

Laws of Integer Exponents Made Simple

Grade 8 math · Worksheet Answer Key · Standards: 8.EE.A.1

Every solution names the rule used, shows each exponent calculation and ends with the answer in bold. If your result differs, check whether the bases really match and whether a negative sign belongs to the base or to the exponent.

Standards: 8.EE.A.1 · **Level:** Grade 8

Problem 1 Repeated multiplication

(a) $4 \cdot 4 \cdot 4 = 64$. (b) $(-2)(-2)(-2)(-2)(-2)$: five negative factors give a negative product, -32 .
(c) $10 \cdot 10 \cdot 10 \cdot 10 = 10,000$.

(a) 64 (b) -32 (c) 10,000

Problem 2 Zero and negative exponents

(a) Any nonzero base to the zero power is 1. (b) $2^{-4} = \frac{1}{2^4} = \frac{1}{16}$. (c) $10^{-3} = \frac{1}{1,000} = 0.001$.

(a) 1 (b) $\frac{1}{16}$ (c) $\frac{1}{1,000}$

Problem 3 Product rule

Same base, so add exponents. (a) $5 + 2 = 7$. (b) $9 + 4 = 13$.

(a) 6^7 (b) m^{13}

Problem 4 Quotient rule

The bottom has two factors of 6. They cancel two of the five on top, leaving three. Rule check: $5 - 2 = 3$.

$6^3 = 216$

Problem 5 Power of a power

Two boxes of three 2s make six factors: $3 \cdot 2 = 6$.



Six factors of 2 in one row.

So $(2^3)^2 = 2^6 = 64$. In the same way $(n^5)^2 = n^{10}$.

$2^6 = 64$ and n^{10}

Problem 6 Counting factors

Six circles in all, so the power is 3^6 . $3^6 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 729$.

$3^6 = 729$

Problem 7 Negative exponents as fractions

(a) $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$. (b) The reciprocal of $\frac{1}{5}$ is 5, so $(\frac{1}{5})^{-2} = 5^2 = 25$.

(a) $\frac{1}{64}$ (b) 25

Problem 8 Mixed exponents, one base

(a) $-2 + 4 = 2$, so $5^2 = 25$. (b) $3 + (-5) = -2$, so $7^{-2} = \frac{1}{49}$.

(a) 25 (b) $\frac{1}{49}$

Problem 9 Power of a product

Apply the exponent to every factor. (a) $5^3y^3 = 125y^3$. (b) $4^3m^6 = 64m^6$. (c) $2^2a^6 = 4a^6$.

(a) $125y^3$ (b) $64m^6$ (c) $4a^6$

Problem 10 Power then divide

$(5^2)^3 = 5^6$. Then $5^6 \div 5^4 = 5^2 = 25$.

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Problem 11 Fractions to a power

(a) The exponent applies to top and bottom: $\frac{2^3}{3^3} = \frac{8}{27}$. (b) A negative exponent flips the fraction:

$$(\frac{4}{3})^2 = \frac{16}{9}.$$

(a) $\frac{8}{27}$ (b) $\frac{16}{9}$

Problem 12 Positive exponents only

(a) $\frac{1}{x^3}$. (b) Only a moves: $\frac{5}{a^2}$. (c) A negative exponent in the denominator moves up: y^4 .

(a) $\frac{1}{x^3}$ (b) $\frac{5}{a^2}$ (c) y^4

Problem 13 Complete the pattern

Each box is the previous one divided by 5: $25 \div 5 = 5$, $5 \div 5 = 1$, $1 \div 5 = \frac{1}{5}$.

5^3	5^2	5^1	5^0	5^{-1}	5^{-2}
125	25	5	1	1/5	1/25

Completed table.

$5^1 = 5$, $5^0 = 1$, $5^{-1} = \frac{1}{5}$; divide by 5 each step.

Problem 14 Find the error

Zoe multiplied the bases. The base stays 4 and the exponents add: $3 + 2 = 5$. Check: $64 \cdot 16 = 1,024$, and 16^5 is far larger.

$4^5 = 1,024$

Problem 15 Share chain

Round 6: $3^6 = 729$ students. Round 4: $3^4 = 81$. Ratio: $3^6 \div 3^4 = 3^2 = 9$, and $729 \div 81 = 9$ agrees.

729 students; 9 times as many

Problem 16 Nested powers

Inside: $-3 + 8 = 5$, so $(2^5)^2 = 2^{10}$. Then $2^{10} \div 2^7 = 2^3 = 8$.

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Problem 17 Simplify with two variables

Multiply each exponent by -2 : x^4y^{-6} . Move y^{-6} to the denominator.

$$x^4/y^6$$

Problem 18 Compare three values

$2^{-3} = 1/8$. $(-2)^{-3} = 1/((-2)^3) = -1/8$. -2^3 means the negative of 8, which is -8 .

$$-2^3 < (-2)^{-3} < 2^{-3}$$

Problem 19 Cookie batches

Total = $2^{-3} \cdot 2^6 = 2^3 = 8$. Check: $2^{-3} = 0.125$ cup and $64 \cdot 0.125 = 8$.

$$2^3 = 8 \text{ cups}$$

Problem 20 Missing exponents

(a) $n - 4 = 9$, so $n = 13$. (b) $3m = 18$, so $m = 6$. (c) $k - (-2) = 7$, so $k + 2 = 7$ and $k = 5$.

(a) 13 (b) 6 (c) 5