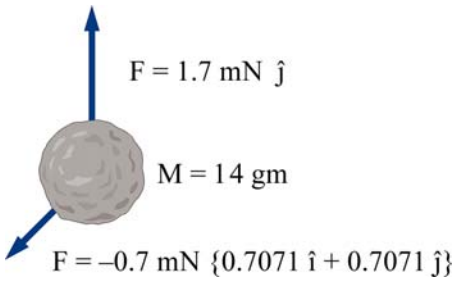
Physics 135-1, Quiz 1, Spring 2018
Solutions

1) Two metric scales are hanging one above the other as shown at left. They happen to be aboard a Martian space ship that is just now taking off for Earth with an acceleration of 8.8 m/s^2. If the gravity on Mars is 3.7 m/s^2, what is the reading on each scale?

The total acceleration acting on the system is 8.8 + 3.7 = 12.5 m/s^2. The bottom scale only has to support the 8 kg mass, so it will read (8 kg)(12.5 m/s^2) = 100 N. The top scale must support both masses, so it will read (5 kg + 8 kg)(12.5 m/s^2) = 162.5 N.

2) Two ants in Physicsland are dragging a perfectly frictionless bit of food towards their colony, albeit with remarkable inefficiency. The {i, j} force vectors for each ant are shown in the figure at right, in a top-looking-down view.



a) If the mass of the bit of food is 14 grams, what is the acceleration vector of the bit in {i, j} notation?

The total force vector is –(0.7)(0.7071) î + {1.7 – (0.7)(0.7071)} ĵ mN, so the acceleration vector is this divided by 14 gm: **a** = {– 0.0354 î + 0.0861 ĵ} m/s^2.

b) The distance to the colony from where the ants are now is 18 cm. Again assuming no friction, and constant force on the part of the ants, how long will it take them to drag the bit to their colony?

The magnitude of the acceleration is $(0.0354^2 + 0.0861^2)^{0.5}$ = 0.0931 m/s^2. Using d = ½ at^2, we have: $t = [2(0.18\text{ m})/(0.0931\text{ m/s}^2)]^{0.5}$ = 1.97 sec