

2.2 Powers of Ten and the Zero Exponent

This table shows decreasing powers of 10.

Number in Words	Standard Form	Power
One billion	1 000 000 000	10^9
One hundred million	100 000 000	10^8
Ten million	10 000 000	10^7
One million	1 000 000	10^6
One hundred thousand	100 000	10^5
Ten thousand	10 000	10^4
One thousand	1 000	10^3
One hundred	100	10^2
Ten	10	10^1
One	1	10^0

We can use the pattern in the exponents to write 1 as 10^0 . In fact, we could make a similar table for the powers of any integer base except 0. So 1 can be written as any power with exponent 0. This is a law.

Zero Exponent Law

A power with an integer base, other than 0, and an exponent 0 is equal to 1.

$$n^0 = 1, \quad n \neq 0$$

Example #1: Evaluating Powers with Exponent Zero

Evaluate each expression.

a) 4^0

b) -4^0

c) $(-4)^0$

► A Solution

A power with exponent 0 is equal to 1.

a) $4^0 = 1$

b) $-4^0 = -1$

c) $(-4)^0 = 1$

Example #2: Writing Numbers Using Powers of Ten

Write 3452 using powers of 10.

A Solution

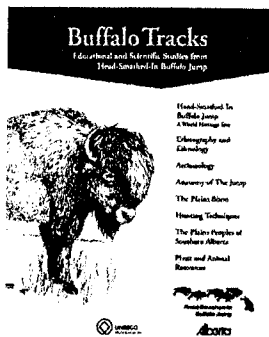
Use a place-value chart.

Thousands	Hundreds	Tens	Ones
3	4	5	2

$$\begin{aligned} 3452 &= 3000 + 400 + 50 + 2 \\ &= (3 \times 1000) + (4 \times 100) + (5 \times 10) + (2 \times 1) \quad \text{We use brackets for clarity.} \\ &= (3 \times 10^3) + (4 \times 10^2) + (5 \times 10^1) + (2 \times 10^0) \end{aligned}$$

Example 3

Interpreting Numbers in the Media



Head-Smashed-In Buffalo Jump is a UNESCO World Heritage Site in Southern Alberta. This site covers 600 hectares and contains cultural remains used in the communal hunting of buffalo. Head-Smashed-In was first used for hunting bison at least 5700 years ago and perhaps as early as 10 000 years ago. It is estimated that close to sixty million Plains Bison roamed the prairies prior to the Europeans' arrival in Western Canada. Less than one hundred years later, fewer than 1000 animals remained.

Use powers of 10 to write each number in the above paragraph.

A Solution

$$\begin{aligned} 600 &= 6 \times 100 \\ &= 6 \times 10^2 \\ 5700 &= 5000 + 700 \\ &= (5 \times 1000) + (7 \times 100) \\ &= (5 \times 10^3) + (7 \times 10^2) \\ 10\,000 &= 1 \times 10^4 \\ 60\,000\,000 &= 6 \times 10\,000\,000 \\ &= 6 \times 10^7 \\ 100 &= 1 \times 10^2 \\ 1000 &= 1 \times 10^3 \end{aligned}$$