

Name \_\_\_\_\_

**No calculators allowed!**

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) Eight weeks after the start of her research, there were nine rabbits in the field.
  - (b) Nine weeks after the start of her research, the rabbit population was increasing by eight rabbits per week.
  - (c) Eight weeks after the start of her research, the rabbit population was increasing by nine rabbits per week.
  - (d) During the first eight weeks of her research, the rabbit population increased an average of nine rabbits per week.
  - (e) 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  $x = 10$ ?
  - (a) 80
  - (b) 70
  - (c) 60
  - (d) 40
  - (e) 20
  - (f) 10

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

$$\frac{dy}{dx} =$$

4. If  $P(t) = t^2 e^{-t}$ , then

$$P'(t) =$$

5. 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.