Name _____ Date _____

Aim: What are the laws of exponents?

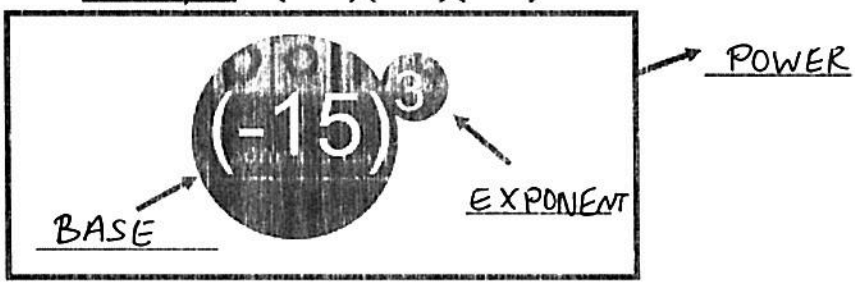
DO NOW:

What are exponents and when do we use them?

An exponent states the number of times a number/variable is used as a factor in a multiplication expression

Power: a repeated multiplication of the same factor

Example: (-15)(-15)(-15)



Power	Base	Exponent	Evaluate
$(-4)^3$	-4	3	$(-4)(-4)(-4) = -64$
-7^4	7	4	$(7)(7)(7)(7) = 2401$ -2401
2^0	2	0	1
2^{-3}	2	-3	$2^{\frac{1}{3}} = \frac{1}{8}$

Law 1: $a^0 = 1$ for all values of a except 0. 0^0 = indeterminate

---

1.) 987^0 [1]

2.) x^0 [1]

3.) x^1y^4 $1 \cdot y^4$ [y^4]

4.) $(87x)^0$ [1]

5.) $87x^0$ $87 \cdot x^0$ $87 \cdot 1$ [87]

Law 2: $a^{-n} = \frac{1}{a^n}$

(reciprocal of the same base to the positive exponent)

What about negative exponents? Let's look at the patter

2^2	4
2^1	2
2^0	1
2^{-1}	$\frac{1}{2^1} = \frac{1}{2}$
2^{-2}	$\frac{1}{2^2} = \frac{1}{4}$
2^{-3}	$\frac{1}{2^3} = \frac{1}{8}$

Negative Exponent Practice

Write the expression using only positive exponents. (Don't evaluate)

1) 7^{-5} $\frac{1}{7^5}$

2) $(-9)^{-3}$ $\frac{1}{(-9)^3}$

3) a^{-8} $\frac{1}{a^8}$

4) y^{-10} $\frac{1}{y^{10}}$

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

6) x^0y^{-3} $1 \cdot \frac{1}{y^3}$ $\frac{1}{y^3}$

Evaluate each of the following expressions.

7) 3^{-2} $\frac{1}{3^2}$ $\frac{1}{9}$

8) 4^{-3} $\frac{1}{4^3}$ $\frac{1}{64}$

9) 5^{-4} $\frac{1}{5^4}$ $\frac{1}{625}$

10) 99^0 1

11) 1^{-99} $\frac{1}{1^{99}}$ 1

Mixed Practice

Simplify each expression using ONLY positive exponents. Evaluate where possible

a. 3^{-2} $\frac{1}{3^2}$ $\frac{1}{9}$

b. 7^0 1

c. n^0n^4 $1 \cdot n^4$ n^4

d. $x^{-6}y^4$ $\frac{1}{x^6} \cdot \frac{y^4}{1} = \frac{y^4}{x^6}$

e. Which expressions are equivalent to 64? Select all that apply.

- ☒ 2^6 64
- ☐ -2^6 -64
- ☒ $(-8)^2$ 64
- ☒ 64^1 64
- ☒ 4^3 64
- ☐ 8^{-2} $\frac{1}{64}$
- ☐ $(-4)^3$ -64
- ☐ 64^{-1} $\frac{1}{64}$
- ☒ $(-2)^6$ 64
- ☒ 8^2 64

f. Answer True or False for each statement.

(i) $\frac{1}{25} = 5^{-2}$ TRUE / (ii) $(-14)^0 = 0$ FALSE 1 / (iii) $(-2)^3 = \frac{1}{2^3}$ FALSE -8 / (iv) $2x^{-3} = \frac{1}{2x^3}$ FALSE $\frac{2}{x^3}$

The TAKE AWAY

For all non-zero values of a:

$a^0 =$ 1

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