Your Name

Mrs. T

2/8/21

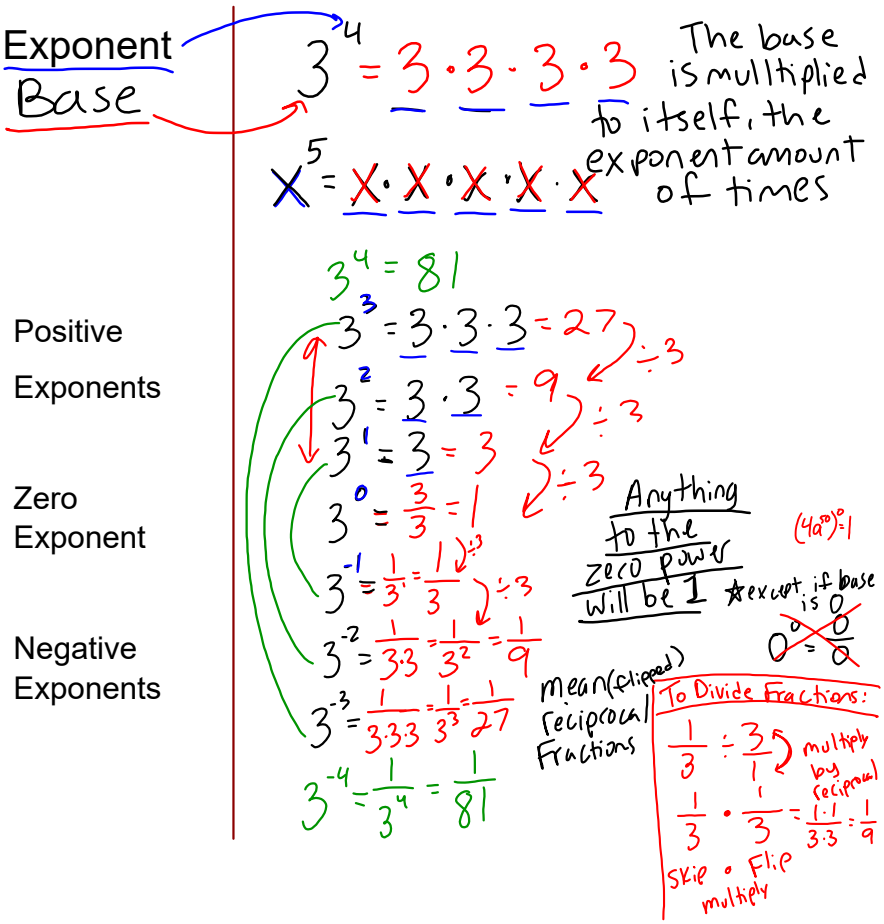
Lesson 6.1

Notes

Properties of Exponents

Objective: To be able to multiply monomials by learning exponent rules such as the product of powers rule.

Life Lesson/Skill: If we can divide monomials we will find an interesting fact about what negative exponents are. Then we can start having fun simplifying algebraic expressions, by multiplying and dividing polynomials and factoring.



$$\frac{-5^0}{2^{-2}} = \frac{-(1)}{\frac{1}{2^2}} = \frac{-1}{\frac{1}{4}} = -1 \div \frac{1}{4} = -1 \cdot \frac{4}{1} = -4$$

(zero power)

$$\frac{(-9)^0}{y^{-3}x^4} = \frac{1}{\frac{1}{y^3} \cdot x^4} = \frac{1 \cdot y^3}{x^4} = \frac{y^3}{x^4}$$

$$\frac{4^{-3}}{2x^4} = \frac{1}{4^3 \cdot 2x^4} = \frac{1}{4 \cdot 4 \cdot 4 \cdot 2 \cdot x^4} = \frac{1}{128x^4}$$

unhappy

happy

11. $\frac{-3^{-3}}{6^{-2}}$

$\frac{-1 \cdot 3^{-3}}{6^{-2}}$

$\frac{-1 \cdot 6^{2}}{3^{3}}$

$\frac{-1 \cdot 6 \cdot 6}{3 \cdot 3 \cdot 3}$

$-\frac{36}{27}$

6. 4^0

1

$4^1 = 4$

$4^0 = \frac{4}{4} = 1$

How to enter in a calculator

6 [^] 2

6 [x^y] 2 phone

3 [x^y] 3

12. $\frac{(-8)^{-2}}{3^{-4}}$

$\frac{\frac{1}{(-8)(-8)}}{\frac{1}{3^4}} = \frac{1}{(-8)^2} \div \frac{1}{3^4}$ divide fractions

$\frac{1}{(-8)^2} \cdot \frac{3^4}{1}$ skip flip multiply

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

$\frac{81}{64}$

Exponents

are applied to what is directly to their left

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

$4 \cdot 4$ $2 \cdot x \cdot x \cdot x$ $2x \cdot 2x \cdot 2x$ $-1 \cdot 4 \cdot 4$ $-4 \cdot -4$

16 $2x^3$ $8x^3$ -16 16

Product of Powers

multiply

When multiplying monomials with a common base, use the product of power rule and **add exponents**.

add exponents

Variables with exponents

exponent stays

$x^2 \cdot x^6 = x^{2+6} = x^8$ $y \cdot y^3 = y^{1+3} = y^4$

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ $y \cdot y \cdot y \cdot y$

Multiplying Monomials with a common variable

Multiply the **numbers normally**, then **add the exponents** for the variable bases that are the same.

$2x^5 \cdot 4x^4 = 8x^9$

$2 \cdot 4 \cdot x^5 \cdot x^4$

$-3x^6 \cdot 4x^7 = -12x^{13}$

$-3 \cdot 4 \cdot x^{6+7}$

$(-5x^6y)(2xy^2) = -10x^7y^3$

$-5 \cdot 2 \cdot x^{6+1} \cdot y^{1+2}$

$-5 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot 2 \cdot x \cdot y \cdot y$

$-5 \cdot 2 \cdot x^7 y^3$

$-10 x^7 y^3$

Let's look at this example...

raising variables with exponents to an exponent

multiply exponents

Power of a Power Rule

when in doubt expand it out!

$(5xy^3)^2 = (5xy^3)(5xy^3) = 25x^2y^6$

$5\cdot x\cdot y\cdot y\cdot y \cdot 5\cdot x\cdot y\cdot y\cdot y$

$5\cdot 5\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y$

When raising a monomial/term to a power/exponent, multiply the exponent outside with each exponent on the inside.

$(8w^1z^4)^3 = 8^{1\cdot 3}\, w^{1\cdot 3}\, z^{4\cdot 3} = 8^3\, w^3\, z^{12}$

$8wz^4 \cdot 8wz^4 \cdot 8wz^4$

$(3^3 \cdot w^6)^5 = 3^{15}\, w^{30}$ 3^15 * w^30

$3^{3\cdot 5}\ w^{6\cdot 5}$

$(2^3x^2y^5z^{-3})^2 = 64x^4y^{10}z^{-6}$ $\frac{64\cdot x^4 y^{10}}{z^6}$

$2^{3\cdot 2}\, x^{2\cdot 2}\, y^{5\cdot 2}\, z^{-3\cdot 2}$

Find each product, use exponents in your answer.

1. $2a^2\cdot 2^5 a\cdot b^2$

$2^6 a^3 b^7$

2. $(-4x^2y)\,6x^5y =$

$-24x^7y^2$

3. $12^2z^3\cdot 12^{10}z$

$12^{12}z^4$

4. $(13x^2y)^3\cdot 2x^5y^2 =$

$13^{1\cdot 3}\, x^{2\cdot 3}\, y^{1\cdot 3}\cdot 2x^5y^2$

$13^3\cdot 2\, x^{6+5}\, y^{3+2}$

$4394x^{11}y^5$

Monomials- a number, a variable, or a product ofnumbers and/or variables.

examples: 80 x 80x xy^2 $\frac{80x}{3}$

non examples: $8+x$ $\frac{80x}{y}$

*remember that any term to the power of 0 = 1

$5^0 = 1$

rules: no terms with variables in the denominator and no terms with variables under a radical sign (square root sign).

Product of Powers

add

$(ab^5)(8a^2b^5)$

$abbbbb \cdot 8aabbbbb$

$8 \cdot a^{1+2} b^{5+5}$

$8a^3b^{10}$

Power of Product

multiply exponents

$(ab^5)(8a^2b^5)^3$

$abbbbb \cdot 8aabbbbb \cdot 8aabbbbb \cdot 8aabbbbb$

$1 \cdot 8 \cdot 8 \cdot 8 \cdot a^{1+2 \cdot 3} b^{5+5 \cdot 3}$

$512a^7b^{20}$

$a^1b^5 \cdot 8^3a^{2 \cdot 3}b^{5 \cdot 3}$

$512 \cdot a^{1+6} b^{5+15}$

Summary

Objective: To be able to multiply monomials by learning exponent rules such as the product of powers rule.

Virtue/Skill: If we can divide monomials we will find an interesting fact about what negative exponents are. Then we can start having fun simplifying algebraic expressions, multiplying polynomials and factoring.

Assignment:

pg. 297 # 5-12

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Workbook 7-1

Assignment KEY:

pg. 297 # 5-12

5. 1
6. 1
7. $\frac{1}{625}$
8. $-\frac{1}{32}$
9. $\frac{1}{16}$
10. $-\frac{1}{5}$
11. $-\frac{4}{3}$
12. $\frac{81}{64}$

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13. $\frac{1}{x^7}$
14. 1
15. $\frac{9}{y^3}$
16. $\frac{15}{c^8}$
17. $\frac{1}{4m^3}$
18. $\frac{s}{9r^{11}}$
19. $\frac{b^7}{64}$
20. $\frac{49q^9}{p^8}$
21. $\frac{32x^7}{y^6}$
22. $\frac{1625z^{10}}{x^5}$
25. 6561
25. 6561
26. 1
27. p^{24}
28. $\frac{1}{s^{15}}$
29. $\frac{1}{216}$
30. $-\frac{1}{343}$

35. The product has a base of 2, not $2 \cdot 2$; $2^4 \cdot 2^5 = 2^9$

Homework Answers 7-1:

1. Yes 2. No 3. No 4. Yes

5. yes 6. No 7. a^{11} 8. x^{10}

9. y^3z^3 10. $l^5\ k^3$ 11. $e^4f^{\ 6}$ 12. c^4d^4

13. $6x^7$ 14. $20a^9$ 15. $12x^4y^8$

16. $7a^7b^5$ 17. $-15m^{11}$ 18. $8c^5d^2$

19. 10^6 or 1,000,000 20. p^{36}

21. $36p^2$ 22. $-27y^3$ 23. $9p^2q^4$

24. $4b^6c^8$ 25. x^7 26. c^2d^2

27. $18p^4$