More force problems

Steps for problem solving:

- Draw free body diagram
- Identify knowns, unknowns, eqns
- Determine net forces
- Rearrange eqns
- Solve

1. Anudja is holding a stuffed dog, with a mass of 0.30 kg, when Sarah decides that she wants it and tries to pull it away from Anudja. If Sarah pulls horizontally on the dog with a force of 10.0 N and Anudja pulls with a horizontal force of 11.0 N, what is the horizontal acceleration of the dog? $a = 3.3\ m/s^2$ toward Anudja

2. Taru and Reiko simultaneously grab a 0.75-kg piece of rope and begin tugging on it in opposite directions. If Taru pulls with a force of 16.0 N and the rope accelerates away from her at 1.25 m/s^2, with what force is Reiko pulling? 17 N

3. An air-track glider passes a marker at an initial speed of 0.25 m/s. As it passes the marker, a constant force of 0.40 N is applied to the glider in the same direction as its motion. The glider has a mass of 0.50 kg.
    a. What is the acceleration of the glider? $0.80\ m/s^2$
    b. It takes the glider 1.3 s to pass a second marker. What is the distance between the two markers? 1.0 m
    c. The 0.40-N force is applied by means of a string attached to the glider. The other end of the string passes over a resistance-free pulley and is attached to a hanging mass, *m*. How big is *m*? 4.1×10^{-2} kg
    d. Derive an expression for the tension, F_T, in the string as a function of the mass, m_g, of the glider, the mass, m_m, of the hanging mass, and *g*. $F_T = m_m g = m_g a$

4. Marcos is playing tug-of-war with his cat using a stuffed toy. At one instant during the game, Marcos pulls on the toy with a force of 22 N, the cat pulls in the opposite direction with a force of 19.5 N, and the toy experiences an acceleration of 6.25 m/s^2. What is the mass of the toy? 0.40 kg

5. When a softball with a mass of 0.18 kg is dropped, its acceleration toward Earth is equal to g, the acceleration due to gravity. What is the force on Earth due to the ball, and what is Earth's resulting acceleration? Earth's mass is 6.0×10^{24} kg. 2.9×10^{-25} m/s^2

6. A 50.0-kg bucket is being lifted by a rope. The rope will not break if the tension is 525 N or less. The bucket started at rest, and after being lifted 3.0 m, it is moving at 3.0 m/s. If the acceleration is constant, is the rope in danger of breaking? Yes, tension = 570 N

7. A 873-kg (1930-lb) dragster, starting from rest, attains a speed of 26.3 m/s (58.9 mph) in 0.59 s.
   a. Find the average acceleration of the dragster during this time interval. 45 m/s^2
   b. What is the magnitude of the average net force on the dragster during this time? 3.9×10^4 N
   c. Assume that the driver has a mass of 68 kg. What horizontal force does the seat exert on the driver? 3.1×10^3 N
   d. The dragster completed a 402.3-m (0.2500-mi) run in 4.936 s. If the car had a constant acceleration, what was its acceleration and final velocity? 33.02 m/s^2, 163.0 m/s
   e. The dragster crossed the finish line going 126.6 m/s. Does the assumption of constant acceleration hold true? What other piece of evidence could you use to determine if the acceleration was constant? explain

8. Two blocks, one of mass 5.0 kg and the other of mass 3.0 kg, are tied together with a massless rope as in **Figure 4-24.** This rope is strung over a massless, resistance-free pulley. The blocks are released from rest. Find the following (*Hint: you will need to solve two simultaneous equations.*)
   a. the tension in the rope 37 N
   b. the acceleration of the blocks 2.4 m/s^2

Figure 4-24