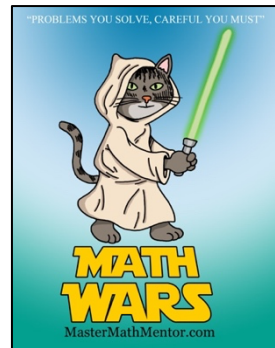


# Math Wars – BC Calculus

## Topic 205 – Euler’s Method



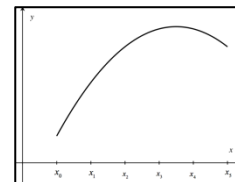
**Maximum Time: 8.5 Minutes**

**Directions:** To start, you need to download the Math Wars application on your cell phone: Use the QR code or the url:

<https://mastermathmentor.com/mmm/mathwars.ashx?key=205>

When ready, start the timer and then solve the problems below, entering your choice, A, B, C, D and pressing **Submit** for each problem when you are sure of your answer. When complete, stop the timer. You will see problems you got correct in green and incorrect in red. You will receive a score based on how many problems you got right and your time. A perfect score is all problems correct using half the maximum time or less. You can text or email your friends with your results.

1. (1 pt) The graph of  $f(x)$  is shown to the right.  $f(x_5)$  is approximated using Euler’s method and  $f(x_0)$  to start and using 5 equal steps. Determine the nature of this approximation.



- A. it overestimates  $f(x_5)$
- B. it underestimates  $f(x_5)$
- C. it equals  $f(x_5)$
- D. it depends on the actual function

2. (3 pts) Consider the differential equation  $\frac{dy}{dx} = -2y^2$  with initial condition  $f(1) = -1$ . Find the Euler approximation of  $f(0)$  using two equal steps.

- A. -2
- B. -4
- C. -6
- D. -8

3. (5 pts) Let  $y = f(x)$  be the solution to the differential equation  $\frac{dy}{dx} = x^2 - 2y$  with initial condition  $f(-3) = 8$ . If Euler’s method is used, starting at  $x = -3$  with step size of 1, for what value of  $x$  is the Euler approximation for  $f(x)$  first less than zero?

- A. -2
- B. -1
- C. 0
- D. 1

4. (7 pts) When hot tar is spread on a roof, it comes out of the heating drum at 324° F and immediately begins to cool. The tar can be easily spread when its temperature is between 225° F and 300° F. The tar’s temperature is described by the differential equation  $\frac{dT}{dt} = -0.1(T - 80)$ ,  $t$  measured in minutes. If Euler’s method is used with step one minute, to the nearest minute, how many minutes is it easily spread?

- A. 3
- B. 4
- C. 5
- D. 6

5. (9 pts) Consider the differential equation  $\frac{dy}{dx} = 2\sin 2x \cos 2x$  with initial condition  $f(0) = 2$ . Find the difference between the exact value of  $f\left(\frac{\pi}{4}\right)$  and the Euler approximation of  $f\left(\frac{\pi}{4}\right)$  using two equal steps.

A. 0.893

B. 2.107

C. 1.107

D. 0.107