Year 8 index laws worksheet

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Name: _____ Date: _____

Question 1

Simplify each expression. Give your answer in exponent form.

(a) $3^4 \times 3^5$

(b) $(2^9)/(2^3)$

Answer: _____

Question 2

Simplify each expression.

(a) $(5^3)^4$

(b) $((2^3)^4 \times 2^0)/(2^5)$

Answer: _____

Question 3

A factory produces 6^8 small bolts on Monday and uses 6^3 bolts to fill each crate. How m any full crates can the factory fill? Write your answer as a power of 6.

Answer: _____

Question 4

Simplify the following expression and write your answer as a single power of 3.
$((3^4)^3)/(3^5 \times 3^2)$

Answer: _____

Question 5

Simplify:

(a) $a^5 \times a^3 \times a$

(b) $2x^4 \times 5x^2$

Answer: _____

Question 6

Simplify $((3^2)^5 \times 3^0)/(3^4)$. Write your answer in exponent form.

Answer: _____

Question 7

Simplify:

(a) $12m^7 \div 4m^3$

(b) $(20a^6b^4)/(5a^2b)$

Answer: _____

Question 8

Simplify:

(a) $(x^3)^4$

(b) $(2a^2)^3$

(c) $5x^0$

(d) $(3m)^0$

Answer: _____

Question 9

Write each expression as a single power of 2.

(a) $2^5 \times 2^3 \div 2^4$

(b) 8×2^6

(c) $4^3 \times 2^2$

(d) Evaluate your answer to (c).

Answer: _____

Question 10

(a) Simplify $((a^2b^3)^4)/(a^5b^{10})$.

(b) Evaluate $4^0 + (-3)^0 - 2 \times 7^0$.

(c) Show that $(2^3)^2$ is not equal to 2^(3^2) by evaluating both.

Answer: _____

Year 8 index laws: answers and worked solutions

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Question 1

Key idea: When multiplying powers with the same base, add the exponents. When dividing, subtract the exponents.

1. (a) $3^4 \times 3^5 = 3^{4+5} = 3^9$ 2. (b) $(2^9)/(2^3) = 2^{9-3} = 2^6$

Answer: (a) 3^9 (b) 2^6

Question 2

Key idea: For a power of a power, multiply the exponents. Any base raised to the power of zero equals 1.

1. (a) $(5^3)^4 = 5^\wedge(3 \times 4) = 5^{12}$ 2. (b) Simplify the numerator first: $(2^3)^4 = 2^{12}$ and $2^0 = 1$, so the numerator is $2^{12} \times 1 = 2^{12}$. 3. Now divide: $(2^{12})/(2^5) = 2^{12-5} = 2^7$

Answer: (a) 5^{12} (b) 2^7

Question 3

Key idea: Dividing quantities with the same base means subtracting the exponents.

1. Number of crates = $(6^8)/(6^3)$ 2. Apply the division law: $6^8 \div 6^3 = 6^{8-3} = 6^5$ 3. Check: $6^5 \times 6^3 = 6^{5+3} = 6^8$ ✓

Answer: 6^5 crates

Question 4

Key idea: Apply the exponent laws step by step: power-of-a-power $(a^m)^n = a^{mn}$, product rule $a^m \times a^n = a^{m+n}$, and quotient rule $a^m \div a^n = a^{m-n}$.

1. Simplify the numerator using the power-of-a-power rule: $(3^4)^3 = 3^\wedge(4 \times 3) = 3^{12}$. 2. Simplify the denominator using the multiplication rule: $3^5 \times 3^2 = 3^{5+2} = 3^7$. 3. Rewrite the expression: $(3^{12})/(3^7)$. 4. Apply the division rule: $3^{12} \div 3^7 = 3^{12-7} = 3^5$.

Answer: 3^5

Question 5

Key idea: When multiplying powers with the same base, add the indices: $a^m \times a^n = a^\wedge(m + n)$.

1. (a) $a = a^1$, so $a^\wedge(5 + 3 + 1) = a^9$ 2. (b) $2 \times 5 = 10$ and $x^\wedge(4 + 2) = x^6$, so $10x^6$

Answer: (a) a^9 (b) $10x^6$

Question 6

Key idea: Apply the power-of-a-power rule first, then use the zero index and division laws.

1. Simplify the power of a power: $(3^2)^5 = 3^{(2 \times 5)} = 3^{10}$ 2. Apply the zero index: $3^0 = 1$ 3. Simplify the numerator: $3^{10} \times 1 = 3^{10}$ 4. Divide: $(3^{10})/(3^4) = 3^{10-4} = 3^6$

Answer: 3^6

Question 7

Key idea: When dividing powers with the same base, subtract the indices: $a^m \div a^n = a^{(m - n)}$. Divide the numbers as usual.

1. (a) $12 \div 4 = 3$ and $m^{(7 - 3)} = m^4$, so $3m^4$ 2. (b) $20 \div 5 = 4$, $a^{(6 - 2)} = a^4$ and $b^{(4 - 1)} = b^3$, so $4a^4b^3$

Answer: (a) $3m^4$ (b) $4a^4b^3$

Question 8

Key idea: For a power of a power, multiply the indices: $(a^m)^n = a^{mn}$. Any non-zero base to the power 0 equals 1.

1. (a) $x^{(3 \times 4)} = x^{12}$ 2. (b) $2^3 \times a^{(2 \times 3)} = 8a^6$ 3. (c) Only x is raised to the power 0: $5 \times 1 = 5$ 4. (d) The whole bracket is raised to the power 0, so it equals 1

Answer: (a) x^{12} (b) $8a^6$ (c) 5 (d) 1

Question 9

Key idea: Write every number as a power of 2 first, then use the index laws.

1. (a) $2^{(5 + 3 - 4)} = 2^4$ 2. (b) $8 = 2^3$, so $2^3 \times 2^6 = 2^9$ 3. (c) $4 = 2^2$, so $4^3 = 2^2 \times 2^2 \times 2^2 = 2^6$, and $2^6 \times 2^2 = 2^8$ 4. (d) $2^8 = 256$

Answer: (a) 2^4 (b) 2^9 (c) 2^8 (d) 256

Question 10

Key idea: Use the power of a power law, then the division law; any non-zero number to the power 0 is 1.

1. (a) $(a^2b^3)^4 = a^8b^{12}$ 2. (a) $(a^8b^{12})/(a^5b^{10}) = a^{(8 - 5)}b^{(12 - 10)} = a^3b^2$ 3. (b) $1 + 1 - 2 \times 1 = 0$ 4. (c) $(2^3)^2 = 8^2 = 64$ 5. (c) $3^2 = 9$, so $2^{(3^2)} = 2^9 = 512$, which is different

Answer: (a) a^3b^2 (b) 0 (c) $(2^3)^2 = 64$ but $2^{(3^2)} = 2^9 = 512$