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. $\log_{(a)}(x) - \log_{a}(y) = \log_{(a)}(\frac{x}{y})$
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 quadtratic formula (can only be used by standard form equations):

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

Completing the square

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

The porabola:

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

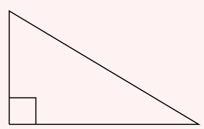
Chapter 2

Trigonometry

2.1 Right-Angled

Definition 2.1.1: Identification

A triangle is right-angled if it contains a right angle (90°):



Definition 2.1.2: Pythagorean Theorem

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

Definition 2.1.3: Finding sides

Trigonometric Ratios are:

Sine:

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

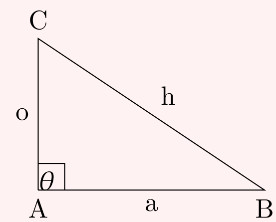
Cosine:

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

Tangent:

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

Where o is the opposite leg a is the adjacent leg, h is the hypotenuse, θ is the angle.



Definition 2.1.4: Finding Angles

θ can be found with Inverse Ratios.

$$\theta = \sin^{-1}\frac{o}{h}$$

$$\theta = \cos^{-1}\frac{a}{h}$$

$$\theta = \tan^{-1}\frac{o}{a}$$

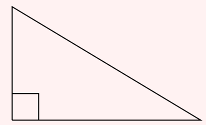
Note:-

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

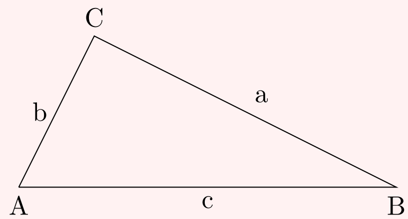
2.2 Non-Right-Angled

Definition 2.2.1: Identification

A triangle is non-right-angled if it does not contain a right angle (90°):



The general rule for keeping sides and angles uniform in a non-right-angled triangle is:



Definition 2.2.2: Sine Rule

The Sine Rule allows for angles and sides to be found within a non-right-angled triangle. To find a side using the Sine Rule, use:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

To find an angle using the Sine Rule, use:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Note:-

Using the Sine Rule requires two known sides/angles and a known side/angle

Definition 2.2.3: Cosine Rule

Like the Sine Rule, the Cosine Rule allows for angles and sides to be found within a non-right-angled triangle. The Cosine Rule is:

$$c^2 = a^2 + b^2 - 2ab\cos C$$