

Name _____

1. A biologist studied the growth of a rabbit population in a field. She let $f(t)$ represent the number of rabbits t weeks from the start of her research. Suppose that $f'(9) = 8$. Which of the following sentences must be true?
- (a) Nine weeks after the start of her research, there were eight rabbits in the field.
 - (b) Eight weeks after the start of her research, there were nine rabbits in the field.
 - (c) Nine weeks after the start of her research, the rabbit population was increasing by eight rabbits per week.
 - (d) Eight weeks after the start of her research, the rabbit population was increasing by nine rabbits per week.
 - (e) During the first eight weeks of her research, the rabbit population increased an average of nine rabbits per week.
 - (f) During the first nine weeks of her research, the rabbit population increased an average of eight rabbits per week.

2. On the graph of $y = 4x^2 - 300$, what is the slope of the curve at $x = 10$?

3. If $y = e^{5x}$, then

$\frac{dy}{dx} =$

4. Suppose that 100 rabbits were released on an island that had no previous rabbits. Let R denote the rabbit population t months after they were released. The rabbit population grows at a rate which is proportional to the population size itself, where the constant of proportionality is 0.05 (i.e. a continuous growth rate of 5% per month). Write down a differential equation with initial condition to model the growth of this rabbit population.

5. Given the following initial value problem, use Euler's Method with $\Delta t = 2$ to estimate $w(6)$.

$$\frac{dw}{dt} = \ln(w + 1), \quad w(0) = 10$$

6. Suppose y is a function of t which satisfies the differential equation

$$\frac{dy}{dt} = \frac{4(y - 5)(y - 20)}{21}$$

On one set of axes, sketch 5 plausible graphs for y given these 5 initial values: $y(0) = 0$, $y(0) = 5$, $y(0) = 10$, $y(0) = 20$, $y(0) = 25$.