

## Warm Up

1/27

Simplify the following (all exponents must be positive in final answer):

$$6x^5y^2 \cdot 4x^{-4}y^{-5}$$

Different Strategies:

$$6x^5y^2 \cdot 4x^{-4}y^{-5}$$

$$24x^5y^2x^{-4}y^{-5}$$

1. Multiply #'s

$$\frac{24x^5y^2}{x^4y^5}$$

2. Make all exponents positive.

$$\frac{24x}{y^3}$$

3. Simplify

$$6x^5y^2 \cdot 4x^{-4}y^{-5}$$

$$24x^5y^2x^{-4}y^{-5}$$

1. Multiply #'s

$$24x^{5+(-4)}y^{2+(-5)}$$

2. Multiply variables

$$24x^1y^{-3}$$

3. Make all exponents positive.

$$\frac{24x}{y^3}$$

## Negative Exponents

Write each expression using positive exponents. Then evaluate the expression.

$$1. 2^{-6} = \frac{1}{2^6} = \frac{1}{64} \quad 2. 5^{-1} = \frac{1}{5} \quad 3. 8^{-2} = \frac{1}{8^2} = \frac{1}{64} \quad 4. 10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$$

Simplify each expression.

$$5. g^{-6} = \frac{1}{g^6} \quad 6. s^{-1} = \frac{1}{s} \quad 7. q^0 = 1 \quad 8. a^{-2}b^2 = \frac{b^2}{a^2}$$

$$9. m^5n^{-1} = \frac{m^5}{n} \quad 10. p^{-1}q^{-6}r^3 = \frac{r^3}{pq^6} \quad 11. x^{-3}y^2z^{-4} = \frac{y^2}{x^3z^4} \quad 12. a^{-2}b^0c^{-1} = \frac{1}{a^2c}$$

$$13. 12m^{-6}n^4 = \frac{12n^4}{m^6} \quad 14. 7xy^{-8}z = \frac{7xz}{y^8} \quad 15. x^{-3}(x^2) = \frac{1}{x} \quad 16. b^3(b^{-5}) = \frac{1}{b^2}$$

$$17. \frac{b^3}{b^5} = \frac{1}{b^2} \quad 18. \frac{y^3}{y^{-2}} = y^5 \quad 19. \frac{m^5n^3}{m^9n^2} = \frac{n}{m} \quad 20. \frac{xy^2}{xy^3} = \frac{1}{y}$$

$$21. \frac{a^7b^4}{a^9b^2} = \frac{b^2}{a^2} \quad 22. \frac{rs^{-3}}{r^2s^4} = \frac{1}{rs^7} \quad 23. \frac{16c^8}{4c^{10}} = \frac{4}{c^2} \quad 24. \frac{9x^{-5}y^5}{36x^4y^3} = \frac{y^2}{4x^9}$$

$$25. \frac{7p^2q^6}{21p^{-3}q^7} = \frac{p^5}{3q} \quad 26. \frac{-6m^5n^2q^{-1}}{36m^{-2}n^4q^{-1}} = -\frac{m^7}{6n^2} \quad 27. \frac{4a^3b^2c^2}{6a^5b^3c} = \frac{2c}{3a^2b} \quad 28. \frac{28x^3y^{-3}z}{-4x^4yz^3} = -\frac{7x}{y^4z^2}$$

$$\#27 \quad \frac{4a^3b^2c^2}{6a^5b^3c} = \frac{2a^3b^2c^2}{3a^5b^3c} = \frac{2c}{3a^2b}$$

$$\#28 \quad \frac{28x^3y^{-3}z}{-4x^4yz^3} = \frac{-7x^3y^{-3}z}{x^4yz^3} = \frac{-7x^3z}{x^4y^4z^3} = \frac{-7x^3z}{x^4y^4z^3} = \frac{-7xz}{y^4z^3} = \frac{-7x}{y^4z^2}$$

What do you think if we see something like this?

$$\left(\frac{1}{x}\right)^{-2} = \frac{1^{-2}}{x^{-2}} = \frac{x^2}{1} = x^2$$

$$\left(\frac{x}{1}\right)^2 = x^2 \quad \text{Dividing by a fraction, FLIP!}$$

$$5(x^3y^4)^{-2} = \frac{5}{(x^3y^4)^2} = \frac{5}{x^6y^8}$$

dividing by  $(x^3y^4)^2$

$$\left(\frac{12x^7}{3x^3}\right)^{-2} = \left(4x^4\right)^{-2} = 4^{-2}x^{-8} = \frac{1}{4^2x^8}$$

simplified

or

$$(4x^4)^{-2} = \frac{1}{(4x^4)^2} = \frac{1}{4^2x^8}$$

### Negative number to a power:

$$-2^3 = -8$$

$$-2^2 \neq 4$$

$$\text{this is really } -1 \cdot 2^2 = -1 \cdot 4 = -4$$

$$(-2)^2 = 4$$

The power is applied to what it is right next to. If you have a negative number, that is really -1 times the number.

## For today's work:

- All work must be done in your notebook.
- Each expression must be written with all positive exponents before you begin to simplify.
- All final answers must have positive exponents.

# What Did Professor Utterbunk Say When Asked: Have You Ever Heard of the Planet Saturn?

Simplify each expression. Write the letter of the answer in the box containing the exercise number.

- 1  $5^3$   
 2  $5^{-3}$   
 3  $3^{-5}$   
 4  $(-5)^{-3}$   
 5  $(-12)^{-2}$   
 6  $-12^{-2}$   
 7  $(-12)^0$   
 8  $(-4)^{-3}$

Answers 1-8:

- T  $\frac{1}{144}$  M  $\frac{1}{125}$   
 P  $-1$  R  $-\frac{1}{64}$   
 I  $125$  L  $144$   
 U  $1$  N  $\frac{1}{243}$   
 O  $-\frac{1}{125}$  F  $-125$   
 E  $\frac{1}{64}$  S  $-\frac{1}{144}$

- 17  $7ab^0$   
 18  $7ab^{-4}$   
 19  $\frac{7}{ab^{-4}}$   
 20  $\frac{7^{-2}a}{b^{-1}}$   
 21  $2x^3y^{-8}$   
 22  $\frac{2x^{-3}}{y^{-8}}$   
 23  $\frac{2^{-1}x^{-3}}{u^8}$

Answers 17-23:

- I  $\frac{2y^8}{x^3}$  A  $\frac{7a}{b^4}$   
 R  $2x^3y^8$  O  $7ab^4$   
 F  $\frac{7b^4}{a}$  L  $\frac{1}{2x^3y^8}$   
 S  $7a$  A  $\frac{ab}{49}$   
 M  $\frac{2x^3}{y^8}$  N  $\frac{b}{49a}$

- 9  $-4^{-3}$   
 10  $10^{-5}$   
 11  $(-10)^{-5}$   
 12  $10^0$   
 13  $75^{-1}$   
 14  $-75^{-1}$   
 15  $(-2)^{-4}$   
 16  $-2^{-4}$

Answers 9-16:

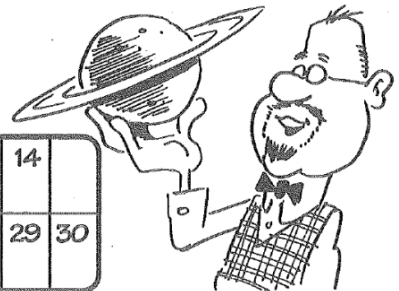
- O  $16$  I  $\frac{1}{75}$   
 T  $-\frac{1}{75}$  E  $-\frac{1}{64}$   
 A  $-\frac{1}{16}$  N  $\frac{1}{1000}$   
 T  $1$  R  $-75$   
 S  $-64$  H  $\frac{1}{16}$   
 B  $\frac{1}{100,000}$   
 U  $-\frac{1}{100,000}$

- 24  $\frac{3n^2}{t^{-5}}$   
 25  $3^4n^{-2}t^5$   
 26  $\frac{3^{-4}t^{-5}}{n^{-2}}$   
 27  $\frac{8^2c^{-1}d^{-6}}{5}$   
 28  $\frac{(-8)^2c^0}{5^{-1}d^{-6}}$   
 29  $\frac{(-8)^{-2}d^{-6}}{5c^{-1}}$   
 30  $\frac{-8^{-2}}{5^{-1}cd^0}$

Answers 24-30:

- T  $\frac{64c}{5d^6}$  G  $-\frac{5}{64c}$   
 I  $3n^2t^5$  I  $320d^6$   
 R  $\frac{n^2}{81t^5}$  A  $\frac{81t^5}{n^2}$   
 E  $320cd^6$  S  $81n^2t^5$   
 R  $\frac{64}{5cd^6}$  N  $\frac{c}{320d^6}$

1	2		3	4	5		6	7	8	9		10	11	12		13	14	
15	16	17		18		19	20	21	22	23	24	25	26		27	28	29	30



### Additional Practice

All work should be done in your notebook. Final answer should contain only positive exponents.

**Remember:** Whenever a term is raised to a negative exponent, that means you are dividing by that term to the positive exponent. When you are dividing by a term, it gets moved to the other side of the division bar.

$$22. \frac{m^{-2}n^{-5}}{(m^4n^3)^{-1}}$$

$$23. \frac{(j^{-1}k^3)^{-4}}{j^3k^3}$$

$$24. \frac{(2a^{-2}b)^{-3}}{5a^2b^4}$$

$$25. \left(\frac{q^{-1}r^3}{qr^{-2}}\right)^{-5}$$

$$26. \left(\frac{7c^{-3}d^3}{c^5de^{-4}}\right)^{-1}$$

$$27. \left(\frac{2x^3y^2z}{3x^4yz^{-2}}\right)^{-2}$$

# Homework

Finish classwork + Additional Practice