- For material covering Ch. 2 (skipping 2-6)
- Due Friday, Sept. 5 at 5 pm

1. A car travels up a hill at a constant speed of 41 km/h and returns down the hill at a constant speed of 72 km/h. Calculate the average speed for the round trip. [Answer: 52 km/h].

2. Two trains, each having a speed of v, are headed at each other on the same straight track. A bird that can fly at speed 3v flies off the front of one train when they are d apart and heads directly for the other train. On reaching the other train it flies directly back to the first train, and so forth. (We have no idea why a bird would behave in this way.) In terms of variables given in the problem, what is the total distance the bird travels? [Answer: 3/2d].

3. You are to drive to an interview in another town, at a distance of 340 km on an expressway. The interview is at 11:15 a.m. You plan to drive at 100 km/h, so you leave at 8:00 a.m. to allow some extra time. You drive at that speed for the first 120 km, but then construction work forces you to slow to 40.0 km/h for 40.0 km. What would be the least speed needed for the rest of the trip to arrive in time for the interview? [Answer: 171 km/h].

4. The position of a particle moving along the x axis is given in centimeters by $x = 9.98 + 1.72\ t^3$, where t is in seconds. Calculate (a) the average velocity during the time interval t = 2.00 s to t = 3.00 s; (b) the instantaneous velocity at t = 2.00 s; (c) the instantaneous velocity at t = 3.00 s; (d) the instantaneous velocity at t = 2.50 s; and (e) the instantaneous velocity when the particle is midway between its positions at t = 2.00 s and t = 3.00 s [Answer: (a) 32.7 cm/s; (b) 20.6 cm/s; (c) 46.4 cm/s; (d) 32.3 cm/s; (e) 34.8 cm/s].

5. Catapulting mushrooms. Certain mushrooms launch their spores by a catapult mechanism. As water condenses from the air onto a spore that is attached to the mushroom, a drop grows on one side of the spore and a film grows on the other side. The spore is bent over by the drop's weight, but when the film reaches the drop, the drop's water suddenly spreads into the film and the spore springs upward so rapidly that it is slung off into the air. Typically, the spore reaches a speed of 1.70 m/s in a 5.00 μm launch; its speed is then reduced to zero in 1.40 mm by the air. Using that data and assuming constant accelerations, find the acceleration in terms of g **(a)** during the launch and **(b)** during the speed reduction. [Answer: (a) 2.95×10^4 g; (b) -105 g].

6. A startled armadillo leaps upward, rising 0.570 m in the first 0.213 s. **(a)** What is its initial speed as it leaves the ground? **(b)** What is its speed at the height of 0.570 m? **(c)** How much higher does it go? [Answer: (a) 3.72 m/s; (b) 1.63 m/s; (c) 0.136 m].

7. (a) With what speed must a ball be thrown vertically from ground level to rise to a maximum height of 38 m? **(b)** How long will it be in the air? [Answer: (a) 27 m/s; (b) 5.6 s].

8. A key falls from a bridge that is 43 m above the water. It falls directly into a model boat, moving with constant velocity, that is 15 m from the point of impact when the key is released. What is the speed of the boat? [Answer: 5.1 m/s].

9. A stone is dropped into a river from a bridge 47.9 m above the water. Another stone is thrown vertically down 1.73 s after the first is dropped. Both stones strike the water at the same time. What is the initial speed of the second stone? [Answer: 27.5 m/s].

10. A drowsy cat is looking at a window from across the room, and sees a flowerpot that sails first up and then down past the window. The pot is in view for a total of 0.46 s, and the top-to-bottom height of the window is 2.01 m. How high above the window top does the flowerpot go? [Answer: 2.95 m].