PHYS 211 Homework Assignment

Chapter 4

Problem 1 The position of a particle is given by the equation $\vec{r}(t) = (5 - 2t^2)\hat{i} + (-4 + 3t)\hat{j}$. The position is measured in meters when t is in seconds.

(a) At what time will the particle cross the y-axis?

(b) At what time will the particle cross the x-axis?

(c) Find a relationship between the x and y coordinates, i.e. $y(x)$. (This can be done by setting the x-component equal to $x(t)$, the y-component equal to $y(t)$, and then eliminating t algebraicly)

Problem 2 A rock is thrown off a bridge at an angle of 20° **below** the horizontal.

(a) Right after the rock leaves your hand, is the acceleration of the rock greater than, less than, or equal to g?

(b) Right before the rock hits the water will its speed be greater than, less than, or equal to the speed at which it was originally thrown?

Problem 3 You again throw a rock off the same bridge at an angle of 20° **below** the horizontal with a speed of 15 m/s.

(a) If the bridge is 120 meters high, how much time will pass before the rock splashes into the water?

(b) How far away in the x-direction will the rock land in the water?

(c) What will be the **total** speed of the rock right before it lands in the water?

Problem 4 A friend wants you to determine their pitching speed. You have them stand on a ledge and throw the ball horizontally from a height of 3 meters.

(a) If the ball lands 20 meters away, how fast did he throw the ball?

(b) Upon further inspection, you discover that your friend varies the angle at which he is throwing the ball from 5° above the horizontal to 5° below the horizontal. If the ball still lands 20 meters away, what is the range of speeds at which he is throwing the ball?

Problem 5 You're on a boat.

(a) It takes 3 hours to travel 30 km down a river, and it takes 5 hours to travel the same 30 km back up the river. How fast is the river flowing?

(b) You now want to cross this same river, so you point your boat directly across the 200 meter wide river and head off at 4 m/s. How far downstream will the current have pushed you when you get to the other side?