

Laws of Exponents/Indices

1. Multiplying powers with same base

$$a^m \times a^n = a^{m+n}$$

$$\text{Similarly, } (a/b)^m \times (a/b)^n = (a/b)^{m+n}$$

2. Dividing powers with the same base

$$a^m \div a^n = a^m/a^n = a^{m-n}$$

3. Power of a power

$$(a^m)^n = a^{m \times n} = a^{mn}.$$

4. Multiplying powers with the same exponents

$$a^m \times b^m = (ab)^m$$

5. Negative Exponents

$$a^{-m} = \frac{1}{a^m}$$

6. Power with exponent zero

$$a^0 = 1$$

$$\text{Similarly, } (a/b)^0 = 1$$

Exponential Laws

Rule	Example
$a^m \times a^n = a^{m+n}$	$2^5 \times 2^3 = 2^8$
$a^m \div a^n = a^{m-n}$	$5^7 \div 5^3 = 5^4$
$(a^m)^n = a^{m \times n}$	$(10^3)^7 = 10^{21}$
$a^1 = a$	$17^1 = 17$
$a^0 = 1$	$34^0 = 1$
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{5}{6}\right)^2 = \frac{25}{36}$
$a^{-m} = \frac{1}{a^m}$	$9^{-2} = \frac{1}{81}$



Powers of Ten



Power	Expression	Standard Form
10^1	10	10
10^2	10×10	100
10^3	$10 \times 10 \times 10$	1,000
10^4	$10 \times 10 \times 10 \times 10$	10,000
10^5	$10 \times 10 \times 10 \times 10 \times 10$	100,000

Power Table from 1 to 10

$1^1 = 1$

$1^2 = 1$

$1^3 = 1$

$1^4 = 1$

$1^5 = 1$

$1^6 = 1$

$1^7 = 1$

$1^8 = 1$

$1^9 = 1$

$1^{10} = 1$

$2^1 = 2$

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

$2^7 = 128$

$2^8 = 256$

$2^9 = 512$

$2^{10} = 1024$

$3^1 = 3$

$3^2 = 9$

$3^3 = 27$

$3^4 = 81$

$3^5 = 243$

$3^6 = 729$

\vdots

\vdots

\vdots

\vdots

$4^1 = 4$

$4^2 = 16$

$4^3 = 64$

$4^4 = 256$

$6^1 = 6$

$6^2 = 36$

$6^3 = 216$

$7^1 = 7$

$7^2 = 49$

$7^3 = 343$

$8^1 = 8$

$8^2 = 64$

$8^3 = 512$

$9^1 = 9$

$9^2 = 81$

$9^3 = 729$

SCIENTIFIC NOTATION PROBLEMS

FIRST DIGIT IS KNOWN AS
LEADING DIGIT

8224.0

MOVING TO THE LEFT
EXPONENT IS POSITIVE

$$8.224 \times 10^3$$

400,000.0

$$4 \times 10^5$$

384.6

$$3.846 \times 10^2$$

FOR EXAMPLE

ZERO CAN'T BECOME
LEADING DIGIT

$$\begin{array}{c} 0.00028 \\ \underbrace{\hspace{1.5cm}} \\ 2.8 \times 10^{-4} \end{array}$$

MOVING TO THE RIGHT
EXPONENT IS NEGATIVE

1 LOOK FOR THE
LEADING DIGIT

$$\begin{array}{c} 0.0000214 \text{ Kg} \\ \underbrace{\hspace{1.5cm}} \\ 2.14 \times 10^{-5} \text{ Kg} \end{array}$$

3 MOVE TO LEFT
EXP. POSITIVE

2 DECIMAL POINT
TO LEFT OR RIGHT

4 RULES

4 MOVE TO RIGHT
EXP. NEGATIVE

Exponents: Practice Test 3

Laws.

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|---------------------------|--------------------------|---|--|---------------------------------------|-------------------------|
| Q1. | $x^3 x^2$ is | <input checked="" type="radio"/> a. x^5 | b. x^6 | c. x | $x^{3+2} = x^5$ |
| Q2. | x^3/x^5 is | a. x^2 | <input checked="" type="radio"/> b. x^{-2} | c. $-x^{-2}$ | $x^{3-5} = x^{-2}$ |
| Q3. | $(2x^2)^3$ is | a. $8x^5$ | <input checked="" type="radio"/> b. $8x^6$ | c. $2x^6$ | $2^3 \cdot x^6$ |
| Q4. | $2(x^0)^3$ is | a. 1 | <input checked="" type="radio"/> b. 2 | c. $2x^3$ | $2x^0 = 2$ |
| $+9x^2$ Q5. | $(-3x)^2$ is | <input checked="" type="radio"/> a. $9x^2$ | b. $-3x^2$ | c. $3x^2$ | |
| $(\frac{1}{2}x)^{-2}$ Q6. | $(-x^2)^0$ is | a. 0 | <input checked="" type="radio"/> b. 1 | c. -1 | $(\frac{1}{2}x^2)^{-2}$ |
| $2(x^2)^2$ Q7. | $(0.5x^2)^{-2}$ | <input checked="" type="radio"/> a. $4x^{-4}$ | b. 2 | c. 4 | $1-x^2+x+1 = 3^2$ |
| $2x^3 \cdot 9x^2$ Q8. | $(3)^{1-x} (3)^{x+1}$ is | a. 3^{2x-1} | b. 3^{2x} | <input checked="" type="radio"/> c. 9 | |
| Q9. | $(2x^3) (3x)^2$ is | a. $6x^5$ | <input checked="" type="radio"/> b. $18x^5$ | c. $6x^6$ | $\frac{12x^3}{4x^2}$ |
| Q10. | $(12x^3)/(2x)^2$ is | a. 4x | <input checked="" type="radio"/> b. 3x | c. 6x | |

Answer key

Standard and Scientific Notations

Mixed: ES1

Express each number in scientific notation.

1) $0.0056 = \underline{5.6 \times 10^{-3}}$

2) $24,010 = \underline{2.401 \times 10^4}$

3) $4,085 = \underline{4.085 \times 10^3}$

4) $0.017 = \underline{1.7 \times 10^{-2}}$

5) $0.000796 = \underline{7.96 \times 10^{-4}}$

6) $952 = \underline{9.52 \times 10^2}$

7) $50,413 = \underline{5.0413 \times 10^4}$

8) $0.004 = \underline{4 \times 10^{-3}}$

Express each number in standard notation.

9) $2.445 \times 10^3 = \underline{2,445}$

10) $1.04 \times 10^{-4} = \underline{0.000104}$

11) $9.165 \times 10^{-2} = \underline{0.09165}$

12) $5.962 \times 10^3 = \underline{5,962}$

13) $2.2 \times 10^{-5} = \underline{0.000022}$

14) $3.12 \times 10^{-1} = \underline{0.312}$

15) $8.0447 \times 10^4 = \underline{80,447}$

16) $1.278 \times 10^2 = \underline{127.8}$

