Unit 1 · Foundations of Algebra Cheat Sheet

Unit 1 focus: variables, order of operations, real numbers, properties and simplifying

1 KEY VOCABULARY

variable	A letter that stands for a number.	$x,\ y,\ n$
expression	Numbers, variables and operations (no equal sign).	$3x - 5$
term	A part of an expression separated by + or −.	In $4x + 7 - 2y$: $4x,\ 7,\ -2y$
coefficient	The number multiplying a variable.	In $5x$, it is 5.
constant	A term with no variable.	$7,\ -3,\ 12$
like terms	Same variables raised to the same powers.	$3x$ and $-5x$

2 ORDER OF OPERATIONS (PEMDAS)

- **P** **Parentheses** — grouping first
- **E** **Exponents** — powers
- **M** **Multiply** — left to right,
- **D** **Divide** — together
- **A** **Add** — left to right,
- **S** **Subtract** — together

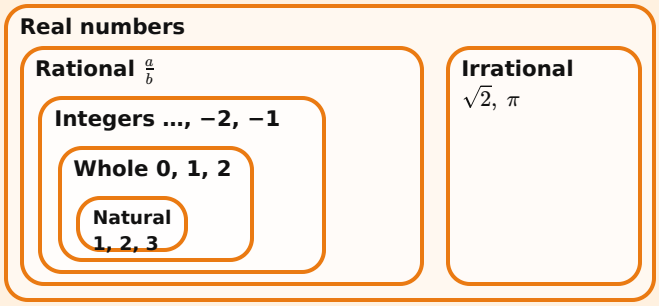
Example: $3 + 4(2^2 - 5)$
Parentheses (exponent inside): $2^2 - 5 = 4 - 5 = -1$
Multiply: $4(-1) = -4$
Add: $3 + (-4) = -1$
Answer: -1

3 EVALUATING EXPRESSIONS

Substitute the value for the variable (use parentheses!), then follow PEMDAS.

Example: Evaluate $x^2 - 3x$ when $x = -2$.
Substitute: $(-2)^2 - 3(-2)$
Simplify: $4 + 6$
Answer: 10

4 THE REAL NUMBERS



Every rational number is a fraction $\frac{a}{b}$ (or a decimal that ends or repeats). Irrational decimals never end or repeat.

5 PROPERTIES

Commutative order changes	$a + b = b + a$	$ab = ba$
Associative grouping changes	$(a + b) + c = a + (b + c)$	$(ab)c = a(bc)$
Identity nothing changes	$a + 0 = a$	$a \cdot 1 = a$
Inverse back to 0 or 1	$a + (-a) = 0$	$a \cdot \frac{1}{a} = 1$
Distributive multiply every term	$a(b + c) = ab + ac$	

6 QUICK REMINDERS & COMMON MISTAKES

✓ Do remember

- Do parentheses and exponents first.
- Multiply/divide left to right, then add/subtract left to right.
- Put substituted negatives in parentheses.
- Combine only like terms.

✘ Common mistakes

- -3^2 is not 9: $-3^2 = -9$, but $(-3)^2 = 9$
- $3x + 2x \neq 5x^2$: it is $5x$
- $4(x + 2) \neq 4x + 2$: it is $4x + 8$

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More practice: like terms, the distributive property, words to algebra and integers

1 COMBINING LIKE TERMS

Add or subtract the coefficients of like terms. Keep the variable part the same.

Example: Simplify $6x + 4 - 2x + 9$.
Group: $(6x - 2x) + (4 + 9)$
Combine: $4x + 13$

Answer: $4x + 13$

2 DISTRIBUTIVE PROPERTY

Multiply the number outside by EVERY term inside the parentheses.

Example: Simplify $-3(2x - 5) + x$.
Distribute: $-6x + 15 + x$
Combine: $-5x + 15$

Answer: $-5x + 15$

3 WORDS TO ALGEBRA

sum, plus, more than, increased by	$+$
difference, minus, less than, decreased by	$-$
product, times, twice, of	$\times$
quotient, divided by, per	$\div$
5 less than x	$x - 5$
twice a number, plus 3	$2n + 3$
the sum of x and 4, times 3	$3(x + 4)$

4 INTEGERS & ABSOLUTE VALUE

- Same signs: add and keep the sign. $-4 + (-6) = -10$
- Different signs: subtract and keep the sign of the larger. $-9 + 4 = -5$
- Subtracting = adding the opposite. $3 - (-5) = 3 + 5 = 8$
- Multiply/divide: same signs $\rightarrow$ positive, different signs $\rightarrow$ negative.
- Absolute value is distance from 0: $|-7| = 7$, $|7| = 7$

5 PUTTING IT TOGETHER

Simplify, then evaluate.

Example: Simplify $2(x + 3) - 4x$, then evaluate for $x = 5$.
Distribute: $2x + 6 - 4x$
Combine: $-2x + 6$
Evaluate: $-2(5) + 6 = -4$

Answer: -4

6 CHECK YOURSELF

- Did you distribute to every term?
- Did you keep the sign in front of each term?
- Are there any like terms left to combine?
- Substitute a number into both forms: equal expressions give the same value.