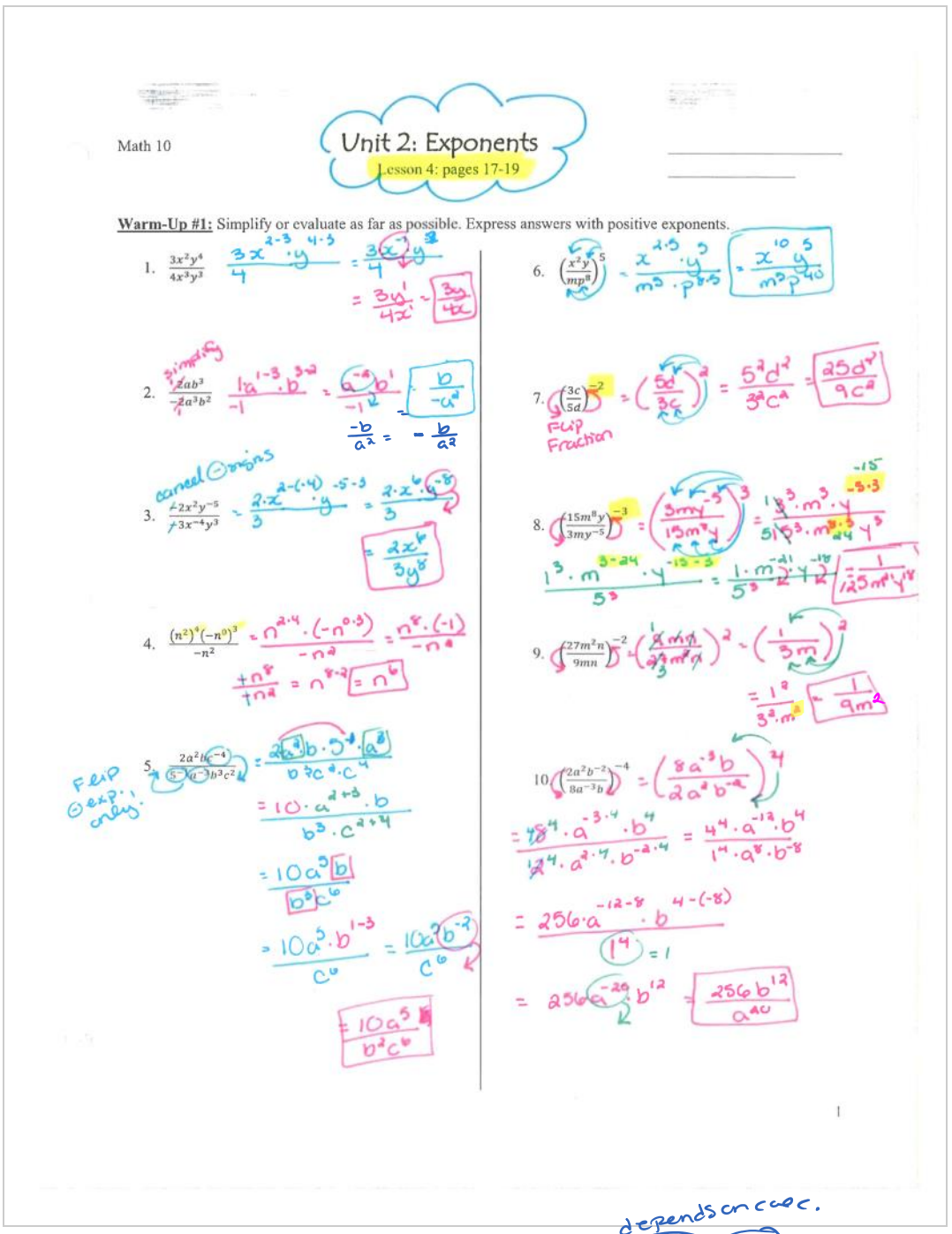
Exponents Lesson 4

October 24, 2018 8:28 AM

Lesson 4 Warm-Up



Math 10

Unit 2: Exponents

Lesson 4: pages 17-19

Warm-Up #1: Simplify or evaluate as far as possible. Express answers with positive exponents.

1. $\frac{3x^2y^4}{4x^3y^3}$

2. $\frac{2ab^3}{-2a^3b^2}$ simplify

3. $\frac{-2x^2y^{-5}}{+3x^{-4}y^3}$ cancel (-)signs

4. $\frac{(n^2)^4(-n^0)^3}{-n^2}$

5. $\frac{2a^2b^{-4}}{5^{-1}a^{-3}b^3c^2}$ Flip (-)exp.'s only.

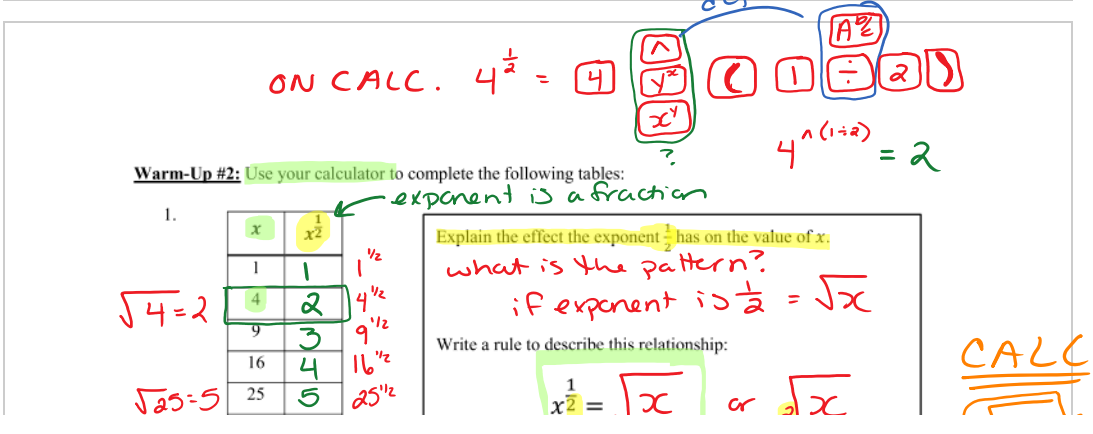
6. $\left(\frac{x^2y}{mp^8}\right)^5$

7. $\left(\frac{3c}{5d}\right)^{-2}$ Flip Fraction

8. $\left(\frac{15m^8y}{3my^{-5}}\right)^{-3}$

9. $\left(\frac{27m^2n}{9mn}\right)^{-2}$

10. $\left(\frac{2a^2b^{-2}}{8a^{-3}b}\right)^{-4}$



depends on calc.

ON CALC. $4^{\frac{1}{2}}$ = 4 ^ (1 ÷ 2)

$4^{\wedge(1\div2)} = 2$

Warm-Up #2: Use your calculator to complete the following tables:

1. exponent is a fraction

x	$x^{\frac{1}{2}}$	
1	1	$1^{1/2}$
4	2	$4^{1/2}$
9	3	$9^{1/2}$
16	4	$16^{1/2}$
25	5	$25^{1/2}$

$\sqrt{4}=2$ $\sqrt{25}=5$

Explain the effect the exponent $\frac{1}{2}$ has on the value of x.

what is the pattern?

if exponent is $\frac{1}{2}$ = $\sqrt{x}$

Write a rule to describe this relationship:

$x^{\frac{1}{2}} = \sqrt{x}$ or $\sqrt{x}$

CALC:

9	3
16	4
25	5
36	6

$\sqrt{25}=5$

$9^{1/2}$ $16^{1/2}$ $25^{1/2}$ $36^{1/2}$

Write a rule to describe this relationship:

$x^{\frac{1}{2}} = \sqrt{x}$ or $\sqrt[2]{x}$

related.

CALC: $\sqrt[2]{\square}$ or $\sqrt{\square}$

2.

y	$y^{\frac{1}{3}}$
1	1
8	2
27	3
64	4
125	5
216	6

$\sqrt[3]{8}=2$ $\sqrt[3]{125}=5$

$1^{1/3}$ $8^{1/3}$ $27^{1/3}$ $64^{1/3}$ $125^{1/3}$ $216^{1/3}$

Explain what effect the exponent $\frac{1}{3}$ has on the value of y.

if the exponent is $\frac{1}{3}$ $= \sqrt[3]{y}$

Write a rule to describe this relationship:

$y^{\frac{1}{3}} = \sqrt[3]{y}$

CALC: $\sqrt[x]{\square}$ $\sqrt[y]{x}$

3. What do you think $x^{\frac{1}{4}}$ means? Test your prediction on your calculator letting $x = 16$.

$x^{\frac{1}{4}} = \sqrt[4]{x}$ $16^{\frac{1}{4}} = \sqrt[4]{16} = 2$

4. What would $x^{\frac{1}{n}}$ mean (as a radical)?

n = any integer

$x^{\frac{1}{n}} = \sqrt[n]{x}$

4 → $\sqrt[x]{\square}$ or $\sqrt[y]{x}$ → 1 → 6 → =

( )

$\frac{1}{2} = \sqrt[2]{\square}$

$\frac{1}{3} = \sqrt[3]{\square}$

$\frac{1}{4} = \sqrt[4]{\square}$

∴ etc.

2

Exponent Law:

write as a radical → solve

Exponent Laws	Example #1 (simplify & evaluate where possible)
Rational Exponents *(with numerator = 1)* $x^{\frac{1}{n}} = \sqrt[n]{x}$ $n = 1$	a) $100^{\frac{1}{2}} = \sqrt[2]{100} = 10$ (simplify, evaluate) b) $(-8)^{\frac{1}{3}} = \sqrt[3]{-8} = -2$ c) $1024^{\frac{1}{5}} = \sqrt[5]{1024} = 4$ d) $(625m^4)^{\frac{1}{4}} = \sqrt[4]{625m^4} = \sqrt[4]{625} \cdot \sqrt[4]{m^4}$ (cancel) $= 5 \cdot m = 5m$ e) $(81m)^{\frac{1}{4}} = \sqrt[4]{81m} = \sqrt[4]{81} \cdot \sqrt[4]{m} = 3 \cdot \sqrt[4]{m}$ (leave in radical form when can't simplify) f) $-343^{\frac{1}{3}} = \sqrt[3]{-343} = -7$ g) $(-49)^{\frac{1}{2}} = \sqrt[2]{-49} =$ no solution ($\sqrt[2]{\ominus} \neq$ no solution) h) $16^{\frac{-1}{4}}$ FLIP $= \frac{1}{16^{1/4}} = \frac{1}{\sqrt[4]{16}} = \frac{1}{2}$ i) $1000^{\frac{-1}{3}}$ FLIP $= \frac{1}{1000^{1/3}} = \frac{1}{\sqrt[3]{1000}} = \frac{1}{10}$

$*$ $\sqrt[2]{-x} \neq$ no answer; $\sqrt[3]{-x}$ ✓ ok! $= \ominus$; $\sqrt[4]{-x} \neq$ NO; $\sqrt[5]{-x}$ ✓ ok $\ominus$

EXPONENTIAL

Example #2: Simplify the following in ~~radical form~~

1. $\sqrt[2]{121}$ = square root = $\sqrt{x} = x^{\frac{1}{2}}$ (given) $= 121^{\frac{1}{2}}$
2. $\sqrt[5]{-32} = (-32)^{1/5}$ (opp #, $\ominus$ ok ✓)
3. $\frac{1}{\sqrt[3]{125}} = \frac{1}{125^{1/3}}$ FLIP $= 125^{-\frac{1}{3}}$
4. $10\sqrt{3xy} = 10 \cdot \sqrt[2]{3xy} = 10 \cdot (3xy)^{1/2} = 10(3xy)^{1/2}$

$-32^{1/5} \neq (-32)^{1/5}$; $-\sqrt[5]{32} \neq \sqrt[5]{-32}$

HW: p. 17 - 19

Mon Oct 29 - Review + Practice Test

Tues Oct 30 - Unit Test.

97. **Challenge #15**

If $\sqrt{9} \times \sqrt{9} = 9$,

and $9^a \times 9^a = 9$

Then what is the value of 'a'?

Explain:

98. **Challenge #16**

If $\sqrt[3]{2} \times \sqrt[3]{2} \times \sqrt[3]{2} = 2$,

and $2^a \times 2^a \times 2^a = 2$

Then what is the value of 'a'?

Explain:

99. Write a "rule" that relates a **rational** (fraction) **exponent** to an equivalent **radical expression**.

Rational Exponents in the form: $x^{\frac{1}{n}}$

Remember, *rational* often refers to fractions.

What does a rational exponent mean?

Recall: $\sqrt{9} \times \sqrt{9} = 9$.

But $9^{\frac{1}{2}} \times 9^{\frac{1}{2}} = 9$

And $3 \times 3 = 9$

So, $\sqrt{9} = 9^{\frac{1}{2}} = 3$

If $\sqrt[3]{2} \times \sqrt[3]{2} \times \sqrt[3]{2} = 2$

But $2^{\frac{1}{3}} \times 2^{\frac{1}{3}} \times 2^{\frac{1}{3}} = 2$

So, $\sqrt[3]{2} = 2^{\frac{1}{3}}$

100. Write another statement like the one to the left.

The Rule…

$$a^{\frac{1}{n}} = \sqrt[n]{a} \qquad \textit{and} \qquad a^{-\frac{1}{n}} = \frac{1}{\sqrt[n]{a}}$$

Evaluate or simplify the following.

101. $49^{\frac{1}{2}}$	102. $-16^{\frac{1}{2}}$	103. $(-16)^{\frac{1}{2}}$
104. $64^{\frac{1}{3}}$	105. $27^{-\frac{1}{3}}$	106. $32^{-\frac{1}{5}}$
107. $10000^{\frac{1}{4}}$	108. $(4x^2)^{\frac{1}{2}}$	109. $(27x^6)^{-\frac{1}{3}}$

Write in radical form.

110. $7^{\frac{1}{2}}$

111. $(3x)^{\frac{1}{3}}$

112. $4^{\frac{1}{5}}$

113. $4^{-\frac{1}{5}}$

114. $-64^{\frac{1}{3}}$

115. $64^{-\frac{1}{3}}$

Write in exponential form.

116. $\sqrt{13}$

117. $-3\sqrt{x}$

118. $\sqrt{2y}$

119. $\sqrt[4]{4}$

120. $\sqrt[7]{4}$

121. $\frac{1}{\sqrt[5]{3x}}$

Consider the following…

Step 1: $32^{\frac{3}{5}} = \left(32^{\frac{1}{5}}\right)^3$

Step 2: $32^{\frac{3}{5}} = \left(\sqrt[5]{32}\right)^3$

Step 3: $32^{\frac{3}{5}} = (2)^3$

Step 4: $32^{\frac{3}{5}} = 8$

122. Challenge #17. Complete the following as shown above.

Step 1: $27^{\frac{2}{3}} =$ Explain:_____

Step 2: $27^{\frac{2}{3}} =$ _____

Step 3: $27^{\frac{2}{3}} =$ _____

Step 4: $27^{\frac{2}{3}} =$ _____