Alg 1 Unit 6 Notes

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Alg 1 Unit 6 Notes

Unit 6 Notes

Exponential Expressions

6.1 Notes: Multiplying with Exponents

Solutions

Key Terms

Base	Exponent	Coefficient	Sample
the value raised to a power	the power	the value multiply is	5(2)3
Sample! 2	Sumple: 3	the base Somov: S	coeff base exp

Exploration A:

* Expand: x^3

$$\chi \cdot \chi \cdot \chi$$

* Expand and simplify: $x^3 \cdot x^4$

$$\chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi = \chi^7$$

Exploration B:

* Expand: $2a^5$

* Expand and simplify: $2a^5 \cdot 7a^3$

Exploration C:

* Expand: $-4h^2g$

* Expand and simplify: $-4h^2g \cdot 3hg^4$

*Expand: x^4

$$\chi \cdot \chi \cdot \chi \cdot \chi$$

*What do you notice?

you can add the power with the same base

*Expand: $7a^3$

*What do you notice?

·multiply coff

· add exponents with some base

*Expand: $3hg^4$

*What do you notice?

· multiply weff

· add exponents with some base

Multiplying Expressions with the Same Base:

· multiply coefficients

· add exponents with the same base

2) $3w^4 \cdot -7w^{21}$

Examples #1 - 6: Simplify each expression.

1)
$$b^7 \cdot b^5 \cdot b$$
1 7+5+1 1 13

3)
$$(-10a^3b^{14})(-7db^2)$$

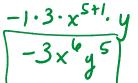
 $-(0\cdot -7\cdot a^{3+1}\cdot b^{14+2})$

You try #4 - 6!

4)
$$5p \cdot p^8 \cdot 2p^3$$

5)
$$(-x^5y)(3xy^4)$$

6)
$$d^5 \cdot d^{13} \cdot d$$



Exploration D: Expand each expression, and then evaluate. Verify on a calculator. $*-2^4$

$$-2 \cdot 2 \cdot 2 \cdot 2$$

$$= -16$$

Draw a conclusion from your observations.

parenthesis matter with negatives and even powers!

Examples #7 – 12: Simplify each expression. Evaluate numerical bases. (alculator Okay 7) $(-3)^3 \cdot (-3)$ 8) $-5^3 \cdot 5$ 9) $(-2)^2 (x^3 y w^4) (-2xy^5 w^3)$

7)
$$(-3)^3 \cdot (-3)$$

$$(-3)^{3+1}$$

8)
$$-5^3 \cdot 5$$

$$-5^{3+1} - 5^{4}$$

9)
$$(-2)^2(x^3yw^4)(-2xy^5w^3)$$

You try!

10)
$$(-5)^2 \cdot (-5)$$

11)
$$4^2 \cdot -4^2$$

12)
$$(-6)^3(a^5b^4)(-6ab)$$

6.2 Notes: Dividing with Exponents

Objectives:

Students will be able to simplify division with expressions with the same base taken to a power.

Exploration A:

* Expand: x^6

 $\chi \chi \chi \chi \chi \chi \chi$

* Expand and simplify: $\frac{x^6}{x^4}$

 $\chi \chi \chi \chi \chi \chi \chi = \chi^2$

Exploration B:

* Expand: $12a^5$

12aaaaa

* Expand and simplify: $\frac{12a^5}{4a^8}$

12hagaa = 3

*Expand: x^4 $\chi \chi \chi \chi$

*What do you notice?

Dividing with same bose ...

Subtact the exponents

*Expand: $4a^8$

4 aaaaaaaa

*What do you notice?

· Diviae coeff

· Subtract exponents w/ same base con have more on denon

Exploration C:

* Expand: $-4h^2gk$

-4hhg K

* Expand and simplify: $\frac{-4h^2gk}{-6ha^4k}$

*Expand: $-6hg^4k$

-6hgggg K

*What do you notice?

· Divide/reduce coeff · subtract power same base

· extras on num or denom

Dividing Expressions with the Same Base:

· Divide/reduce coeff

· Subtract power with same base

- answer on num or denom (whichever had more)

Unit 6 Notes

Exponential Expressions

Examples #1 – 6: Simplify each expression.

1) $\frac{b^7}{b^5}$ 2) $\frac{18w^4}{-9w^{21}}$

1)
$$\frac{b^7}{b^5}$$
 b^{7-5}

$$\frac{-2}{2^{1-4}} = \sqrt{\frac{-2}{w^{17}}}$$

$$3) -\frac{2x^{\frac{1}{4}}}{4x^{\frac{1}{4}}} = \boxed{\frac{1}{2}}$$

You try #4 – 6! 4) $\frac{50p^8}{2p^3}$

4)
$$\frac{50p^8}{2p^3}$$

5)
$$\frac{3a^{1/4}}{9a^{1/4}}$$

6)
$$\frac{-4w^{10}}{-2w^{12}}$$

$$25p^{8-3} = 25p^5$$

$$\frac{2}{w^{12-10}} = \sqrt{\frac{2}{w^2}}$$

Examples #7 - 10: Simplify each expression.

7)
$$\frac{x^4 \cdot x^3}{x^4}$$
 4+3-1 χ

$$8) \frac{\frac{-10a^{3}b^{14}}{-15d^{3}b^{2}}}{2b^{14-2}} = 2b^{12}$$

You try #9 - 10!

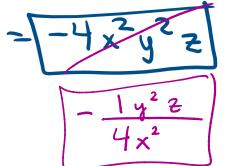
$$9) - \frac{2x^5y}{10xy^4}$$

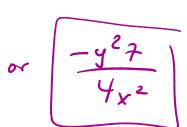
$$- \frac{1}{5} \frac{4}{y^3}$$

$$\frac{d^{5} \cdot d^{13}}{d^{6}} =
\frac{d^{12}}{d^{12}}$$

11) Find and correct the error(s) in the solution shown. Simplify: $-\frac{3x^5y^3z^4}{12x^7yz^3}$

reduce





6.3 Notes: More Rules with Exponents Objective:

- Students will simplify exponential expressions with more than one base raised to the same power.
- Students will simplify exponential expressions with more than one power.

Exploration A: Expand out the following expressions and then simplify.

• $(3xy)^2$

•
$$\left(\frac{5a}{bc}\right)^3$$
 $\frac{5a}{bc}$ $\frac{5a}{bc}$ $\frac{5a}{bc}$

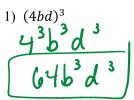
What do you notice?

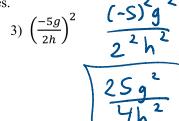
all items in () are taken to the power

$$\frac{125a^3}{b^3c^2}$$

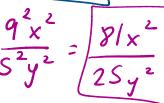
Power to Quotient Rule

Examples #1 – 6: Simplify each expression. Evaluate numerical bases.





$$\begin{array}{c}
4) & (-4fh)^3 \\
 & (-4)^3 f^3 h^3 \\
\hline
 & -64f^3 h^3
\end{array}$$



Exploration B: Expand out the following expressions and then simplify.

• $(5x^4)^2$

$$S_{x}^{4} \cdot S_{x}^{4} = 2S_{x}^{8}$$

What do you notice?

- · raise coeff to the power
- · multiply exponent (keep the base the sme)

5

Power to a Power Rule

- · raise coeff to the power
- ·multiply exponent

- keep the buse the same

Examples #7 – 12: Simplify each expression. Evaluate numerical bases.

$$\begin{array}{c|c}
8) & (-3x^{5})^{4} \\
(-3)^{4} \cdot \chi & 5 \cdot 4 \\
\hline
8 & \chi & 5 \cdot 4
\end{array}$$

$$\begin{array}{c}
9) - (5a^{10})^2 \\
- (5)^2 a^{10 \cdot 2} \\
\hline
-25a^{20}
\end{array}$$

You try #10 - 12!

$$\begin{array}{c|c}
100 & (-10y^3)^3 \\
 & (-10) & y \\
\hline
 & -1000y & 9
\end{array}$$

$$\frac{-(8g^{6})^{2}}{-(g)^{2}g^{6}} = \frac{-(g)^{2}g^{6}}{-(g)^{2}g^{12}}$$

$$\frac{(-7)^{2} h^{11 \cdot 2}}{(-7)^{2} h^{22}}$$

What if there is more than one rule in a single problem?

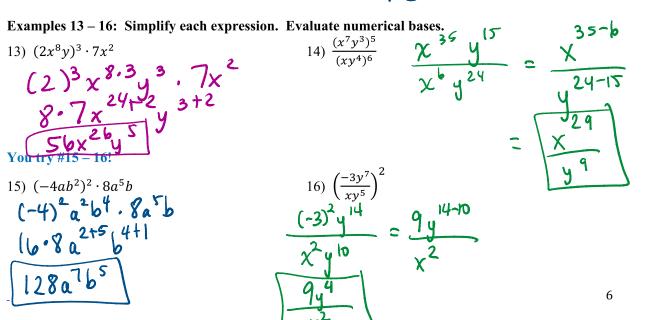
- · do extra powers first ? use order of operations . Then do mult/division }
- PEMDAS

13)
$$(2x^8y)^3 \cdot 7x^2$$

 $(2)^3 \times {}^{8 \cdot 3}y^3 \cdot 7x^2$
 $(2)^3 \times {}^{24} + 2 \cdot 3 + 2$
You try #15 - 16!

15)
$$(-4ab^{2})^{2} \cdot 8a^{5}b$$

 $(-4)^{2}a^{2}b^{4} \cdot 8a^{5}b$
 $(b \cdot 8a^{2+5}b^{4+1})$



Unit 6 Notes

Exponential Expressions

6.4 Notes: Zero and Negative Powers

Objectives: Students will be able to simplify expressions with zero and negative powers

Exploration A: Consider the expanded terms. Simplify using exponential notation.

b)
$$-3 \cdot x \cdot x \cdot x = -3\sqrt{3}$$

b)
$$-3 \cdot x \cdot x \cdot x = -3x^3$$

c) $-3 \cdot x = -3x^3 = -3x$
d) $-3 = -3x^2 = -3$

$$d) -3 = -3x^{6} = -3$$

For part d), how many times does x appear in this expression?

Taking a Base to the Power of Zero

Note: 00 is undefined. Why do you think this is so? having 0, 0 times, doesn't make

Examples 1 - 6: Simplify each expression.

You try #4 – 6!

4.
$$(-24x^3 + 10x^4y^{10})^0$$
5. $-16b^0$
6. $2(7x^3)^0$
7. $-16 \cdot 1 = -16$
6. $2(7x^3)^0$
7. $2 \cdot 1 = 2$

5.
$$-16b^0$$

-16. $| = (-16)$

6.
$$2(7x^3)^0$$

 $= 2 \cdot 1 = 2$

1. (base) -1. base 0 tries = 1

Exploration B: Consider the expanded terms. Simplify using exponential notation. Look

$$\begin{array}{ccc}
a) & \frac{x \cdot x \cdot k}{x} & = x^2 \\
x^{2-1} & & \end{array}$$

b)
$$\frac{x+1}{x+1} = \chi$$

c)
$$\left| \frac{x \cdot x \cdot x}{x \cdot x \cdot x} \right| = 1$$

f) $\frac{x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x} = \frac{1}{\sqrt{3}} \times x^{-1}$

e)
$$\frac{fkk}{\sqrt{x}\sqrt{x}\cdot x} = \frac{1}{x^2} \text{ or } x^{-2}$$

f)
$$\frac{x \cdot x \cdot y}{x \cdot x \cdot x \cdot x} = \frac{1}{\sqrt{3}} \times x^{-3}$$

Negative Exponents

ra pattern in your answers!

a)
$$\frac{x \cdot x \cdot k}{x \cdot x} = \chi^2$$
b) $\frac{x \cdot k \cdot k}{x \cdot x} = \chi$

$$\chi^{2-1}$$

$$\chi^{3-2}$$

$$\chi^{3-2}$$

$$\chi^{3-3} = \chi^{3-3} = \chi^{3-3}$$
d) $\frac{k \cdot x \cdot k}{k \cdot x \cdot x \cdot x} = \frac{1}{\chi^{3}} \text{ or } \chi^{-1}$
e) $\frac{f \cdot k \cdot k}{x \cdot x \cdot x \cdot x} = \frac{1}{\chi^{3}} \text{ or } \chi^{-2}$
f) $\frac{f \cdot k \cdot k \cdot k}{k \cdot x \cdot x \cdot x \cdot x} = \frac{1}{\chi^{3}} \text{ or } \chi^{-3}$
egative Exponents
negative exponents
negative exponents
tell us ne have that base one have that base one have that base one have that base one have exponents
in the other position (numerator or denom) of
$$\chi^{-1} = \chi^{-1} = \chi^{$$

Unit 6 Notes

Exponential Expressions

Examples 7 – 12: Simplify each expression. Do not write negative or 0 exponents in your final answer.

7) 5^{-1} 8) $\left(\frac{1}{b}\right)^{-2}$ 9) $\frac{1}{7^{-2}}$

$$8)\left(\frac{1}{b}\right)^{-2} = (b)^2$$

9)
$$\frac{1}{7^{-2}}$$

You try #10 - 12!



11)
$$\frac{1}{2^{-6}} = 2^{6}$$

12)
$$b^{-3} = \frac{1}{b^3}$$

Examples 13 – 18: Simplify each expression. Do not write negative or 0 exponents in your final answer.

13)
$$\frac{a^3}{a^{-4}}$$

$$a^3 \cdot a^4$$

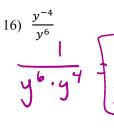
14)
$$\frac{x^3y^{10}}{x^7y^{-3}}$$



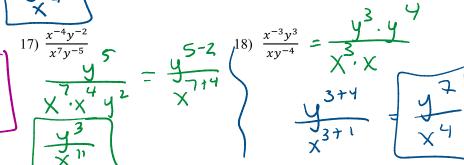
$$15) \frac{5^{-1}b^{3}d^{-2}}{b^{3}d^{4}}$$

$$\frac{1}{5d^4 \cdot d^2} = \frac{1}{5d^6}$$

You try #16 - 18!



$$\frac{17}{x^{-4}y^{-2}}$$



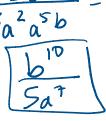
$$\frac{2}{4}$$
 $\binom{18}{x}$

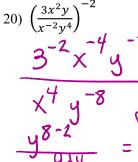
$$\frac{3}{X^{3}} = \frac{y^{3} \cdot y}{X^{3} \cdot X}$$

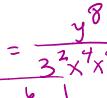
$$\frac{y^{3+1}}{X^{3+1}} = \frac{y^{3} \cdot y}{X^{4}}$$

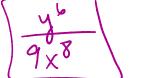
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Challenge Problems: Simplify each expression.









Unit 6 Notes

Exponential Expressions

6.5 Notes: Solving Exponential Equations

Objectives: Students will be able to solve equations with exponents.



Exploration #1: Which of the following expressions below are equivalent to 9²? Choose all that apply.

(A) 34

81

B) 81¹

81

 $\binom{1}{9}$

92=81

 $\left(\frac{1}{3}\right)^{-4}$

3 = 8

 $E)\left(\frac{1}{81}\right)^{-1}$

81=81

Exploration #2: Rewrite the expression 64⁵ in as many ways as you can thinking of by changing the base and the power. Hint: Use bases that go into 64 like 2.4.2

and the power. Hint: Use bases that go into 64 like 2, 4, ?



)⁵

 $\begin{pmatrix} 2^4 \\ 2^0 \\ 2 \end{pmatrix}$

Tullinking of by changing the base

Solving Exponential Equations using the same base.

· write both sides as the same base . set exponents equal & solve

Examples #1 - 3: Solve the following exponential equations.

1) $6^x = 36$

 $\mathbb{Q}^{\times} = 6^{2}$ $\times = 2$

You try #4 - 6!

4) $5^x = 25$

2) $2^{x+5} = 8$

 $2^{X+S} = 2^{3}$ X+S=3 X=-2

3) $2^x = 2^{3x-7}$

X = 3x - 70 = 2x - 7

 $\frac{7 = ? \times}{2} = \times$

 $5) \ 11^{2x-4} = 121$

11 2x-4= 11 3

2x-4=2

2x = b X = 3

 $6^{2x-9} = 6^{3}$

2x-9=3

2x=12 X=6

_

Solving Multi-Step Exponential Equations:

- Duse inverse operations to undo values that are NOT a base or exponent.
- 2) write both sides as same base
- 3) set exponents equal & solve.

Examples 7 - 12: Solve the following exponential equations.

7)
$$3^{x-7} + 1 = 4$$

$$3^{x-7} = 3^{1}$$

8)
$$5(3)^x = 405$$

$$(3)^x = 81$$

$$3^{x} = 3^{4}$$

9)
$$\left(\frac{1}{4}\right)^{5x} = 4^{x+8}$$

$$-5x = 4 \times 7$$

$$-5x = x + 8$$

$$-6x = 8$$

You try #10 - 12!

10)
$$4\left(\frac{1}{3}\right)^x = 108$$

$$(\frac{1}{3})^{x} = 27$$

$$3^{-x} = 3^{3}$$

$$-\chi = 3$$

$$X = -3$$

11)
$$4^{5x+1} + 3 = 19$$

$$4^{5x+1} = 16$$
 $4^{5x+1} = 4$
 $5x+1 = 2$

$$\begin{cases} X = 1 \\ X = 5 \end{cases}$$

12)
$$\left(\frac{2}{3}\right)^4 = \left(\frac{3}{2}\right)^{4x+11}$$

$$\left(\frac{3}{2}\right)^{-4} = \left(\frac{3}{2}\right)^{4\times +11}$$

$$-4 = 4x + 11$$

 $-15 = 4x$