

Unit 5, Page 2

Objectives: I can simplify expressions involving integral exponents.

Negative Exponents

Complete the following tables. Leave all answers as integers or fractions.

2^5	32
2^4	16
2^3	8
2^2	4
2^1	2
2^0	1
2^{-1}	$\frac{1}{2}$
2^{-2}	$\frac{1}{4}$
2^{-3}	$\frac{1}{8}$

($\div 2$ or $\times \frac{1}{2}$)
 $\times \frac{1}{2}$
 $\times \frac{1}{2}$
 $\times \frac{1}{2}$
 $\times \frac{1}{2}$
 $\times \frac{1}{2}$

3^5	243
3^4	81
3^3	27
3^2	9
3^1	3
3^0	1
3^{-1}	$\frac{1}{3}$
3^{-2}	$\frac{1}{9}$
3^{-3}	$\frac{1}{27}$

($\div 3$ or $\times \frac{1}{3}$)
 $\times \frac{1}{3}$
 $\times \frac{1}{3}$
 $\times \frac{1}{3}$
 $\times \frac{1}{3}$
 $\times \frac{1}{3}$

Powers of 10! ($\div 10$ or $\times 10$)

10^5	100,000
10^4	10,000
10^3	1,000
10^2	100
10^1	10
10^0	1
10^{-1}	$\frac{1}{10}$
10^{-2}	$\frac{1}{100}$
10^{-3}	$\frac{1}{1,000}$

$\times \frac{1}{10}$
 $\times \frac{1}{10}$
 $\times \frac{1}{10}$
 $\times \frac{1}{10}$
 $\times \frac{1}{10}$
 $\times \frac{1}{10}$
 $\frac{1}{10^1}$
 $\frac{1}{10^2}$
 $\frac{1}{10^3}$

* Any base raised to the zero power is 1!

Solving Negative Exponents

You already know that an exponent represents the number of times you have to multiply a number by itself. For example, 2^4 means $2 \times 2 \times 2 \times 2$. But what if your variable is being raised to a negative exponent? If you were given 2^{-4} , how would you multiply two by itself negative four times?

A negative exponent is equivalent to the inverse of the same number with a positive exponent. In other words:

* Negative exponents result in fractions

$$\frac{x^{-7}}{1} = \frac{1}{x^7}$$

STEPS

- 1) When a base has a negative exponent, move the base to the denominator or under 1.
- 2) Change the exponent to a positive value

There is nothing special about solving a problem that includes negative exponentials. It's just an intermediate step that you may or may not want to complete to make things simpler. The best way to get comfortable with negative exponents is to work a few example problems that use them. Here are some samples:

$$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

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

Negative not grouped with the base

$$-4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

Negative is grouped with the base!

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

not grouped with base!

Any number raised to the zero power is 1!

$$-4^0 = -1$$