

AP Physics C: Mechanics

Equation Types

Mathematical representations in AP Physics C: Mechanics plays an extremely important role in describing and understanding physical principles. The ability to interpret physical laws and to apply them in a variety of contexts requires a working knowledge of the various mathematical functions and equations. The following is a list of the primary mathematical equation types that are used frequently in the AP Physics C: Mechanics course and your ability to understand and apply them correctly is critical to your success.

In physics, when we speak of a “function”, we mean an equation that describes a precise relationship between physical quantities. In this mathematical expression, the variables represent actual physical quantities that exist in nature and that can be measured; they are not merely variables!

The following is a list of the primary functions or equation types used in

AP Physics C: Mechanics:

- **Linear Functions**

A linear function is a function of the form

$$f(x) = mx + b$$

Which of the following are linear functions?

$$y = 5 - 2x$$

$$y = x^2 + 3$$

$$2xy = -5y + 6$$

$$\frac{1}{4}x + 5y = 3$$

- Quadratic Functions

$$h = -5t^2 + 11t + 7$$

We often express a quadratic equation in general form in order to solve it:

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

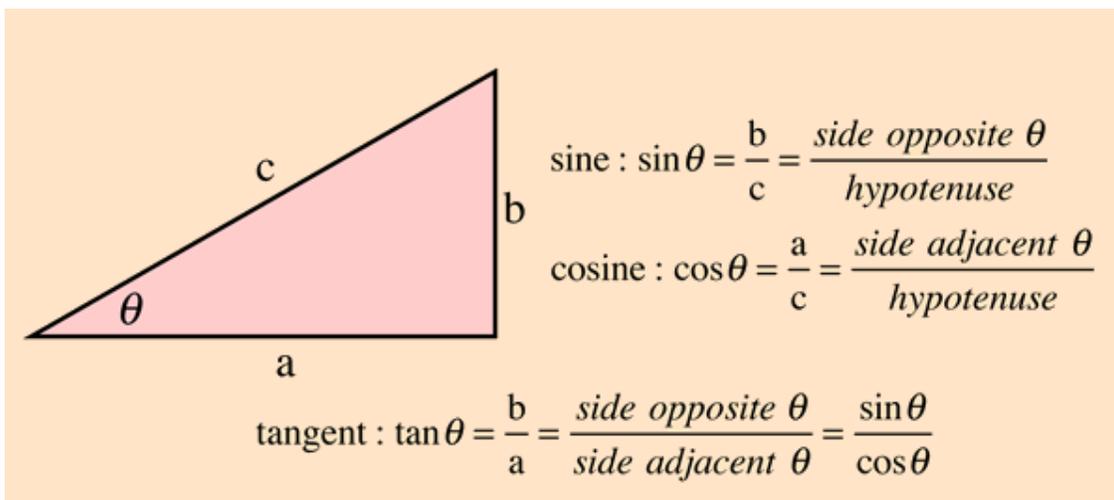
Rewrite the quadratic equation above in general form.

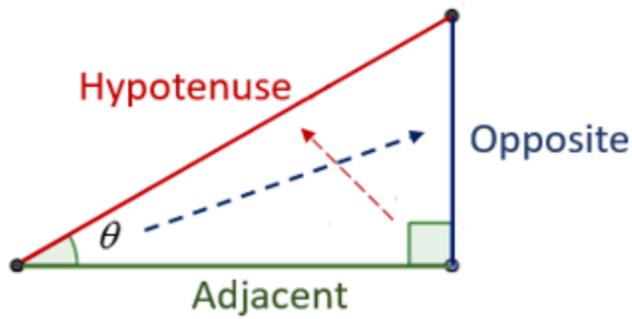
$$-5t^2 + 11t - h = -7 \quad \text{or} \quad 5t^2 - 11t + h = +7$$

Quadratic Solution

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

- Trigonometric and Inverse Trigonometric Functions (Right Angles)





SOH

$$\theta = \sin^{-1} \frac{\textit{opposite}}{\textit{hypotenuse}}$$

CAH

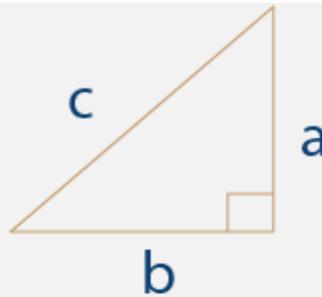
$$\theta = \cos^{-1} \frac{\textit{adjacent}}{\textit{hypotenuse}}$$

TOA

$$\theta = \tan^{-1} \frac{\textit{opposite}}{\textit{adjacent}}$$

- **Geometric Functions**
Pythagorean Theorem

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



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

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

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

- **Differential Equations**

What is a differential equation??

A differential equation is a relationship between a function of time and its derivative.

- **Integral Functions**

In mathematics, an integral assigns numbers to functions in a way that can describe such quantities as displacement, area, volume, and other concepts that arise by combining infinitesimal data. Integration along with differentiation, is one of the two main operations of calculus; its inverse operation. We'll explore and apply a variety of integration techniques this year.

We'll encounter many differential and integral functions this year!!

You should familiarize yourself with the form of these functions and equation types so you may recognize them when you encounter them in your studies this year. Methods for solving these equations and functions will be given in our later application of the physical principles.