Homework 33: 11.3 Euler's method

Bring this handout to class with at least (1a) filled out.

(1) Consider the differential equation $dy/dx = 2x + y$ with initial point $(0, 10)$. The goal is to develop *Mathematica* code to implement Euler's method and solve this problem. Below are some scratch work space to plan for the *Mathematica* coding exercises. You do *not* need to turn in this sheet, but you absolutely should finish these exercises before you start coding.

(a) Use $\Delta x = 0.5$ to estimate the value of the function at $x = 1.5$ using Euler's method. First, write the expressions for slope and "next y" in general; then fill out the table below.

point	slope =	next y =

If you do not get 35.5 **as your final value, get this part checked before moving on.**

(b) We now develop code to implement Euler's method on *Mathematica*.
Reminder: When we set up a function, we type `f[x_]:=...`. When we refer to it later, we type `f[x]` without the underscore. Similarly, when we set up a function with two independent variables like the slope function below, we type `m[x_,y_]:=...`. We refer to it later as `m[x,y]`.

(i) Write the code for the *Mathematica* function `m[x_,y_]` that computes the slope at the point (x, y).

```
m[x_,y_]:=
```

(ii) Write the code for *Mathematica* function `nextY[x_,y_]` that takes a current point and finds the next y value using Euler's method. Use the work you did above under "next y =" to guide you. To make this easier to use for any differential equation, write your code as general as possible. In particular, refer to `m[x,y]` and Δ`x` in the definition of `nextY[x_,y_]`.

```
Δx =

nextY[x_,y_]:=
```

(2) Download `hw33.euler.nb` from Moodle and follow instructions therein.

(3) 11.3 # 15a. Do by hand (with a chart like the one above) and turn in as usual.