Hwk Check

pg 222

8. Evaluate. Express answers in rational form.

a) $5^2(-10)^{-4}$ c) $\frac{12^{-1}}{(-4)^{-1}}$ e) $(8^{-1})\left(\frac{2^{-3}}{4^{-1}}\right)$

b) $16^{-1}(2^5)$ d) $\frac{(-9)^{-2}}{(3^{-1})^2}$ f) $\frac{(-5)^3(-25)^{-1}}{(-5)^{-2}}$

$$\frac{(-5)^3(-25)^{-1}}{(-5)^{-2}}$$

$$= \frac{-125\left(\frac{1}{-25}\right)}{\left(\frac{1}{-5}\right)^2}$$

$$\left(\frac{1}{-5}\right)^2 = \frac{1^2}{(-5)^2}$$

$$= \frac{5/1}{\frac{1}{25}}$$

$$= \frac{5}{1} \times \frac{25}{1} = 125$$

$$\frac{(-5)^3\left(-(5)^2\right)^{-1}}{(-5)^2}$$

$$= \frac{(-5)^3\left(-(5^{-2})\right)}{(-5)^{-2}}$$

$$= (-5)^5\left(-\frac{1}{5^2}\right)$$

$$= \frac{\left((-1)(5)\right)^5}{-5^2} = -\frac{(-1)^5(5)^5}{5^2}$$

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

$$= +125$$

7 b) $(-3)^{-1} + 4^0 - 6^{-1}$

$$= -\frac{1}{3} + 1 - \frac{1}{6}$$

$$= \frac{-2+6-1}{6} = \frac{3}{6} = \frac{1}{2}$$

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

Chapter 4 – Exponential Functions

$2^3 = 2 \times 2 \times 2$

4.3 – Rational Exponents

$2^{-3} = \left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$

A **rational** exponent can be a **fraction**. For example we can consider the number $(16)^{\frac{3}{4}}$. Of course, the question we need to ask is:

What the rip is that thing??

As you know, a fraction has two parts: a numerator, and a denominator. When a fraction is used as an exponent, the two parts of the fraction carry two related (but different) meanings in terms of "powers".

Recall that 4^3 means $4 \times 4 \times 4$. Now $4^{\frac{1}{2}}$ does not mean $4 \div 4$! Your text has a nice explanation of the meaning of numbers like $4^{\frac{1}{2}}$. See (i.e. **READ** examples 1 and 2 on pages 224 and 225. For now, we will simply take the meaning of

roots : $4^{\frac{1}{2}}$ means : Some # "a" which when multiplied by itself twice, the answer would be 4

Definition 4.3.1

> Given a power with a "rational" (fractional) exponent $a^{\frac{m}{n}}$, the numerator of the exponent is a "power", and the denominator represents a "root".

e.g. For the number $16^{\frac{3}{4}}$

separate the numerator from the denominator

$$16^{\frac{3}{4}} = \left(16^{\frac{1}{4}}\right)^3$$
$$= (2)^3$$
$$= 8$$

$\left(16^3\right)^{\frac{1}{4}}$

makes the root part too big

Note:
$16^{\frac{1}{4}}$ MEANS Some number 'a' has the property $a^4 = 16$
$\Rightarrow a = 2$

Always evaluate the "root part" first.

$\sqrt{\ }$ square root

$\sqrt[n]{\ }$ means "n^{th} root"

Example 4.3.1

From your text: Pg. 229 #2.

Write in exponent form, and then evaluate:

a) $\sqrt[9]{512}$

$= (512)^{\frac{1}{9}}$

$= 2$

c) $\sqrt[3]{27^2}$

$= \left(27^2\right)^{\frac{1}{3}}$

$= \left(27^{\frac{1}{3}}\right)^2$

$= 3^2$

$= 9$

b) $\sqrt[3]{-27}$

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

$= -3$

Note: We **CANNOT** take an **Even Root** of a **negative radicand**.
We **CAN** take an **Odd Root** of a negative radicand, however.

f) $\sqrt[4]{\left(\frac{16}{81}\right)^{-1}}$

$= \left(\left(\frac{16}{81}\right)^{-1}\right)^{\frac{1}{4}}$

$= \left(\frac{81}{16}\right)^{\frac{1}{4}} = \frac{81^{\frac{1}{4}}}{16^{\frac{1}{4}}} = \frac{3}{2}$

Example 4.3.2

From your text: Pg. 229 #3

Write as a single power:

a) $\left(8^{\frac{2}{3}}\right)\left(8^{\frac{1}{3}}\right)$

$= 8^{2/3 + \frac{1}{3}}$

$= 8^1$

$= 8$

b) $8^{\frac{2}{3}} \div 8^{\frac{1}{3}}$

$= 8^{2/3 - \frac{1}{3}}$

$= 8^{\frac{1}{3}}$

$= 2$

Example 4.3.3

From your text: Pg. 229 #4

Write as a single power, then **evaluate**. Express answers in **rational form**.

a) $\sqrt{5} \cdot \sqrt{5}$

$= (5)^{\frac{1}{2}} \cdot (5)^{\frac{1}{2}}$

$= 5^{\frac{1}{2}+\frac{1}{2}}$

$= 5^1 = 5$

b) $\dfrac{\sqrt[3]{-16}}{\sqrt[3]{2}}$ $= \dfrac{(-16)^{\frac{1}{3}}}{(2)^{\frac{1}{3}}}$

$= \left(-\dfrac{16}{2}\right)^{\frac{1}{3}}$

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

$= -2$

Class/Homework: Pg. 229 #2de, 3cdef, 4cd, 5, 6, 8

10 (a question of awesomeness)

12 (we may take up next day)