Homework Discussion, Week 2

Physics 1301 Dr. Andersen

Chapter 2

78.) a) After they are released, both balls will experience equal acceleration due to gravity. It might be tempting therefore to conclude that they both will experience the same change in speed, but because it has an a non-zero initial velocity, the second ball will be accelerated for a shorter time, and thus will experience an overall smaller change in speed. b) Use $v^2 = v_0^2 - 2g(x - x_0)$, with $x - x_0 = -32.5\ m$ (negative sign because x is will be less than x_0), and solve for v for the two different balls (one has $v_0 = 0$, the other $v_0 = 11.0\ m/s$). Then compute $v - v_0$ for both cases.
Answer: b) Ball 1 increase is 25.3 m/s, Ball 2 increase only 16.5m/s.

99.) We need to write down two equations, one for the position of the person in the balloon with respect to time, and one for the camera. For the person in the balloon, there is no acceleration. I am going to choose the level the camera is thrown from as $x = 0$, so that means for the person in the balloon, $x_0 = 2.5\ m$, so for them:

$$x_{balloon} = x_0 + v_0 t + \frac{1}{2}at^2 = (2.5\ m) + (2.0\ m/s)t.$$

For the camera, $a = -g$, $v_0 = 13\ m/s$, and $x_0 = 0$, so:

$$x_{camera} = x_0 + v_0 t + \frac{1}{2}at^2 = (13.0\ m/s)t - \frac{1}{2}gt^2.$$

We want to find the times when these two positions coincide, so we must set these two equations equal to one another, and solve for t:

$$(2.5\ m) + (2.0\ m/s)t = (13.0\ m/s)t - \frac{1}{2}gt^2.$$

Solving this quadratic for t gives two roots: $t = 0.256\ s$ and $t = 1.99\ s$ (the first is the time that the camera and person are at the same height when the camera is going up, the second when it is moving downward from its highest point.) The smaller of the two times (the time the camera first reaches the person) can be substituted in either of the position time formulas, giving $x = 3.0\ m$.

Chapter 3

45.) The velocity of the plane with respect to the ground is the sum of its velocity through the air and the velocity of the wind:

$$\mathbf{v}_{ground} = \mathbf{v}_{air} + \mathbf{v}_{wind}.$$

If we draw a coordinate system with $+y$ pointing north, and $+x$ pointing east, notice that the pilot wants to fly such that $\mathbf{v}_{ground}$ has a y component only. Therefore, he must point the plane so that the x-component of the plane's velocity through the air is equal in size to that of the wind (65 km/hr.), but opposite the direction of the wind. We thus know the x-leg and hypotenuse of the vector triangle for the planes velocity through the air, and so can use the inverse cosine to find the angle from those values..

47.) Similar to the previous problem, the velocity of the jet ski with respect to the ground is the sum of its velocity through the water ($\mathbf{v}_{water}$) and the velocity of the river:

$$\mathbf{v}_{ground} = \mathbf{v}_{water} + \mathbf{v}_{river}.$$

In this problem, we know $\mathbf{v}_{ground}$ and $\mathbf{v}_{river}$, and so want to solve for $\mathbf{v}_{water}$:

$$\mathbf{v}_{water} = \mathbf{v}_{ground} - \mathbf{v}_{river}.$$

The speed is then just the magnitude of $\mathbf{v}_{river}$.