1. A jet plane (Figure 1) with mass of 12,000 Kg flies at a constant speed of 950 km/h when it is flying horizontally on a strait line. Air enters the scoop *S* of the plane at a rate of 50 m^3/s. The engine burns fuel at the rate of 0.4 kg/s and the gas (including the air and the fuel) is exhausted with a relative speed to the plane of 450 m/s. Please find the air resistant force. The following equation is the net force of the system F_s, with m the mass of the object, m_e the mass of the exhausting gas, m_i the injected gas, t time, and the vs for the object (v), the exhausting gas ($v_{D/e}$), and the injected gas ($v_{D/i}$). (30%)

$$\sum F_s = m\frac{dv}{dt} - v_{D/e}\frac{dm_e}{dt} + v_{D/i}\frac{dm_i}{dt}$$

Figure 1

2. In Figure 2 is a vehicle of mass 1700 kg traveling horizontally along a 20° banked track. The track is circular and has a radius of 100 m, and its coefficient of static friction with the tire of the vehicle is 0.2. Please determine the maximum constant speed at which the vehicle can travel without sliding upward the slop. The size of the vehicle could be neglected. (35%)

Figure 2

3. In Figure 3, Car B is 800-kg and is connected to Car A which is 350-kg. In between the cars is a spring with k = 600 N/m. Please determine the stretch in the spring for cases when a) wheels of both cars are free for rolling; and b) when Car B applies its brakes with the equivalence of a resistance of $\mu = 0.4$. The mass of the wheels are negligible. (35%)

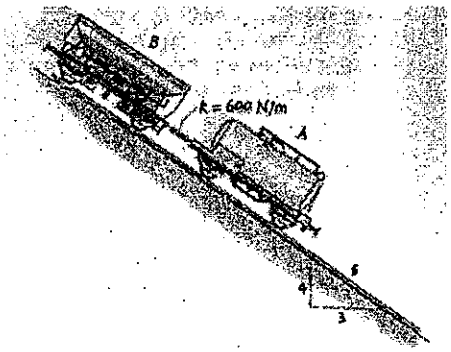

Figure 3

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