TRIGONOMETRY

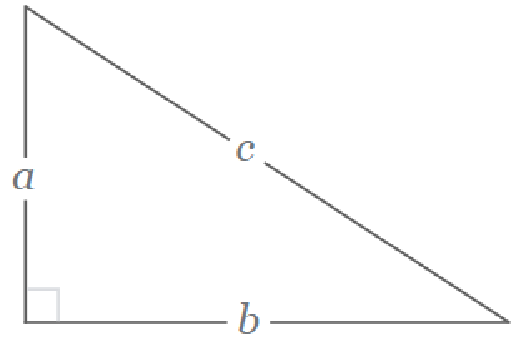
Before we start…

Previously from Chapter 1 of shapes, we have touched the triangle briefly. For this topic, Pythagoras theorem is heavily related, and this theorem is only usable on right-angled triangle.

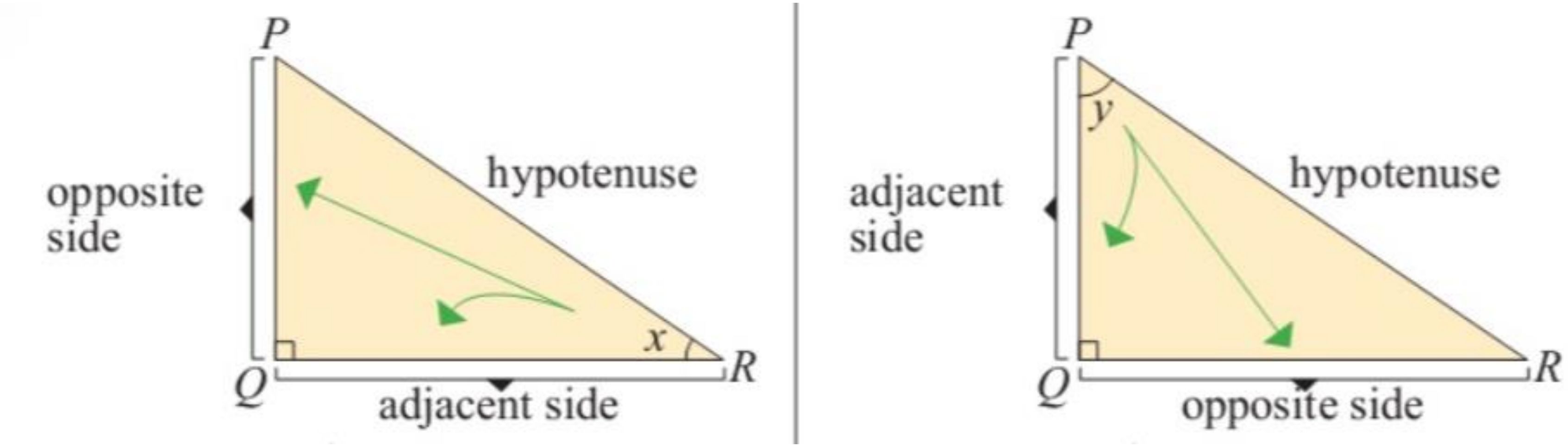
What is **Pythagoras Theorem**?

It refers to the sum of the areas of the two squares on the legs (a and b) equals the area of the square on the **hypotenuse** (c).

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



Adjacent Side + Opposite Side

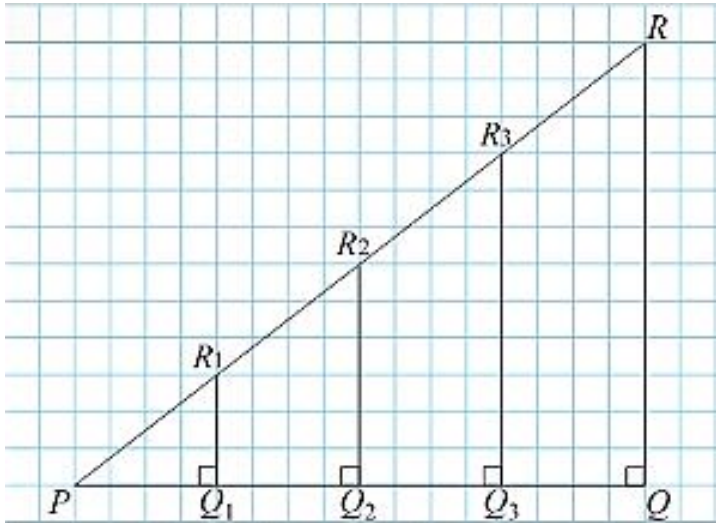


For a right-angled triangle:

a) The hypotenuse is the **longest** side which is **opposite** the **90° angle**
b) The adjacent side and the opposite side **change** based on the **position of the referred acute angle**.

Sine, Cosine, Tangent

Let's try to understand the relationship between acute angles and the ratios of the sides of right-angled triangles.



Sine, Cosine, Tangent

Based on the chart above, try to fill the table below:

Acute angle	$\frac{\text{Opposite side}}{\text{Hypotenuse}}$	$\frac{\text{Adjacent side}}{\text{Hypotenuse}}$	$\frac{\text{Opposite side}}{\text{Adjacent side}}$
$\angle QPR$	$\frac{R_1Q_1}{PR_1} = \frac{3}{5}$	$\frac{PQ_1}{PR_1} = \frac{4}{5}$	$\frac{R_1Q_1}{PQ_1} = \frac{3}{4}$
	$\frac{R_2Q_2}{PR_2} =$	$\frac{PQ_2}{PR_2} =$	$\frac{R_2Q_2}{PQ_2} =$
	$\frac{R_3Q_3}{PR_3} =$	$\frac{PQ_3}{PR_3} =$	$\frac{R_3Q_3}{PQ_3} =$
	$\frac{RQ}{PR} =$	$\frac{PQ}{PR} =$	$\frac{RQ}{PQ} =$

Sine, Cosine, Tangent

Based on the chart above, try to fill the table below:

Acute angle	$\frac{\text{Opposite side}}{\text{Hypotenuse}}$	$\frac{\text{Adjacent side}}{\text{Hypotenuse}}$	$\frac{\text{Opposite side}}{\text{Adjacent side}}$
$\angle QPR$	$\frac{R_1Q_1}{PR_1} = \frac{3}{5}$	$\frac{PQ_1}{PR_1} = \frac{4}{5}$	$\frac{R_1Q_1}{PQ_1} = \frac{3}{4}$
	$\frac{R_2Q_2}{PR_2} = \frac{3}{5}$	$\frac{PQ_2}{PR_2} = \frac{4}{5}$	$\frac{R_2Q_2}{PQ_2} = \frac{3}{4}$
	$\frac{R_3Q_3}{PR_3} = \frac{3}{5}$	$\frac{PQ_3}{PR_3} = \frac{4}{5}$	$\frac{R_3Q_3}{PQ_3} = \frac{3}{4}$
	$\frac{RQ}{PR} = \frac{3}{5}$	$\frac{PQ}{PR} = \frac{4}{5}$	$\frac{RQ}{PQ} = \frac{3}{4}$

Sine, Cosine, Tangent

From the table above, it is found that:

Given a fixed acute angle in a right-angled triangles of a different sizes:

a) The ratio of the length of the opposite side of the hypotenuse is a constant

b) The ratio of the length of the adjacent side of the hypotenuse is a constant

c) The ratio of the length of the opposite side to the length of the adjacent is a constant

Sine, Cosine, Tangent

The relationships obtained above are trigonometric ratios known as **sine, cosine** and **tangent:**

$$\text{sine} = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\text{cosine} = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\text{tangent} = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine, Cosine, Tangent

The change of the size of the angles can impact the value of sine, cosine and tangent:

The larger the size of the acute angle

(a) the **larger the value of sine** and its value **approaches 1**.

(b) the **smaller the value of cosine** and its value **approaches zero**.

(c) the **larger the value of tangent**.

TIPS

$\sin 0° = 0$	$\sin 90° = 1$
$\cos 0° = 1$	$\cos 90° = 0$
$\tan 0° = 0$	$\tan 90° = \infty$