# Assignment 2

**Subhadip Chowdhury**

## Problem 1

A construction worker pulls a 5 meter plank that is lying on the ground up the side of a 20 meter building by means of a rope tied to one end of the plank. The worker pulls the rope straight up at a rate of 0.15 meters per second. How fast is the other end of the plank sliding along the ground when it is 2.5 meters from the wall of the building?

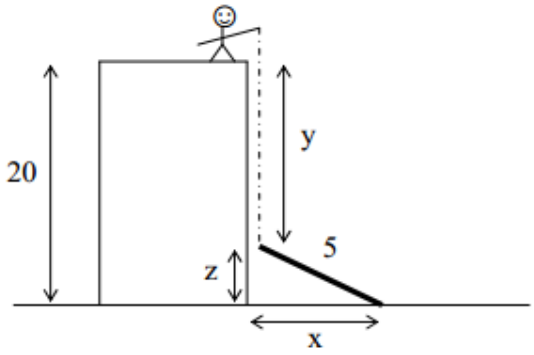


Figure 1:

## Problem 2

A trough of water is 8 meters deep and its ends are in the shape of isosceles triangles whose width is 5 meters and height is 2 meters. If water is being pumped in at a constant rate of 6 $m^3/sec.$ At what rate is the height of the water changing when the water has a height of 120 $cm$?

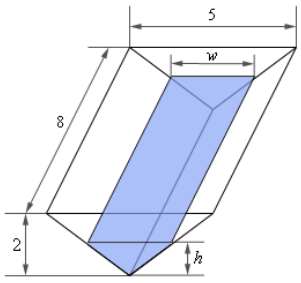


Figure 2:

## Problem 3

A boy launches his toy rocket 15 feet away with his remote control. The toy rocket gains altitude at a rate of 2.5 ft per sec. Find the rate at which the angle of elevation is changing when the rocket has gained an altitude of 15 ft.

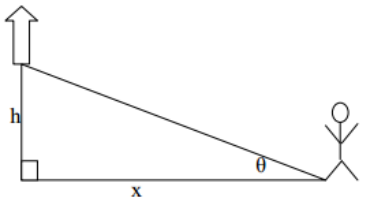


Figure 3:

## Problem 4

An athlete is running around a circular track of radius 50 meters at the rate of 5 meter per second. A spectator is 200 meters from the center of the track. How fast is the distance between the two changing when the runner is approaching the spectator and the distance between them is 200 meters?

## Problem 5

Recall that the value of $g$, acceleration due to gravity is 9.8 meters per second. A stone is dropped from a height of 98 meters. How long will it take to hit the ground? What is the speed of impact? [Remember acceleration is rate of change of velocity and velocity is rate of change of displacement.]

## Problem 6

Two race horsesstart a race at the same time and finish in a tie. Show that there must have been at least one time $t$ during the race when both had exact same speed.

## Problem 7

The thin lens equation in Physics is $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$, where $u$ is the object distance from the lens, $v$ is the image distance from the lens, and $f$ is the focal length of the lens. Suppose that a certain lens has a focal length of 9 $cm$ and that an object is moving towards the lens at the rate of 3 $cm/sec$. How fast is the image distance changing at the instant the object is 12 $cm$ from the lens?