Day 2 – Integer Exponents

By the end of the period, you will be able to:

→ Understand what happens when a base is raised to an exponent of 0 or a negative exponent

→ Simplify and evaluate expressions that involve negative and 0 exponents

Warm - up

- Simplify → Express as a power

a) $4^6 \times 4^7$

b) $4x^9 \times 4x^5$

c) $(2x)^4 \div (2x)^3$

d) $(4^3)^3$

e) $(4x^3)^3$

f) $4(x^3)^3$

g) $\dfrac{45x^7y^4}{9xy^3}$

h) $\dfrac{(4x^4y^5)^2}{8xy^3}$

Sometimes two powers with a different base can be expressed as powers with the same base…

- a) ***Rewrite*** 64^3 as a power with a base of 4.

$$= 4^9$$

Your Turn…

Rewrite 9^3 as a power with a base of 3.

- b) ***Rewrite*** with a <u>common base</u> then simplify.

$$(9^2)(3^2)$$

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

$$= 3^6$$

Try it Yourself…

$$(4^4)(2^5)$$

$$= (2^8)(2^5)$$

$$= 2^{13}$$

Powers with the exponent of 0

- See if you notice a pattern…

What is happening to the numbers as we move down???

$2^4 = 16$

$\div 2$

$2^3 = 8$

$\div 2$

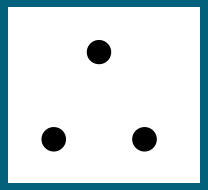
$2^2 = 4$

$\div 2$

$2^1 = 2$

$\therefore$

$2^0 = 1$



$a^0 = 1, \quad when \quad a \neq 0$

→ In fact, any number to the exponent 0 is equal to 1

Here's another way to look at it…

- Simplify: $7^2 \div 7^2 = 7^0$

OK , Now let's evaluate the expression first…

$$7^2 \div 7^2 = 49 \div 49 = 1$$

$$\text{so } 7^0 = 1$$

In general, anything with a zero exponent equals **ONE.**

Powers with Negative Exponents

Lets continue the pattern shall we?...

$2^4 = 16$

$2^3 = 8$

$2^2 = 4$

$2^1 = 2$

$2^0 = 1$

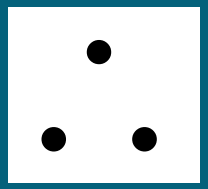
$2^{-1} =$ $\div 2$ $\frac{1}{2}$ *or* $\frac{1}{2^1}$

$2^{-2} =$ $\div 2$ $\frac{1}{4}$ *or* $\frac{1}{2^2}$

$2^{-3} =$ $\div 2$ $\frac{1}{8}$ *or* $\frac{1}{2^3}$

All we did was continue the pattern to reveal what happens with negative exponents, therefore we can conclude that:

A <u>negative</u> exponent implies a **<u>reciprocal</u>** raised to the same **<u>POSITIVE</u>** exponent.



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

Heres another way to look at it.

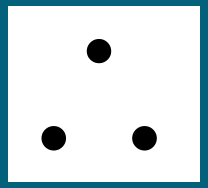
- Simplify: $7^2 \div 7^5 = 7^{-3}$

OK , Now let's expand the expression first…

$$7^2 \div 7^5 = \frac{\cancel{7} \times \cancel{7}}{\cancel{7} \times \cancel{7} \times 7 \times 7 \times 7} = \frac{1}{7^3}$$

$$so\ 7^{-3} = \frac{1}{7^3}$$

A fractional base raised to a **negative** exponent is equal to the reciprocal of the fraction raised to the **same positive exponent**.



$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$$

Simplify: $\left(\frac{3}{4}\right)^{-3} = \left(\frac{4}{3}\right)^{3}$

FOR YOUR INFORMATION

- Exponential Terminology

Simplify – Means that the end result should be in the form of a power.

$$ex. \quad 3^2 \times 3^2 = 3^4$$

Evaluate – Means that the end result should be a non-power

$$ex. \quad 3^2 \times 3^2 = 3^4 = 81$$