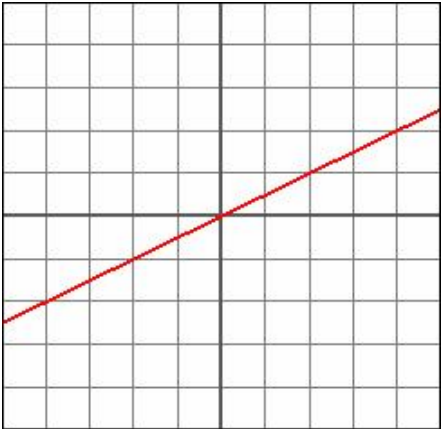

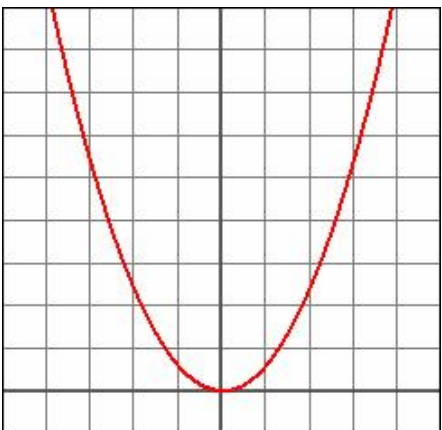
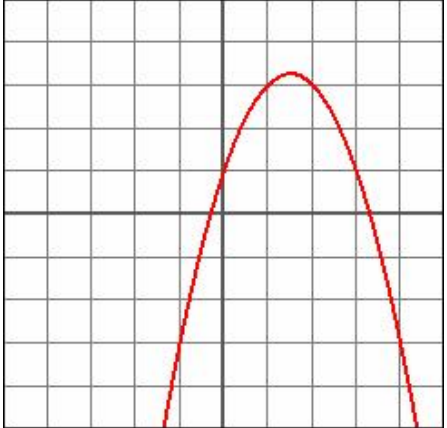
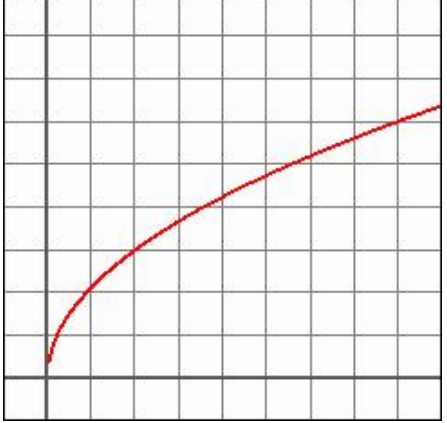

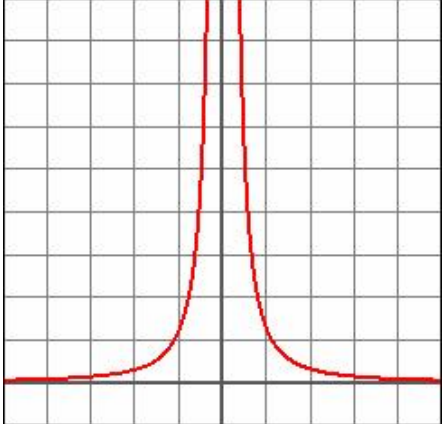


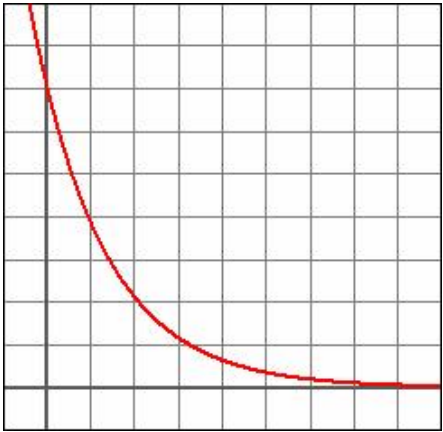
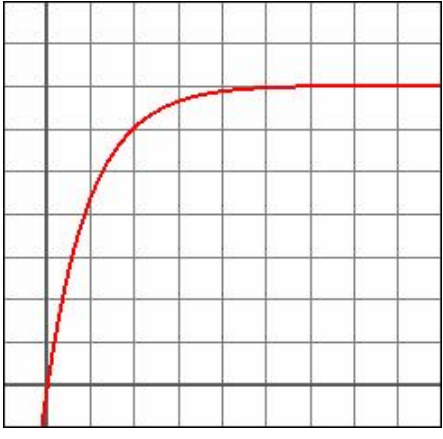
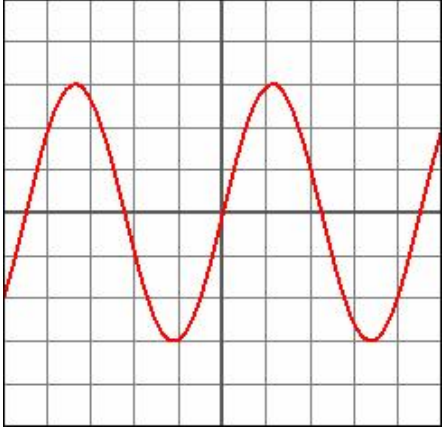
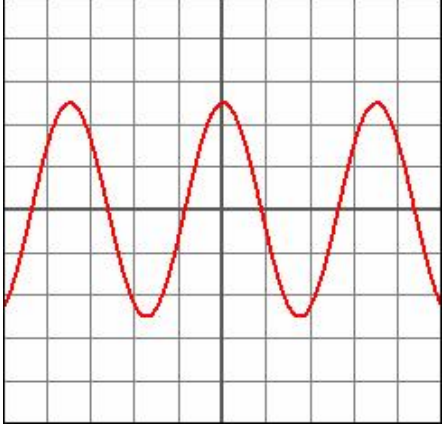
## Functions for AP Physics

In the mathematical sciences there are some common types of equations and relationships. It is helpful for the student to be familiar with the form, terminology, and properties of the functions most frequently encountered. This document is meant to be a helpful overview and resource for physics students.

For the equations below:  $x$ ,  $y$ , and  $t$  are variables, whereas all other symbols represent constants.

$y = mx$		<ul style="list-style-type: none"><li>• <math>y</math> is directly proportional to <math>x</math></li><li>• passes through the origin</li><li>• <math>m</math> is the slope (or the “constant of proportionality”)</li><li>• <math>m = \frac{y_2 - y_1}{x_2 - x_1}</math></li><li>• <math>m &gt; 0</math>, line slants upward (like this one)</li><li>• <math>m &lt; 0</math>, line slants downward</li></ul>
$y = mx + b$		<ul style="list-style-type: none"><li>• <math>x</math> and <math>y</math> have a linear relationship</li><li>• <math>m</math> is the slope</li><li>• <math>m = \frac{y_2 - y_1}{x_2 - x_1}</math></li><li>• <math>m &gt; 0</math>, line slants upward</li><li>• <math>m &lt; 0</math>, line slants downward (like this one)</li><li>• <math>b</math> is the <math>y</math>-intercept</li></ul>
$y = ax^2$		<ul style="list-style-type: none"><li>• <math>y</math> is proportional to <math>x</math>-squared</li><li>• the curve is a parabola</li><li>• vertex of parabola is on the origin</li><li>• <math>a</math> determines the amount of curvature</li><li>• <math>a &gt; 0</math>, parabola opens upward (like this one)</li><li>• <math>a &lt; 0</math>, parabola opens downward</li></ul>

$y = ax^2 + bx + c$		<ul style="list-style-type: none"> <li>• <math>x</math> and <math>y</math> have a quadratic relationship</li> <li>• the curve is a parabola</li> <li>• <math>a</math>, <math>b</math>, and <math>c</math> are sometimes called coefficients</li> <li>• <math>a</math> determines the amount of curvature</li> <li>• <math>a &gt; 0</math>, parabola opens upward</li> <li>• <math>a &lt; 0</math>, parabola opens downward (like this one)</li> <li>• <math>b</math> and <math>c</math> determine where the vertex is located</li> <li>• <math>c</math> is the <math>y</math>-intercept of the parabola</li> </ul>
$y = k\sqrt{x}$		<ul style="list-style-type: none"> <li>• <math>y</math> is proportional to the square root of <math>x</math></li> <li>• the curve is a parabola (half of one)</li> <li>• vertex of parabola is on the origin</li> <li>• <math>k</math> determines the amount of curvature</li> </ul>
$y = \frac{k}{x}$		<ul style="list-style-type: none"> <li>• <math>y</math> is inversely proportional to <math>x</math></li> <li>• the curve is a hyperbola</li> <li>• <math>x</math> and <math>y</math> axes are asymptotes</li> <li>• <math>k</math> determines the amount of curvature</li> </ul>
$y = \frac{k}{x^2}$		<ul style="list-style-type: none"> <li>• <math>x</math> and <math>y</math> have an inverse square relationship</li> <li>• <math>x</math> and <math>y</math> axes are asymptotes</li> <li>• <math>k</math> determines the amount of curvature</li> </ul>

$y = ae^{-bt}$		<ul style="list-style-type: none"> <li>· <math>y</math> is an exponential function</li> <li>· <math>a</math> is the <math>y</math>-intercept</li> <li>· <math>b</math> determines the amount of curvature</li> <li>· the <math>x</math>-axis is an asymptote</li> </ul>
$y = a(1 - e^{-bt})$		<ul style="list-style-type: none"> <li>· <math>y</math> is an inverse exponential function</li> <li>· passes through the origin</li> <li>· the line <math>y = a</math> is an asymptote</li> </ul>
$y = a \sin(\omega t + \phi)$		<ul style="list-style-type: none"> <li>· <math>y</math> is a sinusoidal function</li> <li>· <math>a</math> is the amplitude</li> <li>· <math>\omega</math> is the angular frequency</li> <li>· <math>\phi</math> is the phase angle</li> </ul>
$y = a \cos(\omega t + \phi)$		<ul style="list-style-type: none"> <li>· <math>y</math> is a sinusoidal function</li> <li>· <math>a</math> is the amplitude</li> <li>· <math>\omega</math> is the angular frequency</li> <li>· <math>\phi</math> is the phase angle</li> <li>· note: depending on the values of the phase angle these last two curves are indistinguishable and interchangeable – for both of the example graphs the phase angle is zero</li> </ul>