UNIVERSITY OF WOLLONGONG IN DUBAI

Tutorial 3 – Week 3

Aims:

Upon successfully completing these tutorial exercises, students should be able to:

- Answer problems relating to curvilinear motion.
- Solve normal and tangential curvilinear problems.

Answer problems relating to curvilinear motion

If a particle is at a point (x, y, z), we can define the position vector as:

$$r^{\rightarrow} = xi^{\rightarrow} + yj^{\rightarrow} + zk^{\rightarrow}$$

The magnitude of the position vector (the distance away from the origin can then be calculated by:

$$r = |r^{\rightarrow}| = \sqrt{x^2 + y^2 + z^2}$$

To calculate the velocity, each dimension may be calculated individually:

$$v^{\rightarrow} = v_x i^{\rightarrow} + v_y j^{\rightarrow} + v_z k^{\rightarrow}$$

Similar for the acceleration, refer to the lecture notes for the remaining equations

Example 1: Example 12.9 Text Book

At any instant the horizontal position of the weather balloon in Fig. 1 is defined by $x = (8t)$ m, where t is in seconds. If the equation of the path is $y = x2>10$, determine the magnitude and direction of the velocity and the acceleration when $t = 2$ s.

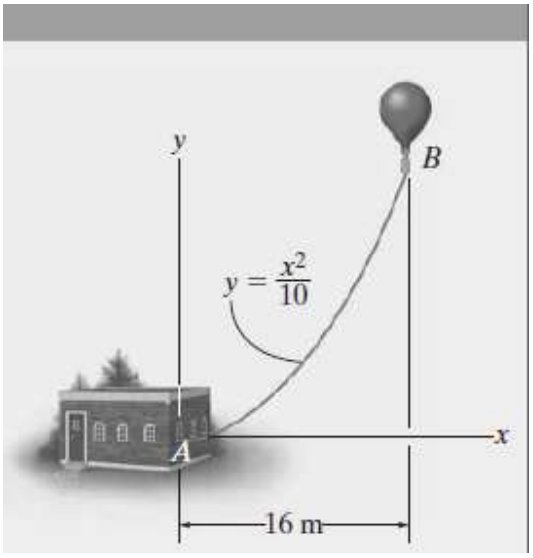

Figure 1

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Example 2: Example 12.10 Text Book

For a short time, an airplane follows a trajectory defined by $y=0.001x^2$ m. If the plane is rising with a constant velocity 10 m/s, determine the magnitudes of the velocity and acceleration when the plane reaches an altitude of y=100 m.

Example 3: Example 12.12 Text Book

A chipping machine ejects wood chips at 7.5 m/s at an angle of 30^o above the horizontal axis. The chips are ejected at a height of 1.2 m. Given that the wood chips land on a pile that is located 6 metres across from the wood chipper, how tall is the pile?

Example 4: Example 12.13 Text Book

Motorbike riders jump off a ramp that is 1 m high at an angle of 30^o. Given that the rider is airborne for 1.5 seconds, calculate the speed of the motorbike when the bike left the ramp.

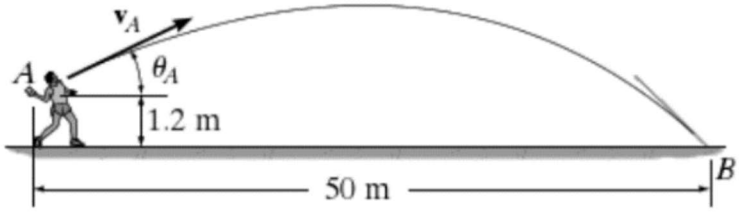
Example 5: Example 12.16 Text Book

The boxes in Fig. 12– 29 a travel along the industrial conveyor. If a box as in Fig. 12– 29 b starts from rest at A and increases its speed such that a = (0.2 t) m > s 2 t , where t is in seconds, determine the magnitude of its acceleration when it arrives at point B .

For student to do:

(Q12-74 from textbook) The velocity of a particle is $v=3\tilde{\imath}+(6-2t)\tilde{\jmath}$ m/s where t is in seconds. If the particle is originally at the origin, determine the displacement of the particle during the time interval t=1 to t=3 seconds.

(Q12-89 from textbook) A ball is thrown 1.2 m above the ground and travels 50 m before hitting the ground at t=2.5 seconds. Determine the initial velocity magnitude and angle.



Prob. 12–89