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: $y(0) = 0$, $y(0) = 5$, $y(0) = 10$, $y(0) = 20$, $y(0) = 25$. 