Negative Indices

We will be exploring two questions in this lesson:

- Can a quantity be raised to a negative power?
- If so, what is the **rule** for raising a quantity to a negative power?

Which of these maths sentences can you complete?

$2^{-1} =$ $2^{-2} =$

$2^{-3} =$ $2^{-4} =$

$10^{-1} =$ $10^{-2} =$

$10^{-3} =$ $10^{-4} =$

$a^{-1} =$ $a^{-2} =$

$a^{-3} =$ $a^{-4} =$

$a^{-n} =$

Can you show WHY this pattern holds?

First……

$2 + 3 = 5$

and

$4 + 1 = 5$

Since 2 + 3 and 4 + 1 both equal 5, it follows that 2 + 3 = 4 + 1

In general:
If $A = C$ and $B = C$, then $A = B$.

In words…
If two quantities are both equal to a third quantity, then they are equal to each other.

The fancy name for this is:
The Transitive Axiom of Equality.
We can use The Transitive Axiom of Equality to answer this question:

What is $a^2 \div a^5$?

Solution 1

$$a^2 \div a^5$$
$$= \frac{a \times a}{a \times a \times a \times a \times a}$$
$$=$$
$$=$$

Solution 2

$$a^2 \div a^5$$
$$= a^{2-5}$$
$$=$$

So $a^2 \div a^5 = a^{-3}$ and $a^2 \div a^5 = \frac{1}{a^3}$

Using the Transitive Axiom of Equality,

$$a^{-3} = \frac{1}{a^3}$$

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

In words, raising a quantity to a negative power is equal to the **reciprocal** of the positive power.