Chapter 5 Even Problem Solutions

24. The parachute jumper is descending at a steady rate, which means he is not accelerating. The force of the air on the parachute must be perfectly canceling the force of gravity. Therefore:

$$F_{air} = mg = 50kg * 9.8\frac{m}{s^2} = 490N \tag{1}$$

36. A $12N$ force will accelerate the total $6kg$ set of blocks at $2\frac{m}{s^2}$, for the $3kg$ block to accelerate at $2\frac{m}{s^2}$, it needs to have a force of $6N$ applied to it. The only block that could be providing this force is the middle block, so we conclude that the middle block is exerting $6N$ of force on the rightmost block.

38. We first assume that the astronaut and the satellite started at rest in our system.

a. The acceleration of the astronaut is:

$$a_a = \frac{120N}{68kg} = 1.76\frac{m}{s^2} \tag{2}$$

Similarly, the acceleration of the satellite is:

$$a_s = \frac{120N}{420kg} = .29\frac{m}{s^2} \tag{3}$$

The respective speeds are thus:

$$v_a = a_a t = 1.76\frac{m}{s^2} * .89s = 1.57\frac{m}{s} \tag{4}$$

$$v_s = a_s t = .29\frac{m}{s^2} * .89s = .26\frac{m}{s} \tag{5}$$

b. The total speed with which the astronaut and the satellite are moving away from each other after the push is:

$$v_{tot} = v_a + v_s = 1.83\frac{m}{s} \tag{6}$$

Therefore, their separation after 1 minute is:

$$d = v_{tot}t = 1.83\frac{m}{s} * 60s = 110m \tag{7}$$

44. By Hooke's law (we don't care about the negative sign):

$$x = \frac{F}{k} = \frac{35N}{220\frac{N}{m}} = .16m \tag{8}$$