

Right-Angle Trigonometry

Unit: Mathematics

NGSS Standards: N/A

MA Curriculum Frameworks (2006): N/A

AP Physics 2 Learning Objectives: N/A

Knowledge/Understanding Goals:

- trigonometry functions that are used heavily in physics

Skills:

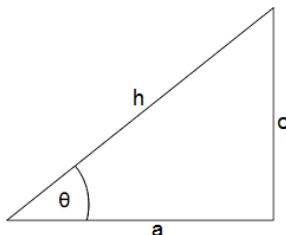
- find the x -component and y -component of a vector

Language Objectives:

- Understand and correctly use the terms “sine,” “cosine,” and “tangent.”
- Accurately describe and apply the concepts described in this section, using appropriate academic language.

Notes:

If we have the following triangle:



- side “ h ” (the longest side, opposite the right angle) is the hypotenuse.
- side “ o ” is the side of the triangle that is opposite (across from) angle θ .
- side “ a ” is the side of the triangle that is adjacent to (connected to) angle θ (and is not the hypotenuse).

Use this space for summary and/or additional notes:

In a right triangle, the ratios of the lengths of the sides will be a function of the angles, and vice-versa.

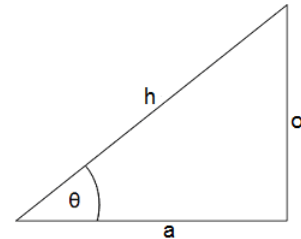
Trigonometry (from “trig” = “triangle” and “ometry” = “measurement”) is the study of these relationships.

The three primary trigonometry functions are defined as follows:

$$\text{sine } \theta = \sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{o}{h}$$

$$\text{cosine } \theta = \cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{a}{h}$$

$$\text{tangent } \theta = \tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{o}{a}$$

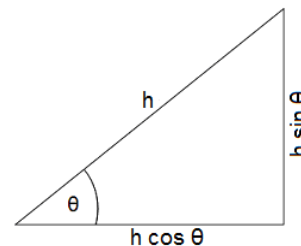


There are a lot of stupid mnemonics for remembering which sides are involved in which functions. My favorite of these is “Oh hell, another hour of algebra!”

The most common use of trigonometry functions in physics is to decompose a vector into its components in the x- and y-directions. In this situation, the vector is the hypotenuse. If we know the angle of the vector, we can use trigonometry and algebra to find the components of the vector in the x- and y-directions:

$$\cos \theta = \frac{a}{h} \text{ which means } a = h \cos \theta$$

$$\sin \theta = \frac{o}{h} \text{ which means } o = h \sin \theta$$

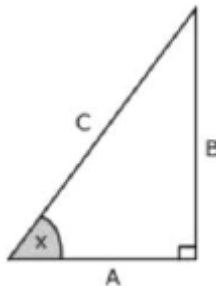


This is often necessary in physics problems involving gravity. Because gravity acts only in the y-direction, the formulas that apply in the y-direction are often different from the ones that apply in the x-direction.

Use this space for summary and/or additional notes:

Homework Problems

Questions 2–5 are based on the following right triangle, with sides A , B , and C , and angle x between A and C .



Note that the drawing is not to scale, and that angle x and the lengths of A , B and C will be different for each problem.

Some problems may also require use of the fact that the angles of a triangle add up to 180° .

1. If $A = 5$ and $C = 13$, what is B ?
2. If $A = 5$ and $C = 13$, what is $\sin x$?
3. If $C = 20$ and $x = 50^\circ$, what are A and B ?

Use this space for summary and/or additional notes:

4. If $A = 100$ and $C = 150$, what is x ?

5. If $B = 100$ and $C = 150$, what is x ?

6. You are a golfer, and your ball is in a sand trap with a hill next to it. You need to hit your ball so that it goes over the hill to the green. If your ball is 10. m away from the side of the hill and the hill is 2.5 m high, what is the minimum angle above the horizontal that you need to hit the ball in order to just get it over the hill?

7. If a force of 80 N is applied at an angle of 40° above the horizontal, how much of that force is applied in the horizontal direction?

Use this space for summary and/or additional notes: