Cheatsheet - Trigonometry

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1. Intro

If $B = 90$, then AC is called the **hypotenuse**, the side **opposite** of θ is BC and the remaining side, AB, is **adjacent** to θ. Angle A is written as $\angle\mathrm{BAC}$, $\angle A$ or just A.

Each side of a triangle is named based on the lowercase letter of the angle opposite of the side.

$$a = \mathrm{BC}$$

$$b = \mathrm{AC}$$

$$c = \mathrm{AB}$$

The total degree of all angles is always 180°

$$A + B + C = 180^\circ$$

2. Convert Degree to Radiant

$$360^\circ = 2\pi \quad \mathrm{rads}$$

To convert x degrees to radians y:

$$x \cdot \frac{\pi}{180} = y$$

For example, 255°:

$$225 \cdot \frac{\pi}{180} \approx 3.93 \quad \mathrm{rads}$$

And in reverse:

$$3.93 \cdot \frac{180}{\pi} \approx 225^\circ$$

3. Trigonometrical Ratios

Sinus, *cosine* and *tangent* are trigonometric functions that can be applied to **right-angled triangles** to determine the degree of an angle. The degree of an angle is independent from the length of each side.

$$\sin\theta = \frac{\text{side opposite to} \quad \theta}{\text{hypotenuse}} = \frac{\mathrm{BC}}{\mathrm{AC}}$$

$$\cos\theta = \frac{\text{side adjacent to} \quad \theta}{\text{hypotenuse}} = \frac{\mathrm{AB}}{\mathrm{AC}}$$

$$\tan\theta = \frac{\text{side opposite to} \quad \theta}{\text{side adjacent to} \quad \theta} = \frac{\mathrm{BC}}{\mathrm{AB}}$$

Sinus and *cosine* are always less than one.

$$\sin x \leq 1$$

$$\cos x \leq 1$$

The ratio of an angle can be reversed.

$$\sin 45^\circ = 0.70710678$$

$$\sin^{-1} 0.70710678 = 45^\circ$$

4. Pythagoras, Sinus and Cosine Rule

For any **right-angled** triangle, the following theorem applies:

$$a^2 + b^2 = c^2$$

$$\sqrt{a^2 + b^2} = c$$

where c is the hypotenuse. For any right-angled, acute and obtuse (non right-angled) triangles, the sinus and cosine rules apply:

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

and:

$$
\begin{aligned}
a^2 &= b^2 + c^2 - 2bc\cos A \\
b^2 &= a^2 + c^2 - 2ac\cos B \\
c^2 &= a^2 + b^2 - 2ab\cos C
\end{aligned}
$$

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