

1. Suppose  $y$  is a function of  $x$  which satisfies the following differential equation.

$$\frac{dy}{dx} = 2x, \quad y(0) = 1$$

(a) Use Euler's Method with  $\Delta x = 1$  to approximate  $y(2)$ .

$x_{old}$	$y_{old}$	$y'_{old}$	$y_{new} \approx y_{old} + y'_{old} \cdot \Delta x$
0.0	1		
1.0			
2.0			

(b) Use Euler's Method with  $\Delta x = 0.5$  to approximate  $y(2)$ .

$x_{old}$	$y_{old}$	$y'_{old}$	$y_{new} \approx y_{old} + y'_{old} \cdot \Delta x$
0.0	1		
0.5			
1.0			
1.5			
2.0			

(c) Use Euler's Method with  $\Delta x = 0.1$  to approximate  $y(2)$ .

$x_{old}$	$y_{old}$	$y'_{old}$	$y_{new} \approx y_{old} + y'_{old} \cdot \Delta x$
0.0	1		
0.1			
0.2			
0.3			
0.4			
0.5			
0.6			
0.7			
0.8			
0.9			
1.0			
1.1			
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			

(d) Can you find an explicit formula for  $y$  which satisfies the differential equation? If so, then use the formula to find the exact value of  $y(2)$ . How do your approximations in parts (a) – (d) compare?

2. Suppose  $P$  is a function of  $t$  which satisfies the following differential equation.

$$\frac{dP}{dt} = 0.1P, \quad P(0) = 100$$

(a) Make tables similar to those used in problem #1 to approximate  $P(3)$  using Euler's Method.

(b) Can you find an explicit formula for  $P$  which satisfies the differential equation? If so, then use the formula to find the exact value of  $P(3)$ . How do your approximations compare to exact value?

3. This is to get you started on question #7b from **Worksheet A**. We saw in class that the appropriate differential equation is

$$\frac{dT}{dt} = -0.1(T - 20), \quad T(0) = 90$$

You are asked to use Euler's method in order to approximate  $T(10)$ . You are not given a value for  $\Delta t$ , but for each value that you choose, you should make a table similar to those used in our last problem.

(a) In the following table, what is the value of  $\Delta t$ ? Fill in appropriate column headings using correct variable names. Now complete the table in order to approximate  $T(10)$ .

$t_{old}$	$T_{old}$		
0.0	90	-7	72.5
2.5	72.5		
5.0			
7.5			
10.0			

(b) Be sure to make a couple of additional tables with smaller values chosen for  $\Delta t$ . If you are proficient at computer programming or using spreadsheets such as Excel, then your smallest value for  $\Delta t$  may be as small as 0.01. The rest of us should at least be willing to use  $\Delta t = 0.5$ .