GRADE 7 ACCELERATED · UNIT 3 · LESSON 2

Quotient Laws of Exponents

MA.7.NSO.1.1

I can use the quotient of powers, power of a quotient and zero exponent laws to rewrite and evaluate a numerical expression.

Warm-Up

1. Write as one power: $3^2 \cdot 3^3$
2. $\sqrt[3]{-27}$
3. Solve $2x + 3 < 11$
4. Simplify $\dfrac{5 \cdot 5 \cdot 5}{5 \cdot 5}$

Warm-Up

1. Write as one power: $3^2 \cdot 3^3$ 3^5
2. $\sqrt[3]{-27}$ **–3**
3. Solve $2x + 3 < 11$ **x < 4**
4. Simplify $\frac{5 \cdot 5 \cdot 5}{5 \cdot 5}$ **5**

Vocabulary

quotient of powers law

$\frac{a^m}{a^n} = a^{m-n}$, $a \neq 0$ — same base, subtract the exponents

power of a quotient law

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, $b \neq 0$ — the exponent goes to numerator and denominator

zero exponent law

$a^0 = 1$ for every nonzero a

Notes

I. Quotient of powers — same base, subtract the exponents

$$\frac{5^6}{5^3} = \frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5} = 5 \cdot 5 \cdot 5 = 5^3$$

Quotient of powers: $\frac{a^m}{a^n} = a^{m-n}$ $(a \neq 0)$

Check with values: $\frac{5^6}{5^3} = \frac{15625}{125} = 125 = 5^3$

Notes

II. Power of a quotient — the exponent goes top and bottom

$$\left(\frac{8}{10}\right)^3 = \frac{8}{10} \cdot \frac{8}{10} \cdot \frac{8}{10} = \frac{8 \cdot 8 \cdot 8}{10 \cdot 10 \cdot 10} = \frac{8^3}{10^3}$$

Power of a quotient: $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ $(b \neq 0)$

Either way: $\frac{8^3}{10^3} = \frac{512}{1000} = 0.512$ and $(0.8)^3 = 0.512$

Notes

III. The zero exponent — two roads to the same answer

2^4	2^3	2^2	2^1	2^0
16	8	4	2	1

$$\frac{2^3}{2^3} = \frac{8}{8} = 1 \quad \text{and} \quad \frac{2^3}{2^3} = 2^{3-3} = 2^0 \quad \text{so} \quad 2^0 = 1$$

Zero exponent: $a^0 = 1$ **for every nonzero** a

Example 1

$$\frac{(-2)^6}{(-2)^3}$$

Which law? Then find the value.

Example 1

$$\frac{(-2)^6}{(-2)^3} = (-2)^{6-3} = (-2)^3$$

$$(-2)^3 = -8$$

$$64 \div (-8) = -8$$

Answer: −8

Your Turn

$$\frac{3^6}{3^2}$$

Which law? Then find the value.

Your Turn

$$\frac{3^6}{3^2}$$

Which law? Then find the value.

$$\frac{3^6}{3^2} = 3^{6-2} = 3^4$$

$$3^4 = 81$$

Answer: $3^4 = 81$

Example 2

$$\left(\frac{0.2}{10}\right)^4$$

Find the value.

Example 2

$$\left(\frac{0.2}{10}\right)^4 = \frac{0.2^4}{10^4} = \frac{0.0016}{10000}$$

$$\frac{0.0016}{10000} = 0.00000016$$

$$(0.02)^4 = 0.00000016$$

Answer: 0.00000016

Your Turn

$$\left(\frac{3}{4}\right)^3$$

Find the value.

Your Turn

$$\left(\frac{3}{4}\right)^3$$

Find the value.

$$\left(\frac{3}{4}\right)^3 = \frac{3^3}{4^3} = \frac{27}{64}$$

Answer: $\frac{27}{64}$

Whiteboards · Question 1 of 9

$$\frac{10^5}{10^3}$$

Answer it.

Whiteboards · Question 1 of 9

$$\frac{10^5}{10^3}$$

$$\frac{10^5}{10^3} = 10^{5-3} = 10^2$$

Answer: 10^2

Whiteboards · Question 2 of 9

A website puts 7^4 photos into 7 equal albums.

The site is 30 days old.

How many photos are in each album?

Answer it.

Whiteboards · Question 2 of 9

A website puts 7^4 photos into 7 equal albums.

The site is 30 days old.

How many photos are in each album?

$$7^4 \div 7^1 = 7^{4-1} = 7^3$$

$$7^3 = 343$$

Answer: 343

Whiteboards · Question 3 of 9

$$\frac{(-6)^6}{(-6)^5}$$

Answer it.

Whiteboards · Question 3 of 9

$$\frac{(-6)^6}{(-6)^5}$$

$$\frac{(-6)^6}{(-6)^5} = (-6)^{6-5} = (-6)^1 = -6$$

Answer: −6

Whiteboards · Question 4 of 9

$$\left(\frac{-5}{10}\right)^{7}$$

Answer it.

Whiteboards · Question 4 of 9

$$\left(\frac{-5}{10}\right)^7$$

$$\left(\frac{-5}{10}\right)^7 = \frac{(-5)^7}{10^7}$$

Answer: $\dfrac{(-5)^7}{10^7}$

Whiteboards · Question 5 of 9

$$9^0$$

Which is the value?

A. 1

B. 9

C. 1/9

D. 0

Answer it.

Whiteboards · Question 5 of 9

9^0

Which is the value?

Any nonzero number to the power 0 is 1.

$9^0 = 1$

Answer: A — 1

Whiteboards · Question 6 of 9

$$\frac{4^8}{4^2}$$

Which expression is equivalent?

A. 1^6

B. 4^{10}

C. 4^6

D. 4^4

Answer it.

Whiteboards · Question 6 of 9

$$\frac{4^8}{4^2}$$

Which expression is equivalent?

$$\frac{4^8}{4^2} = 4^{8-2} = 4^6$$

Answer: C — 4^6

Whiteboards · Question 7 of 9

$$\frac{0.5^8}{0.5^5}$$

Answer it.

Whiteboards · Question 7 of 9

$$\frac{0.5^{8}}{0.5^{5}}$$

$$\frac{0.5^{8}}{0.5^{5}} = 0.5^{8-5} = 0.5^{3}$$

$$0.5^{3} = 0.125$$

Answer: 0.125

Whiteboards · Question 8 of 9

$$\left(\frac{10}{11}\right)^0$$

Answer it.

Whiteboards · Question 8 of 9

$$\left(\frac{10}{11}\right)^0$$

Any nonzero number to the power 0 is 1.

$\left(\frac{10}{11}\right)^0 = 1$

Answer: 1

Whiteboards · Question 9 of 9

Hannah cancels: $\frac{6^2}{6^2} = \frac{36}{36} = 1$. Sebastian subtracts: $\frac{6^2}{6^2} = 6^0$.

Who is right?

Write your answer in sentences.

Whiteboards · Question 9 of 9

Hannah cancels: $\frac{6^2}{6^2} = \frac{36}{36} = 1$. Sebastian subtracts: $\frac{6^2}{6^2} = 6^0$.

Who is right?

Hannah: $\frac{6^2}{6^2} = \frac{36}{36} = 1$

Sebastian: $\frac{6^2}{6^2} = 6^{2-2} = 6^0$

Same fraction, so $6^0 = 1$

Answer: Both — $6^0 = 1$

Independent Set

1. Write as one power. $\frac{6^7}{6^3}$

2. Find the value. $\frac{5^6}{5^4}$

3. Find the value. $\frac{(-4)^5}{(-4)^3}$

4. Rewrite so the exponent is on the numerator and on the denominator. $\left(\frac{3}{7}\right)^4$

5. Find the value. $\left(\frac{12}{13}\right)^0$

6. Find the value of n. $\frac{2^9}{2^n} = 2^4$

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

Powers with negative bases — WFW
Division with exponents — XNC
Identify equivalent expressions involving whole-number exponents — KBE