

2.2 – The Zero Exponent Law and Powers of Ten

INVESTIGATE

- Choose a number between 1 and 10 as your base: 7
- Use the exponents 5, 4, 3, 2, 1, 0 to complete the table below, writing the power, the power as repeated multiplication and in standard form.

Exponent	Power	Repeated Multiplication	Standard Form
5	7^5	$7 \times 7 \times 7 \times 7 \times 7$	16807
4	7^4	$7 \times 7 \times 7 \times 7$	2401
3	7^3	$7 \times 7 \times 7$	343
2	7^2	7×7	49
1	7^1	7	7
0	7^0	N/A	1

Note: Handwritten blue arrows on the right side of the table indicate a downward sequence of divisions by 7: 16807 ÷ 7 = 2401, 2401 ÷ 7 = 343, 343 ÷ 7 = 49, 49 ÷ 7 = 7, 7 ÷ 7 = 1.

3. Describe any pattern you see:
 eg. Divide by base each time we move down standard form column

- Continue the patterns to complete the last entry in the table above.
- Compare the result of the "standard form" in the last entry with a partner that chose a different base. What do you notice? What can you conclude about any number to the power of zero?

Any number to the power zero = 1

This table shows decreasing powers of 10. Notice the patterns in the table.

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

$0^0 = 0$

Zero Exponent Law: $a^0 = 1$ (where $a \neq 0$)

We can make sense of the Zero Exponent Law by looking at patterns in decreasing powers of the same base:

Ex. 1: Evaluate.

(a) $4^0 = 1$ (b) $(-4)^0 = 1$ (c) $-4^0 = -1$ (d) $\left(\frac{-3243 \times 41}{254}\right)^0 = 1$

Ex. 2: Write the following using powers of 10.

(a) 10 000 (b) 1 (c) 3 000 000
 10^4 10^0 3×10^6

(d) 43 000 000. (e) 835 000.
 $= 4.3 \times 10^7$ $= 835 \times 10^3$

Scientific Notation $= 4.3 \times 10^7$ $= 8.35 \times 10^5$

Assignment: Blue worksheet: 2.2 Practice