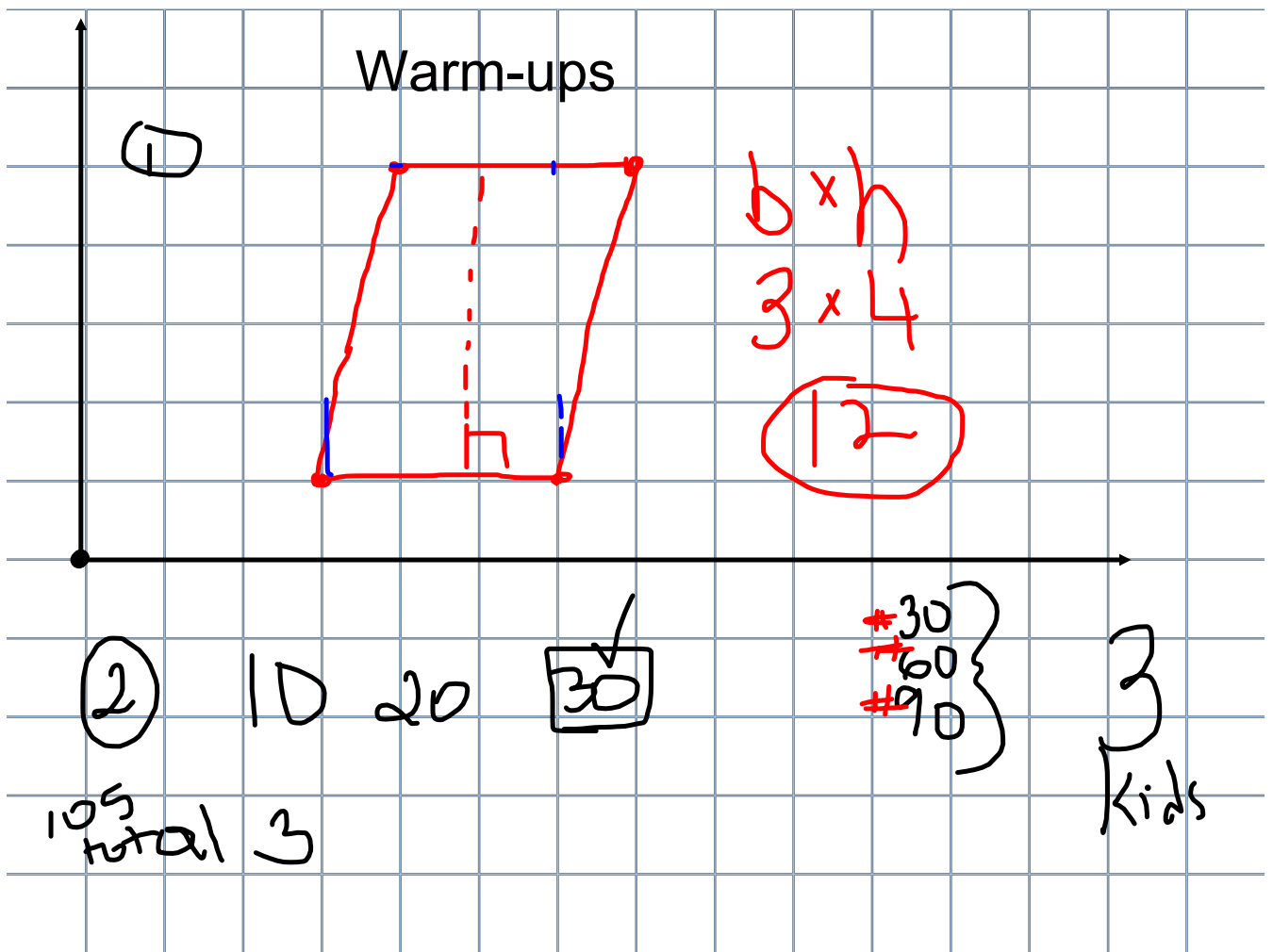


5/5/17 CCM6+7+

Understand and apply the \times and \div laws of exponents.

1. Agenda...HW is p.9-10 and EOG EE
2. Get out p. 6 to check.
3. Do the Friday warm-ups



$$\begin{array}{l} \text{opp. of } 3^2 \\ -9 \end{array} \quad \left| \quad \begin{array}{l} (-3)^2 \\ -3 \cdot -3 \\ 9 \end{array} \right| \quad \begin{array}{l} -(3^2) \\ -9 \end{array}$$

The diagram shows a horizontal line with several terms and arrows. Above the line, the term a^{-3} is circled in red and crossed out with a red diagonal line. To its right is the term b^2 . Below the line, the term a^3 is written in red. To its right, the term c^{-1} is circled in blue and crossed out with a blue diagonal line. Further to the right, the term c^1 is written in purple. A red arrow points from a^3 up to a^{-3} . A blue arrow points from c^{-1} up to c^1 . A purple arrow points from c^1 up to b^2 .

✓ HW

Unit 14 CCM6+/7+ Page 6

1) Simplify:

a) $6^0 = 1$

b) $4x^0y^{-2} = 4 \cdot 1 \cdot \frac{1}{y^2} = \frac{4}{y^2}$

c) $-5x^{-4} = -5 \cdot \frac{1}{x^4} = \frac{-5}{x^4}$

d) $\frac{2}{3}x^{-6} = \frac{2}{3} \cdot \frac{1}{x^6} = \frac{2}{3x^6}$

e) $\frac{1}{4^{-3}} = \frac{4^3}{1} = 64$

2) Evaluate when $a = 2, b = -1, c = -3$

a) $4a^2b^0 = 4 \cdot 2^2 \cdot (-1)^0 = 4 \cdot 4 \cdot 1 = 16$

b) $5a^{-3} = 5 \cdot \frac{1}{2^3} = \frac{5}{2^3} = \frac{5}{8}$

c) $\frac{6c^2}{b^{-1}} = \frac{6 \cdot (-3)^2 \cdot (-1)^1}{6 \cdot 9 \cdot -1} = \frac{6 \cdot 9 \cdot -1}{-54} = -54$

d) $-2a^{-3}b^{-2}$

$$-2 \cdot \frac{1}{2^3} \cdot \frac{1}{(-1)^2} = -2 \cdot \frac{1}{8} \cdot \frac{1}{1} = \frac{-2}{8} = \frac{-1}{4}$$

3) Simplify $a^n \cdot a^{-n}$. What is the mathematical relationship of a^n and a^{-n} ? Justify your answer.

$$\frac{a^n}{1} \cdot \frac{1}{a^n} = 1$$

*reciprocals
*multiplicative inverse

4) Are $3x^{-2}$ and $3x^2$ reciprocals? Explain.

$$\downarrow$$
$$\frac{3}{x^2}$$

$$\downarrow$$
$$3x^2$$

No. $\frac{1}{3x^2}$ is the inverse.5) Choose a fraction to use as a value for the variable a . Find the values of a^{-1} , a^2 , and a^{-2} .

$$a = \frac{1}{2}$$

$\left(\frac{1}{2}\right)^{-1} = \frac{2}{1} = 2$	$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$	$\left(\frac{1}{2}\right)^{-2} = \frac{2}{1} \cdot \frac{2}{1} = 4$
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Page 6

①

$$\frac{3x^{-2}y^2}{2x}$$
$$\frac{3y^2}{2x^3}$$

$x=2$ $y=-3$


②

$$2x^{-2}y$$
$$2 \cdot \frac{1}{2^2} \cdot (-3)$$
$$2 \cdot \frac{1}{4} \cdot (-3) = \frac{-6}{4} = \frac{-3}{2}$$

$$\frac{(-2)^2}{(-2)^{-2}}$$

The image shows a handwritten mathematical expression: $\frac{(-2)^2}{(-2)^{-2}}$. The numerator $(-2)^2$ is written in blue. The denominator $(-2)^{-2}$ is also written in blue. A red arrow points from the -2 in the denominator's exponent to a red $(-2)^2$ written above the arrow. A red circle is drawn around the denominator $(-2)^{-2}$, and a red vertical line is drawn below it.

is $-3^2 = -9$ $= (-3)^2 = 9$

 No

Multiplication Property of Exponents

Ex. $6^4 \cdot 6^5 = \underline{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6} = 6^{\boxed{9}}$

Ex. $e^5 \cdot e = \underline{e \cdot e \cdot e \cdot e \cdot e} = e^{\boxed{6}}$

Ex. $f^6 \cdot f^7 \cdot f^{125} = \underline{\hspace{10em}} = f^{\boxed{138}}$

~~$3^2 \cdot 2^2 = 6^4$~~

Rule To multiply numbers or variables that are raised to a power, + the exponents of the numbers or variables with the base.

Examples. ~~Simplify each expression completely.~~ exp form

1. $3 \cdot 3^3$ 3^4	2. $m^5 \cdot m^7 \cdot m^{87}$ m^{99}	3. $a^5 \cdot a \cdot b^2 \cdot a^{11}$ $a^{17} b^2$
4. $x^2 y^4 x^3 y$ $x^5 y^5$	5. $(3^2)(3)(2^3)$ $3^3 \cdot 2^3$	6. $c^4 \cdot d^7 \cdot c^{17}$ $c^{21} d^7$

What do you do when there are coefficients?

Example: $6a^3 \cdot 3a \cdot 2a^5$

1. $6y^2 \cdot 3y^3 \cdot 2y^4$ $36y^9$	2. $2y^3 \cdot 7x^2 \cdot 2y^4$ $28x^2y^7$	3. $5m \cdot 2p^4 \cdot 3m^8$ $30m^9p^4$
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Multiplication with Exponents

$$5^2 \times 5^3 = (5 \bullet 5) \bullet (5 \bullet 5 \bullet 5) = 5^7$$

$$\text{Rule: } x^a \bullet x^b = x^?$$

Example 1: Rewrite using one base.

$$4^6 \bullet 4^7 =$$

Example 2: Simplify

$$\text{a) } a \bullet a^4 \bullet a^2 =$$

$$\text{b) } 4x^3 \bullet 3x^{-5} = 12x^{-2} = \frac{12}{x^2}$$

$$\text{c) } a^{-2} \bullet b^4 \bullet a^6 \bullet b^3 = a^4 b^7$$

$$\text{d) } 4x^2 \bullet 3y^3 \bullet 6x^5 \bullet y^7 =$$

HW

Unit 14 CCM6+/7+ Page 9

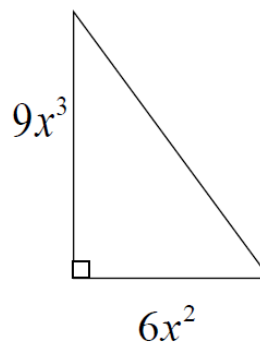
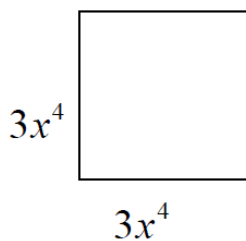
Let's Try!**Simplify:**

1) $a^2 \cdot a^{-4}$

2) $2x^4 \cdot 3x^5$

3) $(6x^2y)(2xy^3)$

4) $(5x^{-3}y)(6x^7y^{-4})$

Find the area of each figure below. Write your answer in simplest exponential form.

HW

Unit 14 CCM6+/7+ Page 10

Division Property of Exponents

Ex. $\frac{6^5}{6^3} = \frac{\cancel{6} \cdot \cancel{6} \cdot \cancel{6} \cdot 6 \cdot 6}{\cancel{6} \cdot \cancel{6} \cdot \cancel{6}} = \frac{6^2}{1} = 6^2$

Ex. $\frac{x^4}{x^2} = \frac{\cancel{x} \cdot \cancel{x} \cdot x \cdot x}{\cancel{x} \cdot \cancel{x}} = x^2$

Rule To divide numbers or variables with the same non-zero base, subtract the exponents. Or, look for where the base is "heavier" and leave the remainder.

Examples. Simplify each expression completely *exp form*

1. $\frac{10^7}{10^3}$

10^4

2. $\frac{x^{25}}{x^{18}}$

x^7

3. $\frac{5^{24}}{5^{27}}$

$5^{-3} = \frac{1}{5^3}$

4. $\frac{3^4}{3^4}$

1

5. $\frac{12m^5}{3m}$

6. $\frac{6b^3}{18}$

7. $\frac{5^{-3}}{2^2}$

8. $\frac{x^5y^6}{x^8y^3}$

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

10. $\left(\frac{4}{5}\right)^{-2}$