Which would you pick: $2 today, doubled each following day for a week or $150 right now?

Exponential Notation

$$2^3 = 8$$

$$\text{base}^{\text{exponent}} = \text{power}$$

Remember that $2^3 = 2 \times 2 \times 2$ and **NOT** 2×3

100 times

$2^{100} = ?$ $\quad 2 \times 2 + \ldots \times 2$

Key rule: $a^m = \underbrace{a \times a \times \ldots \times a}_{m \text{ times}}$

for $m > 1$

What if we have 2^1? Or 2^0? Or 2^{-1}?

$$2^1 = 2 \qquad 2^0 = 1 \qquad 2^{-1} = \frac{1}{2}$$

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

$a^1 = a$ $\qquad\qquad$ $a^0 = 1$ $\qquad\qquad$ $a^{-m} = \dfrac{1}{\underbrace{a \times \ldots \times a}_{m \text{ times}}}$

reciprocal

What if the exponent is a fraction?

$$4^{\frac{1}{2}} = ? \quad \sqrt[2]{4^1}$$

$$4 \times \frac{1}{2} \quad 9^{\frac{1}{2}} =$$

$$a^{\frac{1}{2}} = \sqrt{a}$$

Note: the number can **NOT** be negative

$$\sqrt{-1}$$

$$4^{\frac{1}{3}} = \sqrt[3]{4}$$

$$4^{\frac{4}{9}} = \sqrt[9]{4^4}$$

$$a^{\frac{1}{3}} = \sqrt[3]{a}$$

Can "a" be negative here?

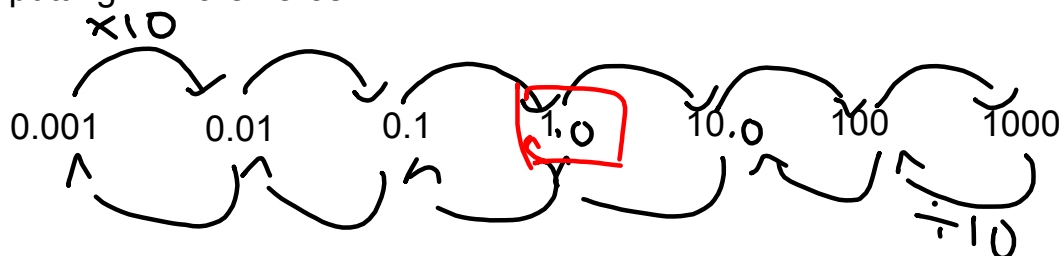$$(-8)^{\frac{1}{3}} = -2$$

Yes!

$$-2 \cdot -2 -2 = -8$$

Scientific Notation

- helps us write very small and very big numbers more quickly

e.g. the sun is 150 000 000 km away from the earth vs. the sun is 1.5×10^8 km from the earth

Why it works

Multiplying or dividing by 10 helps us to move decimal places by putting in more zeros.

$$0.001 \quad 0.01 \quad 0.1 \quad 1.0 \quad 10.0 \quad 100 \quad 1000$$

How it works

1. Find the first non-zero digit.

2. Count how many numbers there are before or after it until you get to where the decimal would be. This is your exponent.

3. Put the decimal right after the first non-zero digit, and copy the numbers until there are only zeros left.

4. Follow this number with x 10 with the exponent you got in 2.

150 000 000.0

1.5×10^8

0.000 0023

2.3×10^{-6}
2.3×10^{-7}

2.3×10^{-6}

HW: p. 101-103 #1, 2, 5, 9