Part I: Population Simulation without Immigration – Class Handout

Start the experiment with 50 M&M's® in a cup. This represents the population at $t = 0$, or the initial condition when time is zero. You will be tossing the M&M's multiple times to represent multiple generations. Each generation, any candy with the "m" facing up "dies" and will be discarded into the cup marked with an "X". The remaining M&M's will be tossed again, and the experiment will be repeated until you are satisfied. Before you begin the experiment, make some predictions.

1. What do you expect to occur?

2. Do you expect the population to level off? If so, at what value do you expect it to level off and how many generations do you expect it to take to reach that value?

Now begin the experiment.

(a) Toss the M&M's gently onto the table.
(b) Remove M&M's with the "m" facing up – they die. Place the dead M&M's into the cup marked with the "X".
(c) Count the remaining M&M's from that generation. Record the data, keeping track of the time (generation number).
(d) Go to step (a) and repeat. Keep track of time (generation number) and number of M&M's each time.

3. Sketch a graph of the population of M&M's versus time (generation number). What type of function does the graph resemble?

4. After the class discussion, write down the differential equation that models this population.

5. What is the solution to that differential equation and how well does its graph match your graph in Problem 3?

Part II: Population Simulation with Immigration – Class Handout

Again, start the experiment with 50 M&M's in a cup. As before, you will be tossing the M&M's multiple times and discarding any candy with the "m" facing up. However, this time (each generation), there will be 10 immigrant M&M's added. Before you begin the experiment, make some predictions.

1. What do you expect to occur?

2. Do you expect the population to level off? If so, at what value do you expect it to level off and how many generations do you expect it to take to reach that value?

Now repeat the experiment in Part I, replacing step (b) with these new instructions.
Remove M&M's with the "m" facing up - they die. Place the dead M&M's into the cup marked with the "X". Take 10 M&M's immigrants from the cup marked with the "X", and add them to your population.

3. Sketch a graph of the population of M&M's versus time (generation number). What type of function does the graph resemble? What change do you see from the first experiment?

4. After the class discussion, write down the differential equation that models this population.

5. What is the solution to that differential equation and how well does its graph match your graph in Problem 3?