so $2x = 20$: pencil ₹10, pen ₹25
20. $2(15 + b) = 46$, so $15 + b = 23$ and the breadth is 8 cm

Remember: whatever you do to one side, do to the other.

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