GRADE 7 ACCELERATED · UNIT 3 · LESSON 5

Applying Exponent Laws

MA.8.NSO.1.3

I can rewrite a rational base with a negative exponent using a positive exponent, and apply several laws to generate an equivalent expression.

Warm-Up

1. Find the value: 2^{-3}
2. Rewrite with a positive exponent: $\frac{1}{7^{-2}}$
3. Which is larger, 4^3 or 3^4?
4. Write the reciprocal of $-\frac{2}{5}$

Warm-Up

1. Find the value: 2^{-3} $\frac{1}{8}$
2. Rewrite with a positive exponent: $\frac{1}{7^{-2}}$ 7^2
3. Which is larger, 4^3 or 3^4? 3^4 **(81 > 64)**
4. Write the reciprocal of $-\frac{2}{5}$ $-\frac{5}{2}$

Vocabulary

reciprocal of a fraction

swap numerator and denominator: the reciprocal of $\frac{2}{5}$ is $\frac{5}{2}$;

the sign stays where it was

rational base with a negative exponent

$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$ — flip the base, make the exponent positive

Notes

I. The pattern with a fraction base

Expression	Expanded	Value
$(2/5)^2$	$2/5 \cdot 2/5$	$4/25$
$(2/5)^1$	$2/5$	$2/5$
$(2/5)^0$	1	1
$(2/5)^{-1}$	$5/2$	$5/2$
$(2/5)^{-2}$	$5/2 \cdot 5/2$	$25/4$

Notes

II. Flip the base, make the exponent positive

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n} \qquad (a, b \neq 0)$$

$$\left(\frac{2}{5}\right)^{-2} = \left(\frac{5}{2}\right)^{2} = \frac{25}{4} \qquad \left(-\frac{2}{3}\right)^{-5} = \left(-\frac{3}{2}\right)^{5}$$

The sign stays with the fraction. Flip the numbers, not the sign.

A whole number is a fraction over 1: $4^{-3} = \left(\frac{4}{1}\right)^{-3} = \left(\frac{1}{4}\right)^{3}$

Notes

III. Several laws at once — the plan is still yours

$$\left(\frac{2.5^{5}}{2.5^{3}}\right)^{-1} = (2.5^{2})^{-1} = 2.5^{-2} = \left(\frac{5}{2}\right)^{-2} = \left(\frac{2}{5}\right)^{2} = \frac{4}{25}$$

Any correct order of laws gives the same value. Finish with a positive exponent.

Example 1

$$\left(-\frac{7}{8}\right)^{-2}$$

Rewrite with a positive exponent, then find the value.

Example 1

$$\left(-\frac{7}{8}\right)^{-2} = \left(-\frac{8}{7}\right)^{2}$$

$$\left(-\frac{8}{7}\right)^{2} = \frac{64}{49}$$

Answer: 64/49

Your Turn

$$\left(-\frac{5}{2}\right)^{-3}$$

Rewrite with a positive exponent, then find the value.

Your Turn

$$\left(-\frac{5}{2}\right)^{-3}$$

Rewrite with a positive exponent, then find the value.

Flip the fraction: $\left(-\frac{5}{2}\right)^{-3} = \left(-\frac{2}{5}\right)^{3}$

$$\left(-\frac{2}{5}\right)^{3} = -\frac{8}{125}$$

Answer: $-\frac{8}{125}$

Example 2

$$\left(\frac{5}{8}\right)^{-2} \cdot \left(\frac{5}{8}\right)^{4}$$

Write an equivalent expression with one base and a positive exponent.

Example 2

$$\left(\frac{5}{8}\right)^{-2} \cdot \left(\frac{5}{8}\right)^{4} = \left(\frac{5}{8}\right)^{-2+4} = \left(\frac{5}{8}\right)^{2}$$

$$\left(\frac{5}{8}\right)^{2} = \frac{25}{64}$$

Answer: $(5/8)^2 = 25/64$

Your Turn

$$\left(-\frac{5}{4}\right)^{-7} \cdot \left(-\frac{5}{4}\right)^{-3}$$

Write an equivalent expression with one base and a positive exponent.

Your Turn

$$\left(-\frac{5}{4}\right)^{-7} \cdot \left(-\frac{5}{4}\right)^{-3}$$

Write an equivalent expression with one base and a positive exponent.

Add the exponents, then flip the fraction:

$$\left(-\frac{5}{4}\right)^{-7+(-3)} = \left(-\frac{5}{4}\right)^{-10} = \left(-\frac{4}{5}\right)^{10}$$

Answer: $\left(-\frac{4}{5}\right)^{10}$

Whiteboards · Question 1 of 9

A copier is set to shrink a page to $\frac{2}{3}$ of its size.

A page 6 inches wide is copied 4 times in a row, each copy from the last.

What fraction of the original page's size is the last copy?

Answer it.

Whiteboards · Question 1 of 9

A copier is set to shrink a page to $\frac{2}{3}$ of its size.

A page 6 inches wide is copied 4 times in a row, each copy from the last.

What fraction of the original page's size is the last copy?

Four copies: $\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4} = \frac{16}{81}$

Answer: $\frac{16}{81}$

Whiteboards · Question 2 of 9

$$\left(\frac{3}{-5}\right)^{-9}$$

Answer it.

Whiteboards · Question 2 of 9

$$\left(\frac{3}{-5}\right)^{-9}$$

Flip the fraction: $\left(\frac{3}{-5}\right)^{-9} = \left(\frac{-5}{3}\right)^{9}$

Answer: $\left(\frac{-5}{3}\right)^{9}$

Whiteboards · Question 3 of 9

$$\left(-\frac{8}{9}\right)^{-2}$$

Answer it.

Whiteboards · Question 3 of 9

$$\left(-\frac{8}{9}\right)^{-2}$$

Flip the fraction: $\left(-\frac{8}{9}\right)^{-2} = \left(-\frac{9}{8}\right)^{2}$

$$\left(-\frac{9}{8}\right)^{2} = \frac{81}{64}$$

Answer: $\frac{81}{64}$

Whiteboards · Question 4 of 9

$$\left(\frac{21}{4}\right)^{-5}$$

Answer it.

Whiteboards · Question 4 of 9

$$\left(\frac{21}{4}\right)^{-5}$$

Flip the fraction: $\left(\frac{21}{4}\right)^{-5} = \left(\frac{4}{21}\right)^{5}$

Answer: $\left(\frac{4}{21}\right)^{5}$

Whiteboards · Question 5 of 9

$$\left(-\frac{7}{10}\right)^{-3}$$

Which expression is equivalent?

A. $(7/10)^3$

B. $(-10/7)^3$

C. $(-7/10)^3$

D. $(10/7)^3$

Answer it.

Whiteboards · Question 5 of 9

$$\left(-\frac{7}{10}\right)^{-3}$$

Which expression is equivalent?

Flip the fraction. The sign stays: $\left(-\frac{7}{10}\right)^{-3} = \left(-\frac{10}{7}\right)^{3}$

Answer: B — $(-10/7)^3$

Whiteboards · Question 6 of 9

$$\left(\frac{2}{9}\right)^{-3} \div \left(\frac{2}{9}\right)^{-7}$$

Which expression is equivalent?

A. $(9/2)^4$

B. $(2/9)^{-10}$

C. $(2/9)^4$

D. $(2/9)^{21}$

Answer it.

Whiteboards · Question 6 of 9

$$\left(\frac{2}{9}\right)^{-3} \div \left(\frac{2}{9}\right)^{-7}$$

Which expression is equivalent?

$$\left(\frac{2}{9}\right)^{-3} \div \left(\frac{2}{9}\right)^{-7} = \left(\frac{2}{9}\right)^{-3-(-7)} = \left(\frac{2}{9}\right)^{4}$$

Answer: C — $(2/9)^4$

Whiteboards · Question 7 of 9

$$\left(\frac{3}{8}\right)^{-1} \cdot \left(\frac{8}{3}\right)^{1}$$

Answer it.

Whiteboards · Question 7 of 9

$$\left(\frac{3}{8}\right)^{-1} \cdot \left(\frac{8}{3}\right)^{1}$$

$$\left(\frac{3}{8}\right)^{-1} = \left(\frac{8}{3}\right)^{1}$$

$$\left(\frac{8}{3}\right)^{1} \cdot \left(\frac{8}{3}\right)^{1} = \left(\frac{8}{3}\right)^{2} = \frac{64}{9}$$

Answer: $\frac{64}{9}$

Whiteboards · Question 8 of 9

$$\left[\left(\frac{2}{3}\right)^{5} \cdot \left(\frac{2}{3}\right)^{-2}\right]^{3}$$

Answer it.

Whiteboards · Question 8 of 9

$$\left[\left(\frac{2}{3}\right)^{5} \cdot \left(\frac{2}{3}\right)^{-2}\right]^{3}$$

Inside: $\left(\frac{2}{3}\right)^{5} \cdot \left(\frac{2}{3}\right)^{-2} = \left(\frac{2}{3}\right)^{5+(-2)} = \left(\frac{2}{3}\right)^{3}$

$\left(\left(\frac{2}{3}\right)^{3}\right)^{3} = \left(\frac{2}{3}\right)^{3 \cdot 3} = \left(\frac{2}{3}\right)^{9}$

Answer: $\left(\frac{2}{3}\right)^{9}$

Whiteboards · Question 9 of 9

Marco says $\left(-\frac{4}{11}\right)^{-7}$ can be rewritten as $\left(\frac{4}{11}\right)^{7}$

because 'two negatives make a positive.' Is he right?

Write your answer in sentences.

Whiteboards · Question 9 of 9

Marco says $\left(-\frac{4}{11}\right)^{-7}$ can be rewritten as $\left(\frac{4}{11}\right)^{7}$

because 'two negatives make a positive.' Is he right?

The negative exponent flips the fraction. The sign stays.

$\left(-\frac{4}{11}\right)^{-7} = \left(-\frac{11}{4}\right)^{7}$

Answer: No — $(-4/11)^{-7} = (-11/4)^{7}$

Independent Set

1. Rewrite with a positive exponent. $\left(\frac{3}{4}\right)^{-2}$
2. Find the value. $\left(\frac{6}{7}\right)^{-2}$
3. Rewrite with a positive exponent. $\left(-\frac{5}{6}\right)^{-3}$
4. Find the value. $\left(\frac{1}{2}\right)^{-4}$
5. Find the value. $\left(\frac{3}{2}\right)^{-1} \cdot \left(\frac{3}{2}\right)^{3}$
6. Find the value of n. $\left(\frac{4}{7}\right)^{n} = \left(\frac{7}{4}\right)^{3}$

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

Identify equivalent expressions involving exponents I — VLM