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?

The correct answer is: \( \text{(c) Nine weeks after the start of her research, the rabbit population was increasing by eight rabbits per week.} \)

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

We note that \( y' = 8x \) and let \( x = 10 \) to obtain that the correct answer is: 80

3. If \( y = e^{5x} \), then

\[
\frac{dy}{dx} = 5e^{5x}
\]
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.

\[
\frac{dR}{dt} = 0.05R \quad \text{and} \quad R(0) = 100
\]

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

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

<table>
<thead>
<tr>
<th>( t_{\text{old}} )</th>
<th>( w_{\text{old}} )</th>
<th>( w'_{\text{old}} )</th>
<th>( w_{\text{new}} \approx w_{\text{old}} + w'_{\text{old}} \cdot \Delta t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<tr>
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<tr>
<td>6</td>
<td>26.4</td>
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</table>

Using Euler’s Method with \( \Delta t = 2 \), we obtain the estimate \( w(6) \approx 26.4 \)

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

- \( y \) is increasing if \( y < 5 \) or \( y > 20 \)
- \( y \) is decreasing if \( 5 < y < 20 \)
- \( y = 5 \) is a stable equilibrium point and \( y = 20 \) is an unstable equilibrium point

See the graph in class on Monday