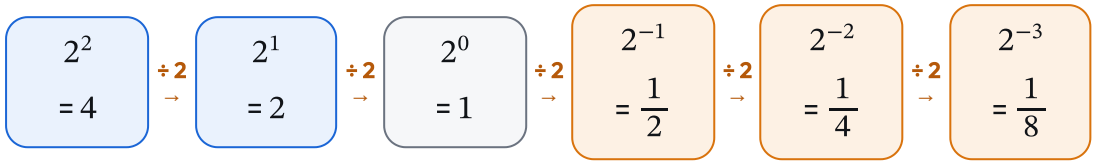
Names (pair) _____ Date _____

Powers with a Negative Exponent

Example

Continue the staircase down, past zero. Each step still divides by 2:



2^{-3} means: start from 1 and **divide by 2 three times**. That is $1 \div 2 \div 2 \div 2 = \frac{1}{8}$, a positive number less than 1.

Remember

For every number $a \neq 0$ and whole number n, $a^{-n} = \frac{1}{a^n}$. A minus up top does not mean a negative answer; it means **dividing**: $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$. This is also an agreement that keeps the rules: the staircase continues with the same division.

1 ON YOUR OWN Complete the staircases. Each step to the right divides by the same number. Write values less than 1 as fractions.

3	$3^2 = 9$	$3^1 =$ ☐	$3^0 =$ ☐	$3^{-1} =$ ☐	$3^{-2} =$ ☐	$3^{-3} =$ ☐
10	$10^2 = 100$	$10^1 =$ ☐	$10^0 =$ ☐	$10^{-1} =$ ☐	$10^{-2} =$ ☐	$10^{-3} =$ ☐

2 ON YOUR OWN Write as a fraction, then as a decimal where it is easy.

$5^{-1} =$ ☐ $=$ ☐ $\quad 2^{-4} =$ ☐ $=$ ☐

$10^{-2} =$ ☐ $=$ ☐ $\quad 10^{-3} =$ ☐ $=$ ☐

Names (pair) _____ Date _____

3 IN PAIRS **When the denominator is bigger.** Work out $2^2 \div 2^5$ in two ways: by cancelling factors, and with the rule "subtract the number of factors". What do you conclude?

by cancelling

$$\frac{2 \times 2}{2 \times 2 \times 2 \times 2 \times 2} = \frac{1}{\square}$$

with the rule

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

So $2^{-3} = \square$

4 IN PAIRS True or false? Correct the false statements.

a) $2^{-3} = -8$ **true** / **false**

Correction: _____

b) $2^{-3} = -6$ **true** / **false**

Correction: _____

c) $10^{-2} = 0.01$ **true** / **false**

Correction: _____

d) 5^{-1} **is a negative number.** **true** / **false**

Correction: _____

5 IN PAIRS Put in order from smallest to largest.

2^{-1} 2^0 2^{-3} 2^2 2^{-2}

The Powers app · otooly.com/powers

Starting from 1 mode: press **÷ 2** three times and look at the picture: 2^{-3} is an eighth of the square, and the step counter is at -3.

★ ON YOUR OWN **Exit card.** $3^{-2} = \square$ Is 3^{-2} a negative number? **yes** / **no**