Physics I (PHYS1210)

Sheet (4)
Motion in Two Dimensions

1. A particle starts from the origin at t = 0 with an initial velocity having an x component of 20 m/s and a y component of -15 m/s. The particle moves in the xy plane with an x component of acceleration only, given by $a_x = 4.0 \text{ m/s}^2$.

   (A) Determine the components of the velocity vector at any time and the total velocity vector at any time.

   (B) Calculate the velocity and speed of the particle at t = 5.0 s.

   (C) Determine the x and y coordinates of the particle at any time t and the position vector at this time.

2. A long-jumper (Fig. …) leaves the ground at an angle of 20.0° above the horizontal and at a speed of 11.0 m/s.

   (A) How far does he jump in the horizontal direction? (Assume his motion is equivalent to that of a particle.)

   (B) What is the maximum height reached?

3. A stone is thrown from the top of a building upward at an angle of 30.0° to the horizontal with an initial speed of 20.0 m/s, as shown in Figure .... If the height of the building is 45.0 m,

(A) how long does it take the stone to reach the ground?

(B) What is the speed of the stone just before it strikes the ground?
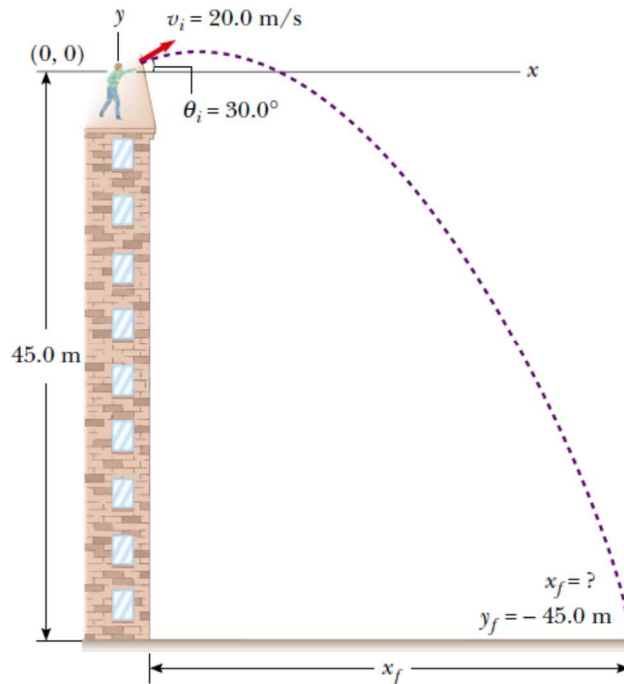
4. A plane drops a package of supplies to a party of explorers, as shown in Figure .... If the plane is traveling horizontally at 40.0 m/s and is 100 m above the ground, where does the package strike the ground relative to the point at which it is released?
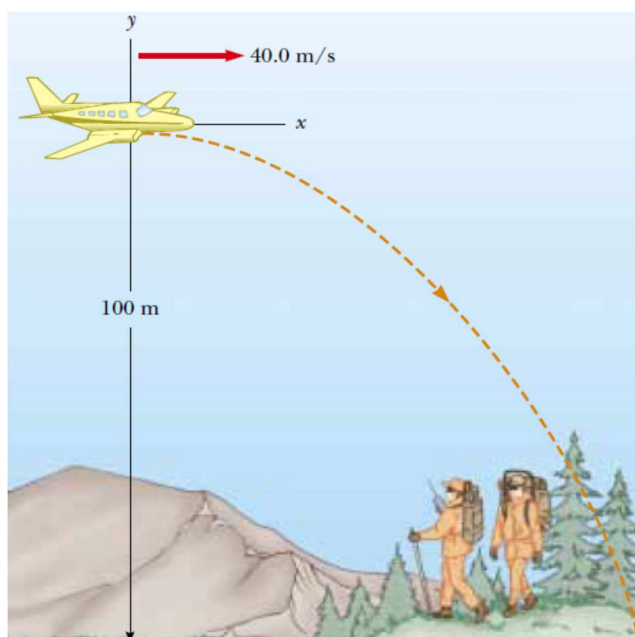
5. a car moves at a constant speed of 10 m/s around a circular path with radius 25 m. Find the following: A: The centripetal acceleration. B: The period.

6. A car exhibits a constant acceleration of 0.300 m/s^2 parallel to the roadway. The car passes over a rise in the roadway such that the top of the rise is shaped like a circle of radius 500 m. At the moment the car is at the top of the rise, its velocity vector is horizontal and has a magnitude of 6.00 m/s.

    What is the direction of the total acceleration vector for the car at this instant?

$a_t = 0.300$ m/s^2

$v = 6.00$ m/s

(a)

(b)