

Chapter 4 – Exponential Functions

4.2 – Working With Integer Exponents Homework: pg 221 #1,2,4,5,6,7,8,18 (3 of each)

Laws of Exponents: (when bases are the same)

1. Product Rule (multiplying)

$$4^3 \times 4^2 =$$

$$a^m \times a^n =$$

Law:

Laws of Exponents: (when bases are the same)

2. Quotient Rule (dividing)

$$\frac{5^6}{5^2} =$$

$$\frac{a^m}{a^n} =$$

Law:

Laws of Exponents: (when bases are the same)

3. Power Law

$$(3^2)^4 =$$

$$(a^m)^n =$$

Law:

Laws of Exponents: (when bases are the same)

4. Zero Law

$$7^0 =$$

$$\frac{7^2}{7^2} =$$

$$\frac{7^2}{7^2} =$$

$$(2000^{1001})^0 =$$

Law:

Laws of Exponents: (when bases are the same)

5. Negative Exponent Law

Law: A negative exponent means the reciprocal.

Exponent	-3	-2	-1	0	1	2	3	4	5
Base	4^{-3}	4^{-2}	4^{-1}	4^0	4^1	4^2	4^3	4^4	4^5
Result				1	4	16	64	256	1024

$$4^{-4} = \frac{1}{4^4} = \frac{1}{256} \quad \frac{1}{4^{-2}} = 4^2 = 16 \quad \frac{3^{-3}}{4^{-2}} = \frac{4^2}{3^3} = \frac{16}{27}$$

Examples: Simplify, then evaluate.

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

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

$$\left[\frac{(4^6)(4^3)}{(4^2)(4^7)} \right]^{-2}$$

Three questions...

What exponent on 9 is equivalent to $\sqrt{9}$?

Why does $\sqrt{x^6} = x^3$?

How can you evaluate $4^{\frac{3}{2}}$?

Note:

A square root is $\sqrt{x}$ or $^2\sqrt{x}$, but we don't typically put the 2 in the "hook" because it is the lowest radical.

A cubic root is $^3\sqrt{x}$, meaning "what number do you multiply by itself 3 times to get x". Ex: $^3\sqrt{64} = 4$ because $4^3 = 64$.

A 4th root is $^4\sqrt{x}$. Ex: $^4\sqrt{16} = 2$ because $2^4 = 16$.

Let's make a mathematical leap of logic:

If $\sqrt{x} = x^{\frac{1}{2}}$, then does $^3\sqrt{x} = x^{\frac{1}{3}}$ and $^4\sqrt{x} = x^{\frac{1}{4}}$?

The "rule":

$$^n\sqrt{x^m} = (x^m)^{\frac{1}{n}} = x^{\frac{m}{n}}$$

ex: $^5\sqrt{6^2} = 6^{\frac{2}{5}}$

Examples: Simplify, then evaluate.

$$81^{0.25}$$

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

$$\frac{64^{\frac{4}{3}}}{64}$$

Examples: Simplify, then evaluate.

$$\left[\frac{\sqrt[4]{5^8}}{\sqrt[3]{25^6}}\right]^{-2}$$

$$4^{-2} + \sqrt[3]{27^{-1}} - 8^0$$

4.4 – Algebraic Expressions

Homework: pg 236 #1,2,4-9 (half of each)

$$\frac{(n^{-4})(n^{-6})}{(n^{-2})^7}$$

$$\frac{(-2x^5)^3}{8x^{10}}$$

$$\frac{(4r^{-6})(-2r^2)^5}{(-2r)^4}$$

$$\frac{\sqrt[6]{(8x^6)^2}}{\sqrt[4]{625x^8}}$$

$$\frac{(mn^3)^{-\frac{1}{2}}}{m^{\frac{1}{2}}n^{-\frac{5}{2}}}$$

$$\sqrt{\frac{9b^3(ab)^2}{(a^2b^3)^3}}$$

4.7 – Applications Involving Exponential Functions

Homework: pg 261 #1-12,15,16,17

The exponential function equation is:

$$f(x) = ab^x$$

A population of 320 frogs grows at a rate of 4.5% per year. How many frogs will there be in 15 years?

A new car depreciates at a rate of 20% per year.
Steve bought a new car for \$26,000.

a) How much will Steve's car be worth in 3 years?

b) When will Steve's car be worth \$4000?

Unfortunately, its not always that simple....

A 200g sample of radio-active material has a half-life of 138 days. How much will be left in 5 years?