Year 10A index laws worksheet

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Name: _____ Date: _____

Question 1

Simplify $3a^4 \times 5a^3$.

Answer: _____

Question 2

Evaluate 4^{-2}, giving your answer as a fraction or a decimal.

Answer: _____

Question 3

A storage container is a cube with a volume of 200 cubic metres. The side length of a cube with volume V is given by s = V^(⅓). Write the exact side length of this container in surd form, and then evaluate it correct to two decimal places.

Answer: _____

Question 4

Simplify $((3x^2y)^3)/(9x^4y^2)$, giving your answer with positive indices only.

Answer: _____

Question 5

Evaluate $(\frac{1}{5})^{-2} + 2^{-1}$.

Answer: _____

Question 6

Evaluate without a calculator.

(a) 16^(½)

(b) 27^(⅓)

(c) 32^(⅕)

Answer: _____

Question 7

A square solar panel has a side length of $2x^3$ metres. Four of these panels are laid flat in a single row end to end, and the combined area is divided equally among $8x^2$ households.

Write an expression for each household's share of the total panel area in square metres, giving your answer with positive indices only.

Answer: _____

Question 8

Evaluate, writing fractions or decimals where needed.

(a) 2^{-1}

(b) 5^{0}

(c) 10^{-2}

(d) 3^{-2}

Answer: _____

Question 9

Evaluate without a calculator.

(a) 8^(⅔)

(b) 25^(3/2)

(c) 81^(-¼)

(d) (16/9)^(-3/2)

Answer: _____

Question 10

Simplify $((2x^{3})^{4})/(x^{5})$, giving your answer as a coefficient times a power of x.

What is the exponent of x in the simplified expression?

Answer: _____

Year 10A index laws: answers and worked solutions

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Question 1

Key idea: When multiplying terms with the same base, add the exponents: $a^m \times a^n = a^{m+n}$.

1. Multiply the coefficients: 3 × 5 = 15. 2. Apply the product law to the powers of a: $a^4 \times a^3 = a^{4+3} = a^7$. 3. Write the result: $15a^7$.

Answer: $15a^7$

Question 2

Key idea: $a^{-n} = (1)/(a^n)$.

1. $4^{-2} = (1)/(4^2)$. 2. = 1/16 = 0.0625.

Answer: 1/16

Question 3

Key idea: V^(⅓) means the cube root of V, so V^(⅓) = $\sqrt[3]{V}$.

1. Substitute V = 200: s = 200^(⅓) = $\sqrt[3]{(200)}$ 2. Write 200 = 8 × 25, so: $\sqrt[3]{(200)} = \sqrt[3]{(8 \times 25)} = \sqrt[3]{8} \times \sqrt[3]{(25)} = 2\sqrt[3]{(25)}$ 3. Evaluate numerically: $2\sqrt[3]{(25)} \approx 2 \times 2.9240 \approx 5.85$ m

Answer: Exact side length is $2\sqrt[3]{(25)}$ m, which is approximately 5.85 m.

Question 4

Key idea: Expand any brackets using the power law first, then apply the quotient law to simplify.

1. Expand the numerator using the power law: $(3x^2y)^3 = 3^3 \cdot x^{(2 \times 3)} \cdot y^3 = 27x^6y^3$. 2. Write the full expression: $(27x^6y^3)/(9x^4y^2)$. 3. Divide the coefficients: 27/9 = 3. 4. Apply the quotient law to each base: $x^{6-4} = x^2$ and $y^{3-2} = y^1 = y$. 5. Write the result: $3x^2y$.

Answer: $3x^2y$

Question 5

Key idea: A negative index means take the reciprocal.

1. $(⅕)^{-2} = 5^2 = 25$. 2. $2^{-1} = ½ = 0.5$. 3. Total = 25.5.

Answer: 25.5 (or 25½)

Question 6

Answer: (a) 4 (b) 3 (c) 2

Question 7

Key idea: Find the total area of the four panels, then divide by the number of households using the quotient law.

1. Find the area of one panel: $(2x^3)^2 = 4x^6$ square metres. 2. Find the total area of four p anels: $4 \times 4x^6 = 16x^6$ square metres. 3. Divide by the number of households: $(16x^6)/(8x^2)$. 4. D ivide the coefficients: $16/8 = 2$. 5. Apply the quotient law: $x^{6-2} = x^4$.

Answer: $2x^4$ square metres per household

Question 8

Answer: (a) ½ (or 0.5) (b) 1 (c) 1/100 (or 0.01) (d) 1/9

Question 9

Answer: (a) 4 (2^2) (b) 125 (5^3) (c) ⅓ (d) 27/64 ((9/16)^(3/2) = $(3^3)/(4^3)$)

Question 10

Key idea: Apply the power law $(a^m)^n = a^{mn}$ first, then the quotient law $a^m \div a^n = a^{m-n}$.

1. Apply the power law to the numerator:\ $(2x^3)^4 = 2^4 \times x$^(3 × 4) $= 16x^{12}$ 2. Rewrite the expression:\ $(16x^{12})/(x^5)$ 3. Apply the quotient law to the x terms:\ $x^{12} \div x^5 = x^{12-5} = x^7$ 4. Combine with the coefficient:\ $16x^7$

Answer: $16x^7$, so the exponent of x is 7.