Assignment 3

September 18, 2022

Q1 A soccer player wants to kick a ball into an open window that is 15 m above the ground. If the ball is going straight up, what must the initial velocity be to make the ball perfectly level with the window?

Q2 A ball is dropped from the roof of a building, It took 2.6s to fall to the ground. How tall is the building?

Q3 Please provide another way to describe the directions below:

(a) $[W\ 40^\circ\ S]$

(b) $[N\ 72^\circ\ E]$

(c) $[E\ 64^\circ\ S]$

(d) $[W\ 33^\circ\ N]$

Q4 Convert the following vectors into their corresponding Cartesian referential form. Show all steps.

(a) $42[W\ 33^\circ\ S;]$

(b) $1.7[N\ 33^\circ\ E;]$

(c) $10[E\ 27.5^\circ\ S;]$

Q5 Convert the following vectors into their polar coordinate form. Show all steps.

(a) $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$

(b) $\begin{bmatrix} -5 \\ 7 \end{bmatrix}$

(c) $\begin{bmatrix} 21 \\ -13 \end{bmatrix}$

Q6 An ant travels 2.78 cm[W], turns, and then travels 6.25 cm[S40°E]. What is this ant's total displacement?

Q7 A conductor in a train travelling at 4.0 m/s[N] walks across the train car at 1.2 m/s[E] to validate a ticket. If the car is 4 m wide, how long does it take the conductor to reach the other side? What is his velocity relative to the ground?

Q8 A swimmer jumps into a 5.1 km wide river and swims straight for the other side at 0.87 km/h[N]. There is a current in the river of 2.0 km/h[W]/

(a) How long does it take the swimmer to reach the other side?

(b) How far downstream has the current moved her by the time she reaches the other side?

Q9 If the initial speed of a projectile is the same, under what angle would the projectile travel the longest distance in a vacuum?

Q10 A golfer hits the ball on a cliff that is 30 m tall. If she hits the ball with an initial velocity of 40 m/s at an angle of 30° above the ground, how far would the ball travel?

Bonus A person wishes to travel across the river to a point 2 km downstream. The river is 5 km wide, and flows at a velocity of 15 km/h downstream. If the boat has a maximum speed of 32 km/h, in order to arrive precisely at the desired destination point, at what angle should the boat travel relative to the river?