

MATH 8: Week of April 20

- Go through the slides (notes) and work through the examples on a separate piece of paper.
- Do the given practice problems (again, on a separate piece of paper).
- Check your answers with the key given (last slide).
- If you have questions or would like feedback on your work, submit a photo/scan of it to google docs or return your work to the school Monday.
- If you do not have questions/need feedback, click on the "mark as complete" button on Google Docs.
- Check your school email/google calendar for online help sessions via Zoom.

Day 1: Slides 2-6
Day 2: Slides 7-8
Day 3: Slides 9-14
Day 4: Slide 15
Day 5: Slide 16

Day 1: Lesson 3-F notes

Division Properties of Exponents

Target:

Use properties of exponents to simplify expressions involving division.

A simplified expression should have:

- each base appear exactly once,
- no powers to powers,
- no numeric values with powers (only variables w/power), and
- Fractions (NO DECIMALS!) written in simplest form.
- No parentheses

Division Properties of Exponents

Quotient of Powers

To divide two powers with the same base, subtract the exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

Power of a Quotient

To find the power of a quotient, find the power of each factor and divide.

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

Example 1a

Simplify the following.

a. $\frac{x^5 y^8}{x^2 y}$

Group powers that have the same base.

$$\left(\frac{x^5}{x^2}\right)\left(\frac{y^8}{y}\right)$$

Subtract exponents.

$$x^{5-2} y^{8-1} = x^3 y^7$$

Example 1b

Simplify the following.

b. $\left(\frac{3m^4}{5}\right)^2$

Distribute the power to each base.

$$\frac{3^2 \cdot (m^4)^2}{5^2}$$

Multiply powers of powers and evaluate coefficients.

$$\frac{9m^8}{25}$$

L3-F Practice Problems:

1. $\frac{6^4}{6^8}$

2. $\frac{x^7}{x^3}$

3. $\frac{a^7 b^{11}}{a^2 b^4}$

4. $\frac{3w^6 v^3}{15w^2 v}$

5. $\left(\frac{a^4}{g^8}\right)^3$

6. $\left(\frac{y^3}{2}\right)^5$

End Day 1

DAY 2: Explore!

Going Negative

Step 1 Copy the tables below. Find the value of each power with a calculator. If the value of the power is less than 1, write the power as a **fraction**.

Power	Value
2^4	
2^3	
2^2	
2^1	

Power	Value
2^{-4}	
2^{-3}	
2^{-2}	
2^{-1}	

Step 2 What do you notice about the powers with opposite exponent (i.e., 2^2 and 2^{-2})?

Step 3 Use your observation from **Step 2** to predict the value of each power below.

a. Given that $4^2 = 16$, what is the value of 4^{-2} ?

b. Given that $3^5 = 243$, what is the value of 3^{-5} ?

c. Given that $6^{-3} = \frac{1}{216}$, what is the value of 6^3 ?

Explore!

Going Negative (Cont.)

Step 4 Look at the statements below. What is the value of each expression (write without an exponent)?

a. $\frac{5^2}{5^2} = \frac{25}{25} = ?$

b. $\frac{2^3}{2^3} = ?$

c. $\frac{3^4}{3^4} = ?$

Step 5 Notice that $\frac{5^2}{5^2} = 5^{2-2} = 5^0$, $\frac{2^3}{2^3} = 2^0$, and $\frac{3^4}{3^4} = 3^0$ using the Division Property of Exponents.

? Based on your findings in **Step 4**, what is the value of 5^0 , 2^0 , and 3^0 ?

Step 6 Use your calculator to raise other numbers to a power of 0. Try whole numbers and decimal values. What can you conclude?

End Day 2

Day 3

More Properties of Exponents

Negative Exponents

For any nonzero number, a and integer n , the expression a^{-n} is the reciprocal of a^n . Also, a^n is the reciprocal of a^{-n} .

$$a^{-n} = \frac{1}{a^n} \quad \text{and} \quad a^n = \frac{1}{a^{-n}}$$

Zero Exponents

Any nonzero number, a , raised to the zero power is 1.

$$a^0 = 1$$

Example 2a

Simplify the following.

a. $\left(\frac{4p^5k}{3}\right)^0$

Any term to the power of 0 equals 1.

$$\left(\frac{4p^5k}{3}\right)^0 = 1$$

Example 2b

Simplify the following.

b. $\frac{x^2y^{-4}}{z^{-3}}$

Write as separate factors.

$$\frac{x^2y^{-4}}{z^{-3}} = \left(\frac{x^2}{1}\right)\left(\frac{y^{-4}}{1}\right)\left(\frac{1}{z^{-3}}\right)$$

Use the rules for negative exponents.

$$\left(\frac{x^2}{1}\right)\left(\frac{1}{y^4}\right)\left(\frac{z^3}{1}\right)$$

Multiply factors.

$$\frac{x^2z^3}{y^4}$$

Example 2c

Simplify the following.

c. $\frac{6a^2b^{-6}c^8}{-2a^2b^{-5}c^{-1}}$

Write as separate factors and group like bases.

$$\left(\frac{6}{-2}\right)\left(\frac{a^2}{a^2}\right)\left(\frac{b^{-6}}{b^{-5}}\right)\left(\frac{c^8}{c^{-1}}\right)$$

Simplify by subtracting exponents and dividing coefficients.

$$(-3)(a^0)(b^{-1})(c^9)$$
$$-3b^{-1}c^9$$

Example 2c Continued

Simplify the following.

$$c. \frac{6a^2b^{-6}c^8}{-2a^2b^{-5}c^{-1}}$$

Use rules for zero and negative exponents.

$$(-3)\left(\frac{1}{b}\right)(c^9)$$

Simplify.

$$\frac{-3c^9}{b}$$

L3-F Practice Problems:

7. $(7yh^3)^0$

8. $\left(\frac{4x^{12}}{5w^{-6}}\right)^0$

9. 3^{-4}

10. 2^{-3}

11. $\frac{k^{-2}m^4}{n^{-8}}$

12. $6p^{-1}q^{-7}$

End Day 3

Day 4

L3-F Practice Problems:

13. A contractor plans to build a rectangular office complex. The floor area on the first floor of the complex is represented by $18x^4y^{10}$. The length of the complex is represented by $6xy^5$. What expression represents the width?

14. A truckload of cement weighs approximately 3^9 pounds. The driver of the truck weighs 3^2 pounds. The truckload of cement weighs how many times more than the driver?

Simplify.

15. $\frac{-4m^6}{m^{13}}$

16. $\frac{25x^9y^{-5}}{5x^{-2}y^3}$

17. $\frac{12p^4w^7}{8p^{-3}w^7}$

18. $\left(\frac{8y}{z^{-5}}\right)^2$

End Day 4

Day 5

L3-F Practice Problems:

19. $\frac{-15m^5}{-3m^{14}}$

20. $\frac{5x^9y^{-5}}{45x^{-2}y^0}$

21. $\frac{2p^4w^7m^0}{8p^{-3}w^7}$

22. $\left(\frac{2y^2}{z}\right)\left(\frac{8y^{-2}}{z^{-3}}\right)^2$

23. $\left(\frac{x^4y^3}{x^{11}y^{-2}}\right)\left(\frac{x^{-3}}{y^{-1}}\right)$

24. $\frac{(3x^9y^{-5})^0}{2x^{-2}y^{-4}}$

End Day 5

3-F Practice Problems: Answers

Day 5:
19. $\frac{m^9}{2x^{11}}$
20. $\frac{9y^5}{x^{11}}$
21. $\frac{4}{128x^5}$
22. $\frac{y^2}{128x^5}$
23. $\frac{y^5}{x^{10}}$
24. $\frac{z}{4x^4y^4}$

Day 4:
15. $\frac{-4}{m^7}$
16. $\frac{5x^{11}y^{-8}}{5x^{-2}y^3}$
17. $\frac{3}{2}$
18. $\frac{64y^2}{z^{-10}}$

Day 3:
1. $\frac{1}{3}$
2. $\frac{1}{8}$
3. $\frac{1}{16}$
4. $\frac{1}{32}$
5. $\frac{1}{64}$
6. $\frac{1}{128}$
7. $\frac{1}{256}$
8. $\frac{1}{512}$
9. $\frac{1}{1024}$
10. $\frac{1}{2048}$
11. $\frac{1}{4096}$
12. $\frac{1}{8192}$
13. $\frac{1}{16384}$
14. $\frac{1}{32768}$
15. $\frac{1}{65536}$
16. $\frac{1}{131072}$
17. $\frac{1}{262144}$
18. $\frac{1}{524288}$
19. $\frac{1}{1048576}$
20. $\frac{1}{2097152}$
21. $\frac{1}{4194304}$
22. $\frac{1}{8388608}$
23. $\frac{1}{16777216}$
24. $\frac{1}{33554432}$

Day 2:
Explore!
Step 1: $16, 8, 4, 2$
1st table: $\frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}$
2nd table: $\frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}$
Step 2: They are reciprocals
Step 3: a) $\frac{1}{16}$ b) $\frac{1}{8}$ c) $\frac{1}{4}$
Step 4: a) 1 b) 1 c) 1
Step 5: Each has a value of 1
Step 6: All numbers when raised to a power of 0 will equal 1.

Day 1:
1. $\frac{1}{32}$
2. $\frac{1}{64}$
3. $\frac{1}{128}$
4. $\frac{1}{256}$
5. $\frac{1}{512}$
6. $\frac{1}{1024}$
7. $\frac{1}{2048}$
8. $\frac{1}{4096}$
9. $\frac{1}{8192}$
10. $\frac{1}{16384}$
11. $\frac{1}{32768}$
12. $\frac{1}{65536}$
13. $\frac{1}{131072}$
14. $\frac{1}{262144}$
15. $\frac{1}{524288}$
16. $\frac{1}{1048576}$
17. $\frac{1}{2097152}$
18. $\frac{1}{4194304}$
19. $\frac{1}{8388608}$
20. $\frac{1}{16777216}$
21. $\frac{1}{33554432}$
22. $\frac{1}{67108864}$
23. $\frac{1}{134217728}$
24. $\frac{1}{268435456}$

MATH 8: FINAL SLIDE for this week!