

# Math Notes

By me (Thanks to for the template [SirCharlieMars](#))

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# Chapter 1

## Algebra

### 1.1 Indices

#### Definition 1.1.1: Index Laws

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

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

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

4.  $a^{-m} = \frac{1}{a^m}$

5.  $a^0 = 1$

6.  $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

#### Example 1.1.1 (Laws In Action)

1.  $2^3 \times 2^7 = 2^{10}$

2.  $\frac{3^6}{3^2} = 3^4$

3.  $(5^2)^5 = 5^{10}$

4.  $7 \times 2^{-2} = \frac{7}{2^2}$

5.  $45^0 = 1$

6.  $5^{-\frac{3}{7}} = \frac{1}{\sqrt[7]{5^3}}$

#### Note:-

Indices are used extremely frequently and there are often multiple laws hidden in each question

## 1.2 Logarithms (Logs)

### Definition 1.2.1: Principle

The general equation is:

$$\log_{(a)}(y) = x \leftrightarrow a^x = y$$

For example:

$$\log_{10} 1 = 0 \leftrightarrow 10^0 = 1$$

To calculate logarithm:

$$\frac{\log_{(10)}(y)}{\log_{(10)}(a)}$$

### Definition 1.2.2: Laws

1.  $\log_{(a)}(x) + \log_{(a)}(y) = \log_{(a)}(xy)$
2.  $\log_{(a)}(x) - \log_{(a)}(y) = \log_{(a)}\left(\frac{x}{y}\right)$
3.  $\log_{(a)}(x^n) = n \log_{(a)}(x)$
4.  $\log_{(a)}(a) = 1$
5.  $\log_{(a)}(1) = 0$

To use these laws, the bases must be the same  $a$

### Example 1.2.1 (Laws In Action)

Round to two decimal place

1.  $\log_2 2 + \log_2 5 = \log_2 10 = 3.32$
2.  $\log_5 12 - \log_5 2 = \log_5 6 = 1.11$
3.  $\log_7 2^2 = 2 \times \log_7 2 = 0.71$
4.  $\log_{84} 84 = 1$
5.  $\log_{153} 1 = 0$

### Note:-

some calculators have a default log base of 10, this means  $\log_{10}(x) = \log(x)$

## 1.3 Quadratic Equations

### Definition 1.3.1: Formulae

A quadratic equation is an equation where the highest power is two.

The standard form quadratic equation:

$$ax^2 + bx + c = 0$$

where  $a, b, c$  are known.

The quadratic formula (can only be used by standard form equations):

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Completing the square

$$ax^2 + bx + c = 0 \rightarrow$$

The parabola:

$$y = ax^2 + bx + c$$

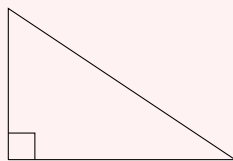
## Chapter 2

# Trigonometry

### 2.1 Right-Angled

#### Definition 2.1.1: Identification

A triangle is right-angled if it contains a right angle ( $90^\circ$ ):



#### Definition 2.1.2: Formulae

Pythagorean theorem  $c^2 = a^2 + b^2$  can find the exact length of the an unknown side given two other known sides.

Trigonometric Ratios are:

Sine:

$$\sin \theta = \frac{o}{h}$$

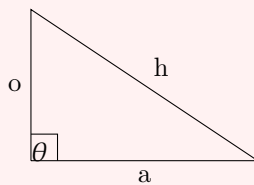
Cosine:

$$\cos \theta = \frac{a}{h}$$

Tangent:

$$\tan \theta = \frac{o}{a}$$

Where  $o$  is the opposite leg  $a$  is the adjacent leg,  $h$  is the hypotenuse,  $\theta$  is the angle.



**Note:-**

To remember the Trigonometric ratios, we can use *SOHCAHTOA*.

## 2.2 Non-Right-Angled