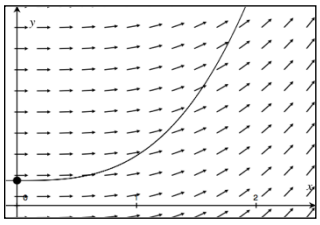
DIGITLE – BC CALCULUS
Puzzle 206 – Euler's Method

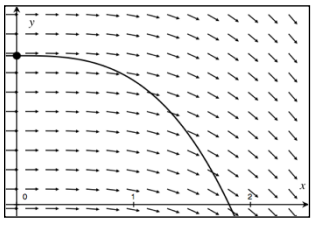
Directions: The first 5 problems have single digit or letter answers. The 6th problem has a 3-digit answer (counting leading zeros if present). You have a choice: solve the easier single-character answer problems or tackle the more difficult 3-digit answer and the multiple choice.

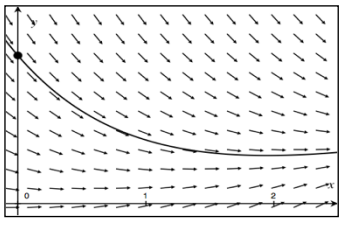
Single Digit or Letter Answers:

1) Let $y = f(x)$ be a solution to the differential equation $\frac{dy}{dx} = 3 - x - y$ with initial condition $f(-2) = 6$. If Euler's method is used to approximate $f(x)$ with step –0.25, what is the root of $f(x)$?

2) The slope fields for a differential equation and its particular solution passing through the point on the *y*-axis are shown below. If Euler's method is used to approximate the solution, which graph(s) will give an under-approximation?

I. 

II. 

III. 

A. I only B. II only C. III only D. I and III only

3) Let $y = f(x)$ be the solution to the differential equation $\frac{dy}{dx} = 4x^2 - x^2y^2 - 4$ with initial condition $f(0) = 4$. If Euler's method is used, starting at $x = 0$ with step size of 0.5, for what value of *x* is the Euler approximation for $f(x)$ first less than zero?

A. 1.5 B. 2 C. 2.5 D. never

4) Consider the differential equation $\frac{dy}{dx} = \frac{y}{x}$ with initial condition $f(1) = 8$. Find the difference between the exact value of $f(8)$ and the Euler approximation of $f(8)$ using a step of 0.5.

5) Consider the differential equation $\frac{dy}{dx} = 2(y^2 - 2x - 2)$ with initial condition $f(0) = 1$. Find the Euler approximation of $f(2)$ using a step of 0.5.

Three Digit Answer:

6) A cup of hot chocolate is taken out of a microwave when it is nearly boiling (200° F) and allowed to cool. The liquid's temperature is described by the differential equation $\frac{dT}{dt} = -0.1(T - 72)$, *t* measured in minutes. If Euler's method is used with step one minute, what is the temperature of the hot chocolate to the nearest degree after 6 minutes?