

Name

SOLUTIONS

1. (4 points) Given that $\frac{dq}{dt} = 3q^{1/3}$ and $q(0) = 64$, use Euler's Method with $\Delta t = 2$ to obtain an estimate for $q(8)$.

| t | q | $\frac{dq}{dt} = 3q^{1/3}$ | CALCULATIONS |
|-----|---------|----------------------------|---------------------------------|
| 0 | 64 | 12 | $64 + 12(2) = 88$ |
| 2 | 88 | 13.344 | $88 + 13.344(2) = 114.688$ |
| 4 | 114.688 | 14.576 | $114.688 + 14.576(2) = 143.840$ |
| 6 | 143.840 | 15.719 | $143.840 + 15.719(2) = 175.278$ |
| 8 | 175.278 | | |

$$q(8) \approx 175.3$$

2. (2 points) Suppose that the population of a town is always growing at a rate which is proportional to the square root of the population itself. Suppose further that the population is currently 900 and is currently growing at a rate of 15 people per year. Find a differential equation with initial value to model the population of this town. Use P for the population t years from now.

$$\frac{dP}{dt} = K\sqrt{P}$$

$$15 = K\sqrt{900}$$

$$\text{so } K = 0.5$$

$$\frac{dP}{dt} = 0.5\sqrt{P}$$

$$P(0) = 900$$

3. (2 points) Let S represent the number of squirrels on a small island t years from now. There are currently 500 squirrels living on the island and the population is expected to increase by 10 squirrels per year.

(a) Find a differential equation with initial value to model the number of squirrels on this island.

$$\frac{dS}{dt} = 10$$
$$S(0) = 500$$

(b) Find an explicit formula for the number of squirrels on this island.

$$S = 10t + 500$$

4. (2 points) Let R represent the number of rabbits in a large wooded area t years from now. There are currently 100 rabbits living in this area and the population is expected to increase at a continuous rate of 5% per year.

(a) Find a differential equation with initial value to model the number of rabbits in this area.

$$\frac{dR}{dt} = 0.05R$$
$$R(0) = 100$$

(b) Find an explicit formula for the number of rabbits in this area.

$$R = 100e^{0.05t}$$