

## The Rules of Indices

**First rule:**

$$a^m \times a^n = a^{m+n}$$

$$x^2 \times x^3 = x^{2+3} = x^5$$

$$2^2 \times 2^3 = 2^{2+3} = 2^5 = 32$$

**Second rule:**

$$a^m \div a^n = a^{m-n}$$

$$x^5 \div x^3 = x^{5-3} = x^2$$

$$4^5 \div 4^3 = 4^{5-3} = 4^2 = 16$$

**Third rule:**

$$(a^m)^n = a^{m \times n} = a^{mn}$$

$$(x^2)^3 = x^{2 \times 3} = x^6$$

$$(2^2)^3 = 2^{2 \times 3} = 2^6 = 64$$

**Fourth rule:**

$$a^{-1} = \frac{1}{a} \text{ or more generally } a^{-m} = \frac{1}{a^m}$$

$$x^{-1} = \frac{1}{x}$$

$$3^{-1} = \frac{1}{3}$$

$$x^{-2} = \frac{1}{x^2}$$

$$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

**Fifth rule:**

$$a^{1/2} = \sqrt{a} \text{ or more generally } a^{1/n} = \sqrt[n]{a}$$

$$x^{1/2} = \sqrt{x}$$

$$9^{1/2} = \sqrt{9} = 3$$

$$x^{1/3} = \sqrt[3]{x}$$

$$8^{1/3} = \sqrt[3]{8} = 2$$

$$8^{2/3} = (\sqrt[3]{8})^2 = (2)^2 = 4$$

Those are the main 5 rules but there are two more things to be aware of:

$$x^0 = 1 \text{ Anything to the power of zero is equal to 1. i.e. } 23432^0 = 1$$

$$1^a = 1 \text{ 1 to the power of anything is equal to 1. i.e. } 1^{237} = 1$$