

At the end of this lesson, you should be able to:

- Read & write index notation for positive and negative powers (including base 10)
- Find the missing base or index of an index notation

Numbers, Operations & Algebra

INDEX NOTATION

$$\begin{array}{c} \text{index} \\ \swarrow \\ 2^3 = 2 \times 2 \times 2 \\ \nwarrow \\ \text{base} \end{array}$$

3 factors

$$5^4 = 5 \times 5 \times 5 \times 5$$

4 factors

$$81 = 9 \times 9 = 9^2$$

9^2 is the index form of 81 in the **base 9**

$$81 = 3 \times 3 \times 3 \times 3 = 3^4$$

3^4 is the index form of 81 in the **base 3**

RULES	EXAMPLES
Positive Index $a^n = a \times a \times \dots \times a$	$3^5 = 3 \times 3 \times 3 \times 3 \times 3$ $41 \cdot 41 \cdot 73 \cdot 73 \cdot 73 = 41^2 \cdot 73^3$ $(-3) \times (-3) \times (-3) \times (-3) = (-3)^4$
Zero Index $a^0 = 1$	$3^0 = 1$
Negative Index $a^{-n} = \frac{1}{a^n}$, given that $a \neq 0$	$6^{-2} = \frac{1}{6^2}$
Base 10	$10^3 = 10 \times 10 \times 10 = 1000$ (1 thousand) $10^2 = 10 \times 10 = 100$ (1 hundred) $10^0 = 1$ $10^{-1} = \frac{1}{10^1} = \frac{1}{10}$ $10^{-4} = \frac{1}{10^4} = \frac{1}{1000}$

EXERCISE

1. Fill in the missing index:

a. $8 \times 8 \times 8 \times 8 \times 8 = 8^{\square}$

b. $5 \times 5 = 5^{\square}$

c. $17 \times 17 \times 19 \times 19 = 17^{\square} \times 19^{\square}$

d. $11 \times 11 \times 11 \times 11 \times 13 \times 13 \times 13 = 11^{\square} \times 13^{\square}$

2. Fill in the blanks below

a. $100\,000 = 10^{\square}$

b. $\frac{1}{100000} = 10^{\square}$

c. $\frac{1}{100} = 10^{\square}$

d. $5^{-1} =$

e. $3^{-4} =$

f. $\frac{1}{2^3} =$