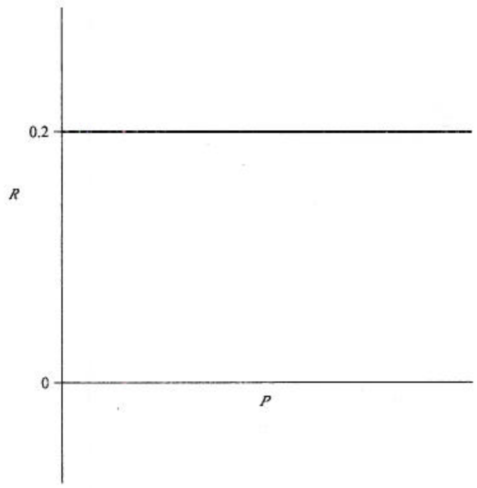
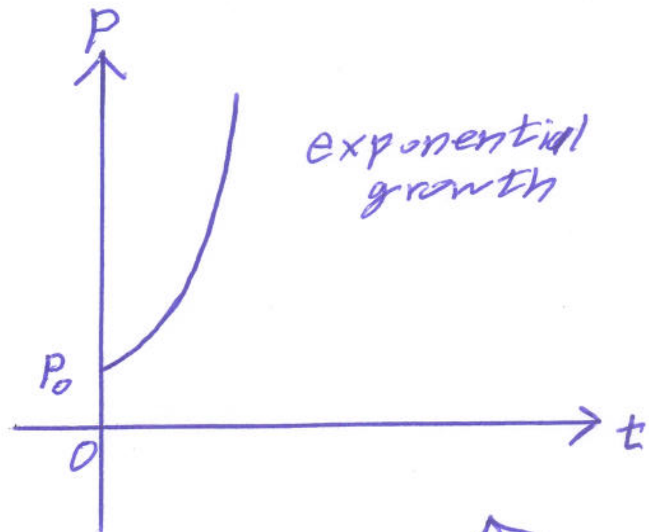
Math 172 **Worksheet H Solutions** **Spring 2008**

1. A population can be modeled by the following discrete dynamical system

$$P(t) = P(t-1) + R \cdot P(t-1)$$

where the growth rate R is a function of the population P and is given in the graph below.





(a) The intrinsic growth rate for this population is 0.2 or 20%.

(b) This population has no carrying capacity. It grows exponentially without bound.

(c) The only equilibrium value is $P^* = 0$.

(d) See above for a rough graph of the population as a function of time.

(e) For the given growth rate, there is no minimum viable population. As long as there is some positive population, the species will not die out.

(f) $R = 0.2$

(g) Using the discrete dynamical system

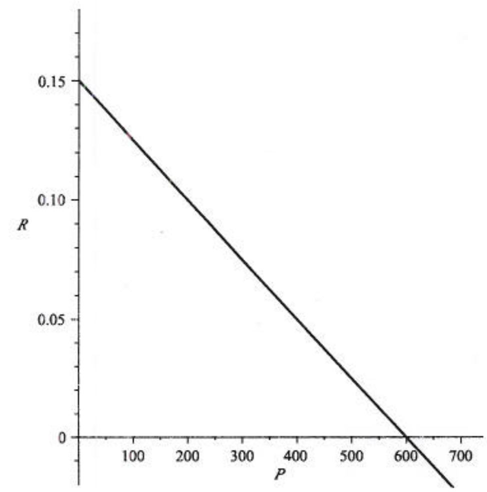
$$P(t) = P(t-1) + 0.2P(t-1)$$
$$P(0) = 200$$

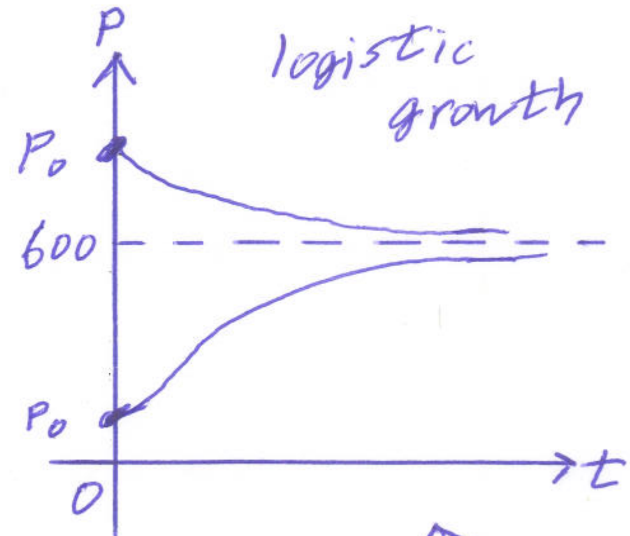
we obtain that $P(10) \approx 1238.3$.

2. A population can be modeled by the following discrete dynamical system

$$P(t) = P(t-1) + R \cdot P(t-1)$$

where the growth rate R is a function of the population P and is given in the graph below.





(a) The intrinsic growth rate for this population is 0.15 or 15%.

(b) The carrying capacity for this population is $P = 600$.

(c) The equilibrium values for this population are $P^* = 0$ and $P^* = 600$.

(d) See above for a rough graph of the population as a function of time.

(e) For the given growth rate, there is no minimum viable population. As long as there is some positive population, the species will not die out.

(f) $R = -\frac{0.15}{600}P + 0.15$

(g) Using the discrete dynamical system

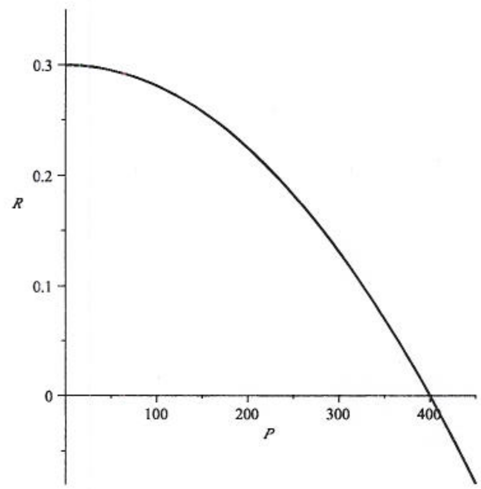
$$P(t) = P(t-1) + \left(-\frac{0.15}{600}P(t-1) + 0.15\right)P(t-1)$$
$$P(0) = 200$$

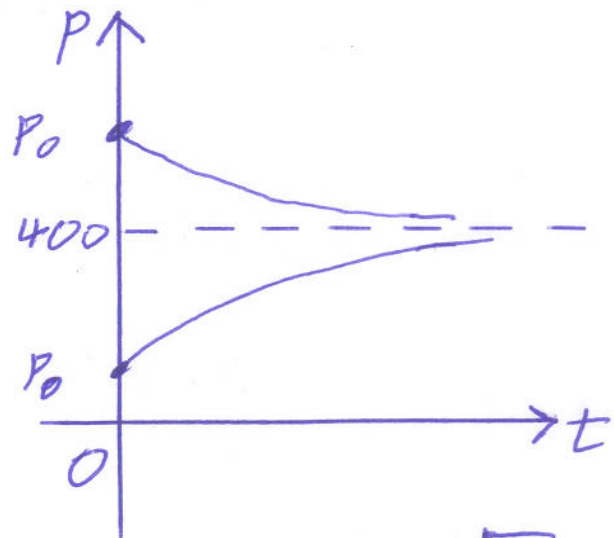
we obtain that $P(10) \approx 415.1$.

3. A population can be modeled by the following discrete dynamical system

$$P(t) = P(t-1) + R \cdot P(t-1)$$

where the growth rate R is a function of the population P and is given in the graph below.





(a) The intrinsic growth rate for this population is 0.3 or 30%.

(b) The carrying capacity for this population is $P = 400$.

(c) The equilibrium values for this population are $P^* = 0$ and $P^* = 400$.

(d) See above for a rough graph of the population as a function of time.

(e) For the given growth rate, there is no minimum viable population. As long as there is some positive population, the species will not die out.

(f) $R = -\frac{0.3}{400^2}P^2 + 0.3$

(g) Using the discrete dynamical system

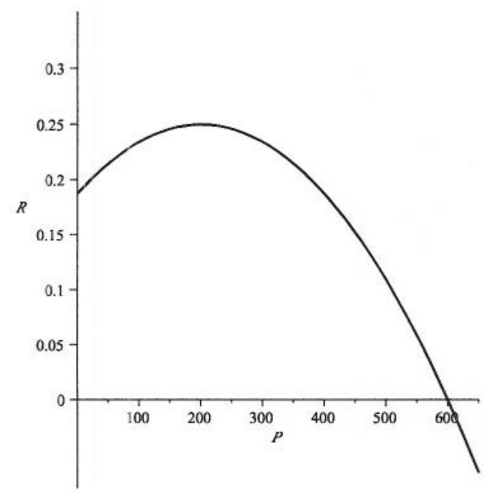
$$P(t) = P(t-1) + \left(-\frac{0.3}{400^2}P^2(t-1) + 0.3\right) P(t-1)$$
$$P(0) = 200$$

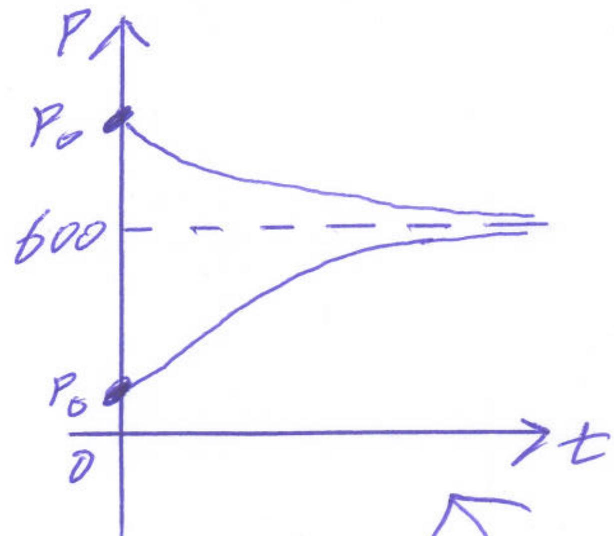
we obtain that $P(10) \approx 399.46$.

4. A population can be modeled by the following discrete dynamical system

$$P(t) = P(t-1) + R \cdot P(t-1)$$

where the growth rate R is a function of the population P and is given in the graph below.





(a) The intrinsic growth rate for this population is 0.25 or 25%.

(b) The carrying capacity for this population is $P = 600$.

(c) The equilibrium values for this population are $P^* = 0$ and $P^* = 600$.

(d) See above for a rough graph of the population as a function of time.

(e) For the given growth rate, there is no minimum viable population. As long as there is some positive population, the species will not die out.

(f) $R = -\frac{0.25}{400^2}(P - 200)^2 + 0.25$

(g) Using the discrete dynamical system

$$P(t) = P(t-1) + \left(-\frac{0.25}{400^2}(P(t-1) - 200)^2 + 0.25\right) P(t-1)$$
$$P(0) = 200$$

we obtain that $P(10) \approx 599.84$.