1 Measurement

1.1 Further Areas and Volumes

1.1.1 Percentage error

When measuring anything, there is a degree of error accompanied with the measurement that is equal to the smallest unit used in the measurement. For example, a ruler measuring in centimetres has an 'accuracy' of $\pm 0.5cm$.

1.1.2 Various formulae for areas and volumes

There are multiple shapes and composite volumes you'll need to be able to calculate in the HSC, but most revolve around the areas of spheres, cylinders, cones and rectangles:

SURFACE AREAS

$$\begin{aligned} A_{sphere} &= 4\pi r^2 \\ A_{cylinder\ \text{(closed)}} &= 2\pi r^2 + 2\pi rh \end{aligned}$$

VOLUMES

$$\begin{aligned} V_{sphere} &= \frac{4}{3}\pi r^3 \\ V_{cylinder} &= \pi r^2 h \\ V_{cone} &= \frac{1}{3}\pi r^2 h \\ &= V_{pyramid} \end{aligned}$$

1.1.3 Simpson's rule

Most of the time (in the real world), shapes are not perfect and do not take the form of polygons that we readily have area/volume formulae for. In this case, there are numerous methods of *approximating* the area/volume. One of those is **Simpson's rule**.

If we know the height/depth of the shape taken at multiple uniformly spaced intervals, we can easily determine a roughly correct value for the area/volume of that shape.

In finding the area of a shape with three values for height:

$$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$$

1.1.4 Annulus

The annulus is simply two circles of *different* radius sharing a common centre. These are called concentric circles. To determine the area of an annulus simply use:

$$A = \pi(R^2 - r^2)$$

1.2 Applications of Trigonometry

In year 11, you focused on looking at and analysing the right-angled triangle, with little/no consideration for non-right-angled triangles. In the HSC course, we extend our formulae to include non-right-angled triangles.

The General Maths 2 HSC course will require you to apply the formulae/content you learn about this to various topics, such as bearings, elevation/depression and surveys.

1.2.1 Area

If we know the length of two sides of a triangle, as well as the **angle formed by <u>those two sides</u>**, we can determine the area of that triangle.

$$A_{triangle} = \frac{1}{2}ab\sin C$$

1.2.2 Finding sides and angles in a triangle

With right-angled triangles, it is very simple to find all sides and angles given a bit of information. With non-right-angled triangles, it can come across as less straightforward, but it's important to commit the following to memory - doing so gives you easy marks in an exam.

SINE RULE

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

This rule is very common - it's essential that you know which angles/sides to use. Just remember that A/a, B/b, C/c correspond to <u>opposite</u> sides and angles.

COSINE RULE

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

Again, ensure you know which side corresponds to which. As well as this - remember that you

1.3 Spherical Geometry

Spherical geometry applies what we know about trigonometry to problems involving the Earth (effectively a sphere), using latitude/longitude.

1.3.1 Arc length and great/small circles

Arc length describes the length of a specific portion of the circumference of a circle. We calculate the arc length based on the angle made at the centre of the circle made by the two radii at each end of the arc.

$$l = \frac{\theta}{360}2\pi r$$

- **Great circle:** A circle drawn on a sphere whose radius is equal to that of the sphere.
- **Small circle:** All other circles drawn on a sphere.

On a sphere, we can draw infinitely many circles on the surface, each of different size. In the context of the earth, those circles are referred to as the lines of **latitude** and **longitude.**

- Lines of latitude: Parallel horizontal circles going from the north pole to the south pole
- Lines of longitude: Perpendicular to latitudinal lines, each intersecting with each other at the poles.

Which circles corresponding to latitudinal and longitudinal lines are great/small?

1.4 Time zones

When we calculate time zones, we use the fact that one degree of longitude is equal to rougly 4 minutes time difference.

In calculating the time in different parts of the world, given latitudinal/longitudinal coordinates, calculate the time difference using the shortest distance between the two locations