

Use the laws of exponents to rewrite each expression as a single power with a positive exponent.

Do not evaluate.

1. 11^{-15} $\frac{1}{11^{15}}$	2. $(-4)^7 \cdot (-4)^{-3}$ $(-4)^{7+(-3)}$ $(-4)^4$	3. $p^5 \div p^{-9}$ $p^{5-(-9)}$ KCO p^{5+9} p^{14}	4. $\frac{w^5}{w^2 \cdot w^4}$ <i>simplify denominator first</i> $\frac{w^5}{w^{2+4}} = \frac{w^5}{w^6} = w^{5-6}$ $w^{5+(-6)} = w^{-1} = \frac{1}{w}$	5. $(15^7)^4$ $15^{7 \cdot 4}$ 15^{28}
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Use the laws of exponents to simplify and evaluate each expression.

6. 6^{-2} $\frac{1}{6^2}$ $\frac{1}{36}$	7. $\frac{-12m^5}{6m^3}$ <ul style="list-style-type: none"> divide coefficients (numbers) keep the base (m) and subtract exponents $-2m^{5-3}$ $-2m^2$	8. $(14^2)^3 \div 14^7$ <i>apply power rule first and division rule second</i> $14^{2 \cdot 3} \div 14^7$ $14^6 \div 14^7$ $14^{6-7} = 14^{6+(-7)}$ $14^{-1} = \frac{1}{14}$	9. $(3y)^0$ <i>the entire quantity is being raised to the zero power</i> $(3y)^0 = 1$	10. $3y^0$ <i>rewrite as a multiplication problem</i> $3y^0 = 3 \cdot y^0$ $3 \cdot 1$ 3
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11. Which numerical expression(s) below are equivalent to $\frac{1}{81}$? Circle all that apply.

A. 9^2
 $9 \cdot 9$
81

B. $\frac{1}{3^4}$
 $\frac{1}{3 \cdot 3 \cdot 3 \cdot 3}$
 $\frac{1}{81}$

C. 81^{-1}
 $\frac{1}{81^1}$
 $\frac{1}{81}$

D. 3^4
 $3 \cdot 3 \cdot 3 \cdot 3$
81

E. 9^{-2}
 $\frac{1}{9^2}$
 $\frac{1}{81}$

F. $\frac{1}{3^2 \cdot 3^2}$
 $\frac{1}{3^{2+2}} = \frac{1}{3^4}$
 $\frac{1}{81}$

G. $3^5 \div 3^9$
 $3^{5-9} = 3^{5+(-9)} = 3^{-4}$
 $3^{-4} = \frac{1}{3^4} = \frac{1}{81}$

12. Rewrite A and B in **scientific notation** and rewrite C and D in **standard form**.

A. 370,000,000 3.7×10^8

B. 0.0000109 1.09×10^{-5}

C. 6.05×10^5 **605,000**

D. 2.3×10^{-4} **0.00023**

13. Which numerical expression(s) below are equivalent to 74×10^3 ? Circle all that apply.

$$7.4 \times 10^1 \times 10^3$$

$$\underline{7.4 \times 10^4}$$

$$\underline{74,000}$$

Rewrite all the expressions in scientific notation or in standard form. Compare.

(A.) 74,000

$$\underline{7.4 \times 10^4}$$

(B.) 0.74×10^5

$$7.4 \times 10^{-1} \times 10^5$$

$$\underline{7.4 \times 10^4}$$

OR

$$\underline{74,000}$$

C. 0.074

$$7.4 \times 10^{-3}$$

(D.) 7.4×10^4

$$\underline{74,000}$$

14. Evaluate the expressions and write your final answer in scientific notation.

A. $(2 \times 10^9)(3 \times 10^{-2})$

multiply coefficients and multiply powers of ten

$$(2 \times 3)(10^9 \times 10^{-2})$$

$$6 \times 10^{9+(-2)}$$

$$\mathbf{6 \times 10^7}$$

B. $(1.2 \times 10^{13}) \div (4 \times 10^8)$

divide coefficients and divide powers of ten

$$\frac{1.2 \times 10^{13}}{4 \times 10^8} = \frac{1.2}{4} \times \frac{10^{13}}{10^8}$$

$$0.3 \times 10^{13-8}$$

$$0.3 \times 10^5 \text{ not written in scientific notation}$$

$$3 \times 10^{-1} \times 10^5$$

$$\mathbf{3 \times 10^4}$$

15. Order the following numbers from **least** to **greatest**. 3.24×10^{-11} 9.108×10^{-12} 2×10^{-11}

Order exponents from least to greatest. If exponents are the same, order the coefficients from least to greatest.

$$\mathbf{9.108 \times 10^{-12}}$$

$$\mathbf{2 \times 10^{-11}}$$

$$\mathbf{3.24 \times 10^{-11}}$$