PHYS 253 – Summer 2009
Assignment #4

1. Problem 4.16 A constant force $F$ is applied to a mass $m$, and this causes it to accelerate at $a_0 = \frac{F}{m}$. So...

(a) If the force is halved, then the acceleration is halved too: $a = \frac{1}{2} \frac{F}{m} = \frac{1}{2} \frac{F}{m} = \frac{1}{2} a_0$.
(b) If the mass is halved, then the acceleration doubles: $a = \frac{F}{\frac{1}{2} m} = 2 \frac{F}{m} = 2 a_0$.
(c) If both the force and mass are halved, then the acceleration stays the same: $a = \frac{1}{2} \frac{F}{\frac{1}{2} m} = \frac{F}{m} = a_0$.
(d) If the force is halved and the mass doubles, then the acceleration is $1/4$ as large: $a = \frac{1}{4} \frac{F}{2m} = \frac{1}{4} \frac{F}{m} = \frac{1}{4} a_0$.

2. Problem 4.47 In this free-body diagram, the net force $F_{\text{net}}$ is pulling down an incline. The frictional force $f$ is also going down the incline. This would be the case for a car rolling up a hill: gravity would pull down, and friction would oppose the motion up the hill (and thus would point down too).

3. Problem 5.12 The net force in the $\hat{x}$-direction can be read off the diagram: $F_{\text{net},x} = 4.0 - 2.0 = 2.0 \text{ N}$. Similarly, we have $F_{\text{net},y} = 3.0 - 1.0 - 2.0 = 0 \text{ N}$.

4. Problem 5.25 Suppose Clyde pushes with a force $F_1 = 385 \text{ N}$, and Bonnie pulls with a force $F_2 = 350 \text{ N}$. The net force on the safe is $F_{\text{net}} = F_1 + F_2 - f_k$, where the frictional force is $f_k = \mu_k n_{\text{safe}} = \mu_k m g$. Since we’re told the safe moves at a constant speed, the net force must be $F_{\text{net}} = 0$. We can thus solve for the coefficient of kinetic friction: $\mu_k = \frac{F_1 + F_2}{m g} = \frac{385 + 350}{(300)(0.8)} = 0.25$. 