# Math 10B Dynamics Worksheet 1

1. When you are falling, your acceleration is the sum of your acceleration due to gravity and your deceleration due to drag. Acceleration due to gravity is constant and deceleration due to drag is proportional to your current veolcity. Write a differential equation to express how your velocity changes as you fall.

2. A 5 foot tall person is initially standing 3 feet from a 8 foot tall lamp. The person begins to walk forward at a rate of one foot per second. Write a differential equation to express how the length of their shadow changes as they walk.

3. Find a solution to
$$\frac{dy}{dt} = e^{-t} + \frac{2t}{t^2 - 1}.$$

4. Find a solution to
$$\frac{dy}{dt} + y = e^{-t}.$$

5. Find a solution to
$$\frac{dy}{dt} + \frac{3y}{t} = \frac{e^t}{t^3}.$$

6. Find a solution to
$$t\frac{dy}{dt} - 2y = t^2.$$

7. Find a solution to
$$t\frac{dy}{dt} - 2y = t^4 \sin t.$$

8. Compute the following indefinite integral
$$\int \frac{3t + 11}{t^2 - t - 6}\, dt.$$

9. Compute the following indefinite integral
$$\int \frac{t^2 - 29t + 5}{(t - 4)^2(t^2 + 3)}\, dt.$$

10. Compute the following indefinite integral
$$\int \frac{t^4 - 5t^3 + 6t^2 - 18}{t^3 - 3t^2}\, dt.$$