Name _____

AP Calculus Unit 4 Free Response

1. $W(t)$ is the weight of a bird, in grams, at time t days after it is first weighed. When the bird is first weighed its weight is 20 grams. The rate at which a baby bird gains weight is proportional to the difference between its adult weight and its current weight and is modeled by $W'(t) = \frac{1}{5}(100 - W)$. Is the bird gaining weight faster when it weighs 40 grams or when it weighs 70 grams? Explain your reasoning.

2. The number of fish in a small bay is modeled by the function $F(t) = 10(t^3 - 12t^2 + 45t + 100)$, where t is measured in days and $0 \leq t \leq 8$.
   (a) Using the correct units, interpret the meaning of $F'(4) = -30$ in the context of the problem.

   (b) At $t = 2$, is the rate of change of the number of fish in the bay increasing or decreasing? Justify your answer

3. For $0 \leq t \leq 6$ the position of the particle P at time t in seconds, is given by $P(t) = 2\cos\left(\frac{\pi}{4}t\right)$ in meters.
   At $t = 2$ is the particle moving to the left, or right? Justify your answer.

4. For $0 \leq t \leq 6$ the position of the particle Q at time t in seconds, is given by $Q(t) = t^3 - 6t^2 + 9t + 3$ in meters.
   At $t = 4$ is the particle speeding up or slowing down? Justify your answer