Exam 1 Review: Chapters 1-4
An air-traffic controller observes two planes on the radar "directly east" of the airport. One is at a radial distance $d_1$ and angle $\theta_1$ above the horizontal, the other is at a distance $d_2$ and angle $\theta_2$. What is the distance between the two planes? (Given $d_1$, $d_2$, $\theta_1$, and $\theta_2$ find the distance $d_{12}$ between the planes.)
A basketball player releases the ball from a height $h_1$ at an angle $\theta$ and initial velocity $v_0$ in an attempt to put the ball into the basket which is at height $h_2$ and a horizontal distance $d$. Calculate the distance $d$ if the ball is to make it into the basket. (given $h_1$, $h_2$, $\theta$, and $v_0$ find $d$)
A coyote wearing an ACME rocket pack is traveling along a road at a constant velocity \( v_0 \) and spots a road runner directly ahead at a distance \( d_0 \). The road runner is standing still but spots the coyote at \( t = 0 \) and races with constant acceleration \( a \) toward a cave opening which is at a distance \( d_c \) from the road runner. Find the velocity \( v_0 \) such that the coyote just manages to catch the road runner at the entrance to the cave. (given \( d_0, d_c, \) and \( a \) find \( v_0 \) so that the poor hungry coyote gets to have roast road runner for dinner.)
A carnival ride is a large cylinder that rotates along its axis with a frequency $f$ revolutions per second. People are supposed to stand along the wall of the cylinder at radius $R$ and feel an acceleration $5g$ when the cylinder is rotating. Find the radius $R$ such that this is the case.
5)

A ball is dropped (from rest) from a window at height $h$ and is seen to reach the ground in a certain time. The ball-dropper then climbs to a height $2h$ but wants the ball to reach the ground in the original time. Find the velocity $v_0$ that must be given to this ball to achieve the goal.
A cannon ball is fired with a velocity $v_0$ at an angle $\alpha$ from a height $y_0 = 0$ from position $x_0 = 0$. It strikes a cliff a distance $D$ away at a height $H$. What is the value of the height $H$ in terms of the other given variables.
Consider the block shown at the right. The block is on an incline with angle \( \theta \) and a person is pulling on a rope with force \( F \) at an angle \( \alpha \) relative to the surface of the ramp as shown. The mass of the block is \( m \) and there is no friction. What is the total force acting on the block along the line parallel to the ramp (along the dotted line)?
A block of mass $M_1$ is attached to a mass $M_2$ with a massless rope as shown. A force $F$ is causing the two blocks to accelerate upward. What is the tension in the rope in terms of $M_1$, $M_2$, $F$, and $g$?