

Name: _____

Mark: _____

Mini-math AP Calculus BC: Friday, April 1, 2022 (15 minutes)

1. Consider the initial value problem $\frac{dy}{dx} = 2x + y$ and $y(1) = 2$.
 - (a) (2 points) Find an approximation of $y(1.2)$ using Euler's Method with two equal steps.

- (b) (2 points) Is your estimate in part (a) an overestimate or an underestimate?

2. The number of squirrels in a park at time t is modelled by the function $y = F(t)$ that satisfies the logistic differential equation $\frac{dy}{dt} = \frac{1}{2000}y(1500 - y)$, where t is measured in weeks. The number of squirrels in the park at time $t = 0$ is $F(0) = b$, where b is a positive constant.

(a) (i) (1 point) If $b = 300$, what is the largest rate of increase in the number of squirrels in the park?

(ii) (1 point) If $b = 1000$, what is the largest rate of increase in the number of squirrels in the park?

(b) (2 points) If $b = 150$, find $\lim_{t \rightarrow \infty} F(t)$ and interpret the meaning of this limit in the context of the problem.

- (c) (4 points) Find the function $F(t)$ if $b = 500$. For reference, the differential equation is $\frac{dy}{dt} = \frac{1}{2000}y(1500 - y)$.