

Math 29
Homework 1

Write a 1-3 sentence summary of what we did in class last period.

1. A body of mass m is falling with positive downward velocity v . Newton's Second Law of Motion is $F = ma$, where F represents the net downward force, and a represents the downward acceleration. The net force, F , consists of the force due to gravity, F_g minus the air resistance F_r . The force due to gravity is mg , where g is a constant. Assume the air resistance is proportional to the velocity of the body.

- a) Write an equation expressing the net force, F , as a function of the velocity, v .
- b) Write an equation expressing the acceleration, a , as a function of the velocity, v .
- c) Sketch a graph of your equation in part b), and explain what your graph means.

2. For small changes in temperature, the formula for the expansion of a metal rod under a change in temperature is: $l - l_0 = al_0(t - t_0)$ where l is the length of the rod at temperature t , and l_0 is the initial length at temperature t_0 , and a is a constant which depends on the type of metal. Suppose you have a rod which was initially 100 cm long at 60 degrees Fahrenheit and made of a metal with $a = 10^{-5}$.

- a) Write an equation for the length of the rod as a function of the temperature.
- b) Explain how the equation tells you whether the metal will expand or contract as the rod is heated.

3. We can express the concentration $[X]$ of a solution containing compound X as the ratio of moles of the dissolved compound to the number of liters of the solution, where 1 mole of a compound contains 6.0×10^{23} molecules of it. Suppose that you are given the following chemical information. Solve for $[H^+]$.

$$\frac{[H^+][NO_2^-]}{[HNO_2]} = 4.5 \times 10^{-4}$$

$$[H^+] = [NO_2^-]$$

$$[HNO_2] = (1.00 \times 10^{-2}) - [H^+]$$