GRADE 7 ACCELERATED · UNIT 3 · THREAD A · DAY 1

Exponent Laws with Variable Bases

MA.8.AR.1.1

I can multiply and divide monomials, and raise a monomial to a power, by applying the laws of exponents to variable bases.

Warm-Up

1. Find the value: $(2^3)^2 \cdot 2^{-4}$
2. Write as one power: $\dfrac{6^7}{6^5}$
3. $\sqrt{50}$ is between which two whole numbers?
4. Write with an exponent: $y \cdot y \cdot y \cdot y \cdot y$

Warm-Up

1. Find the value: $(2^3)^2 \cdot 2^{-4}$ **4**
2. Write as one power: $\frac{6^7}{6^5}$ **$6^2 = 36$**
3. $\sqrt{50}$ is between which two whole numbers? **7 and 8**
4. Write with an exponent: $y \cdot y \cdot y \cdot y \cdot y$ y^5

Vocabulary

monomial

a number, a variable,

or a product of a number and variables with whole-number exponents: 7, x, $-3x^2y^5$

coefficient

the number factor of a monomial: in $-3x^2y^5$ the coefficient is -3

like bases

powers of the same variable: x^2 and x^5 have like bases; x^2 and y^5 do not

Notes

I. Product of powers — the base is a letter now

$$x^2 \cdot x^3 = (x \cdot x)(x \cdot x \cdot x) = x^5 \qquad x^m \cdot x^n = x^{m+n}$$

$$3x^2 \cdot 5x^4 = (3 \cdot 5)(x^2 \cdot x^4) = 15x^6$$

Multiply the coefficients. Add the exponents of like bases.

Different variables stay separate: $x^2y \cdot x^3y^4 = x^5y^5$

Notes

II. Power of a power, power of a product

$$(x^3)^4 = x^3 \cdot x^3 \cdot x^3 \cdot x^3 = x^{12} \qquad (x^m)^n = x^{mn}$$

$$(2y^2)^3 = 2^3 \cdot (y^2)^3 = 8y^6 \qquad (15xy^2)^3 = 3{,}375x^3y^6$$

Power of a power: multiply the exponents. Power of a product: raise every factor.

Notes

III. Quotient of powers — dividing monomials

$$\frac{x^7}{x^2} = \frac{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x} = x^5 \qquad \frac{x^m}{x^n} = x^{m-n}$$

$$\frac{12a^5}{4a^2} = 3a^3 \qquad \frac{m^6n^4}{m^2n^4} = m^4n^0 = m^4$$

Divide the coefficients. Subtract the exponents of like bases.

Example 1

$$(4x^3y)(-2x^2y^5)$$

Write an equivalent expression as a single monomial.

Example 1

$$(4x^3y)(-2x^2y^5) = (4)(-2) \cdot x^3x^2 \cdot y^1y^5$$

$$= -8 \cdot x^5 \cdot y^6 = -8x^5y^6$$

Answer: $-8x^5y^6$

Your Turn

$$(5a^2b^4)(3ab^2)$$

Write an equivalent expression as a single monomial.

Your Turn

$$(5a^2b^4)(3ab^2)$$

Write an equivalent expression as a single monomial.

Numbers: $5 \cdot 3 = 15$

The a's: $a^2 \cdot a^1 = a^{2+1} = a^3$

The b's: $b^4 \cdot b^2 = b^{4+2} = b^6$

Answer: $15a^3b^6$

Example 2

$$\frac{(3m^2n)^3}{9m^4n}$$

Write an equivalent expression as a single monomial.

Example 2

$$(3m^2n)^3 = 27m^6n^3$$

$$\frac{27m^6n^3}{9m^4n} = 3 \cdot m^{6-4} \cdot n^{3-1} = 3m^2n^2$$

Answer: $3m^2n^2$

Your Turn

$$\frac{(2p^3)^4}{8p^5}$$

Write an equivalent expression as a single monomial.

Your Turn

$$\frac{(2p^3)^4}{8p^5}$$

Write an equivalent expression as a single monomial.

Top first: $(2p^3)^4 = 2^4 \cdot p^{3 \cdot 4} = 16p^{12}$

Numbers: $16 \div 8 = 2$

The p's: $p^{12} \div p^5 = p^{12-5} = p^7$

Answer: $2p^7$

Whiteboards · Question 1 of 9

$$x^5 \cdot x^8$$

Answer it.

Whiteboards · Question 1 of 9

$$x^5 \cdot x^8$$

$$x^5 \cdot x^8 = x^{5+8} = x^{13}$$

Answer: x^{13}

Whiteboards · Question 2 of 9

$$(y^5)^3$$

Answer it.

Whiteboards · Question 2 of 9

$$(y^5)^3$$

$$(y^5)^3 = y^{5 \cdot 3} = y^{15}$$

Answer: y^{15}

Whiteboards · Question 3 of 9

A cube has edges $2x^3$ centimeters long.

Its surface area is $24x^6$ square centimeters.

What is the volume of the cube, in cubic centimeters?

Answer it.

Whiteboards · Question 3 of 9

A cube has edges $2x^3$ centimeters long.

Its surface area is $24x^6$ square centimeters.

What is the volume of the cube, in cubic centimeters?

Volume = edge × edge × edge: $(2x^3)^3$

$$(2x^3)^3 = 2^3 \cdot x^{3 \cdot 3} = 8x^9$$

Answer: $8x^9$

Whiteboards · Question 4 of 9

$$(3a^2b)(4ab^5)$$

Answer it.

Whiteboards · Question 4 of 9

$$(3a^2b)(4ab^5)$$

Numbers: $3 \cdot 4 = 12$

The a's: $a^2 \cdot a^1 = a^{2+1} = a^3$

The b's: $b^1 \cdot b^5 = b^{1+5} = b^6$

Answer: $12a^3b^6$

Whiteboards · Question 5 of 9

$$(5m^3)^2$$

Which expression is equivalent?

A. $25m^6$

B. $10m^6$

C. $25m^5$

D. $5m^6$

Answer it.

Whiteboards · Question 5 of 9

$$(5m^3)^2$$

Which expression is equivalent?

$$(5m^3)^2 = 5^2 \cdot m^{3 \cdot 2} = 25m^6$$

Answer: A — $25m^6$

Whiteboards · Question 6 of 9

$$\frac{12x^8}{3x^2}$$

Which expression is equivalent?

A. $4x^{10}$

B. $4x^6$

C. $9x^6$

D. $4x^4$

Answer it.

Whiteboards · Question 6 of 9

$$\frac{12x^8}{3x^2}$$

Which expression is equivalent?

Numbers: $12 \div 3 = 4$ The x's: $x^8 \div x^2 = x^{8-2} = x^6$

Answer: B — $4x^6$

Whiteboards · Question 7 of 9

$$\frac{c^{10}d^{3}}{c^{2}d^{3}}$$

Answer it.

Whiteboards · Question 7 of 9

$$\frac{c^{10}d^{3}}{c^{2}d^{3}}$$

The c's: $c^{10} \div c^{2} = c^{10-2} = c^{8}$

The d's: $d^{3} \div d^{3} = d^{3-3} = d^{0} = 1$

Answer: c^{8}

Whiteboards · Question 8 of 9

Find the value of n:

$$x^3 \cdot x^n = x^{11}$$

Answer it.

Whiteboards · Question 8 of 9

Find the value of n:

$$x^3 \cdot x^n = x^{11}$$

Same base, so the exponents add: $3 + n = 11$

$n = 11 - 3 = 8$

Answer: $n = 8$

Whiteboards · Question 9 of 9

Rachel writes $(14a^3b)^3$ as

$$14 \cdot 14 \cdot 14 \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b.$$

Justina writes it as $2{,}744a^9b^3$. Who is correct? Explain.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Rachel writes $(14a^3b)^3$ as

$$14 \cdot 14 \cdot 14 \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b.$$

Justina writes it as $2{,}744a^9b^3$. Who is correct? Explain.

$14 \cdot 14 \cdot 14 = 2{,}744$

$a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a = a^9$ and $b \cdot b \cdot b = b^3$

Answer: Both are correct; $14^3 = 2{,}744$, nine a's make a^9, and $b \cdot b \cdot b = b^3$.

Independent Set

1. Write as one power. $x^6 \cdot x^9$
2. Write as a single monomial. $(a^5)^4$
3. Write as a single monomial. $(4y^6)^3$
4. Write as a single monomial. $(2m^4)(5m^3)$
5. Write as a single monomial. $\dfrac{20x^9}{4x^3}$
6. Find the value of n. $y^4 \cdot y^n = y^{10}$

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 3 test.

Today's skills — all required

Multiply powers: variable bases — TR9

Powers of a power: variable bases — 2CU

Divide monomials with positive exponents — C8L