Chapter 3 Nonlinear Motion.

Be able to state the definitions of the sine, cosine and tangent of an angle in terms of the lengths of the sides of a right triangle. \( \cos \theta = \text{adj} / \text{hyp} \), \( \sin \theta = \text{opp} / \text{hyp} \) and \( \tan \theta = \text{opp} / \text{adj} \)

Be able to use the Pythagorean theorem to find the length of a side of a right triangle in terms of the other two sides.

Be able to find the component of a vector in a given direction knowing the angle of the vector from that direction.

Be able to find the \( x \) and \( y \) components of a vector in terms of the angle of the vector from the \( x \) axis.

\[ V_x = V \cos \theta, \quad V_y = V \sin \theta \]

Be able to draw the \( x \) and \( y \) components of a vector.

Be able to state how to find the angle between two vectors - draw them tail to tail.

Be able to state how to add two vectors - draw the second vector with its tail at the head of the first vector, the sum (resultant) vector has its tail at the tail of the first vector and its head at the head of the second vector.

Be able to draw the sum of two vectors.

Be able to explain what is meant by the statement that velocities combine as vectors and give simple examples.

Be able to add velocities as vectors.

Be able to describe projectile motion.

Given the initial \( x \) and \( y \) position and velocity of a projectile, be able to give the \( x \) and \( y \) position and velocity components at a later time.

Be able to solve simple problems in two dimensional motion using separate descriptions for the horizontal and vertical motions.

Be able to give the values of the velocity and height at the top of its motion for a projectile given its initial velocity.

Be able to explain what the range of a projectile is and how it is affected by the initial speed and direction.

Be able to explain what a satellite is and what the orbital velocity of a satellite must be just above the surface of the earth given that the curvature of the earth’s surface causes the surface to fall 4.9 m below the horizontal when you move a distance of 8000 m.

Be able to define the period of rotational motion.

Be able to define tangential speed in rotational motion.

Be able to define angular velocity in rotational motion.

Be able to compute the value of the tangential speed in terms of the radius and period of the rotational motion.