Unit 7 · Exponents and Scientific Notation Cheat Sheet

Unit 7 focus: exponent rules, zero and negative exponents, and evaluating powers

1 KEY VOCABULARY

base	The number being multiplied.	5 in 5^3
exponent	How many times the base is a factor.	3 in 5^3
power	A base with an exponent.	$5^3 = 125$
coefficient	The number in front of a variable.	4 in $4x^2$
monomial	A number, variable, or product of them.	$-3x^2y$

2 THE EXPONENT RULES

Rule	In symbols	Example
Product	$x^a \cdot x^b = x^{a+b}$	$x^3 \cdot x^4 = x^7$
Quotient	$\frac{x^a}{x^b} = x^{a-b}$	$\frac{x^9}{x^4} = x^5$
Power	$(x^a)^b = x^{ab}$	$(x^2)^5 = x^{10}$
Product to a power	$(xy)^a = x^a y^a$	$(2x)^3 = 8x^3$
Zero	$x^0 = 1$	$7^0 = 1$
Negative	$x^{-a} = \frac{1}{x^a}$	$2^{-3} = \frac{1}{8}$

3 POWER OF A PRODUCT

Raise EVERY factor inside the parentheses to the power, including the number.

Example: Simplify $(3x^4)^2$.
Each factor: $3^2 \cdot (x^4)^2$
Simplify: $9x^8$
Answer: $9x^8$

4 NEGATIVE EXPONENTS

A negative exponent means "one over." Move the factor across the fraction bar and make the exponent positive.

Example: Simplify $\frac{4x^{-2}}{x^3}$.
Move x^{-2} to the bottom: $\frac{4}{x^2 \cdot x^3}$
Add exponents: $\frac{4}{x^5}$
Answer: $\frac{4}{x^5}$

5 EVALUATING POWERS

Watch the parentheses: the exponent applies only to what it touches.

Example: Compare $(-3)^2$ and -3^2.
$(-3)^2$**:** $(-3)(-3) = 9$
-3^2**:** $-(3 \cdot 3) = -9$
Answer: 9 **and** -9

6 QUICK REMINDERS & COMMON MISTAKES

✓ Do remember

- Multiply same bases: ADD exponents.
- Power of a power: MULTIPLY exponents.
- Any nonzero number to the zero power is 1.

✘ Common mistakes

- $x^3 \cdot x^4 \neq x^{12}$: add, do not multiply
- $2^{-3} \neq -8$: it is $\frac{1}{8}$
- $(2x)^3 \neq 2x^3$: cube the 2 too: $8x^3$

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More practice: scientific notation and operations with it

1 SCIENTIFIC NOTATION

A number between 1 and 10, times a power of 10: $a \times 10^n$ with $1 \leq a < 10$.

Example: Write 0.00056 in scientific notation.
Move the decimal: 4 places right gives 5.6
Small number: negative exponent

Answer: 5.6×10^{-4}

2 BIG OR SMALL?

Standard form	Scientific notation
$4{,}500{,}000$	4.5×10^6
$72{,}000$	7.2×10^4
0.03	3×10^{-2}
0.000801	8.01×10^{-4}

Big numbers (10 or more) have positive exponents; numbers less than 1 have negative exponents.

3 MULTIPLYING

Multiply the numbers, add the exponents, then adjust so the number is between 1 and 10.

Example: $(4 \times 10^3)(6 \times 10^5)$
Numbers: $4 \cdot 6 = 24$
Powers: $10^{3+5} = 10^8$
Adjust: $24 \times 10^8 = 2.4 \times 10^9$

Answer: 2.4×10^9

4 DIVIDING

Divide the numbers, subtract the exponents, then adjust.

Example: $\dfrac{3 \times 10^2}{6 \times 10^7}$
Numbers: $3 \div 6 = 0.5$
Powers: $10^{2-7} = 10^{-5}$
Adjust: $0.5 \times 10^{-5} = 5 \times 10^{-6}$

Answer: 5×10^{-6}

5 POWERS OF 10

Power	Value
10^3	1,000
10^1	10
10^0	1
10^{-1}	0.1
10^{-3}	0.001

6 CHECK YOURSELF

- Did I add exponents when multiplying and subtract when dividing?
- Is my coefficient between 1 and 10?
- Did I raise the number in front to the power too?
- Are all my exponents positive in the final answer?