

Name SOLUTIONS

1. (2 points) Given that $\frac{dw}{dt} = \sqrt{w}$ and $w(0) = 81$, use Euler's Method with $\Delta t = 2$ to obtain an estimate for $w(10)$.

t_{current}	w_{current}	w'_{current}	$w_{\text{next}} \approx w_{\text{current}} + w'_{\text{current}} (\Delta t)$
0	81	9	$81 + 9(2)$
2	99	9.9499	$99 + 9.9499(2)$
4	118.8997	10.9041	$118.8997 + 10.9041(2)$
6	140.7080	11.8620	$140.7080 + 11.8620(2)$
8	164.4321	12.8231	$164.4321 + 12.8231(2)$
10	190.0783		

$$w(10) \approx 190.1$$

2. (2 points) Suppose that the population of a town is always growing at a rate which is proportional to the population itself. Suppose further that the population is currently 400 and is growing at a rate of 25 people per year. Find a differential equation with initial condition to model the population of this town. Use P for the population t years from now.

$$\frac{dP}{dt} = k \cdot P$$

$$25 = k \cdot 400$$

$$k = 25/400 = 0.0625$$

$$\frac{dP}{dt} = 0.0625 P$$

$$P(0) = 400$$

3. (2 points) Suppose that 800 rabbits are currently on an island. Let R represent the number of rabbits on this island t months from now. Write down a differential equation with initial value to model the number of rabbits on this island under the following conditions.

- (a) This rabbit population increases by 20 rabbits per month.

$$\frac{dR}{dt} = 20$$
$$R(0) = 800$$

- (b) This rabbit population increases at a continuous growth rate of 2.5% per month.

$$\frac{dR}{dt} = 0.025R$$
$$R(0) = 800$$

4. (2 points) Determine an explicit formula for the rabbit population in problem (3a).

$$R = 20t + 800$$

5. (2 points) Determine an explicit formula for the rabbit population in problem (3b).

$$R = 800e^{0.025t}$$