

1. Suppose the population of a town is currently 800, and it is growing by 20 people per year. Let $u(n)$ represent the population of this town n years from now.

(a) Find a discrete dynamical system along with an initial value for $u(n)$.

$$u(n) = u(n-1) + 20 \text{ and } u(0) = 800$$

(b) Find an explicit formula for $u(n)$.

$$u(n) = 20n + 800$$

2. Pregnant women metabolize some drugs at a slower rate than the rest of the population. The amount of caffeine in a pregnant woman's bloodstream decreases by approximately 7% each hour (for others it decreases by 16%.) This is important because caffeine, like all psychoactive drugs, crosses the placenta to the fetus. Let $u(n)$ represent the amount of caffeine in a pregnant woman's bloodstream n hours after finishing a cup of coffee containing 100 mg of caffeine.

(a) Find a discrete dynamical system along with an initial value for $u(n)$.

$$u(n) = 0.93u(n-1) \text{ and } u(0) = 100$$

(b) Find an explicit formula for $u(n)$.

$$u(n) = 100(0.93)^n$$

(c) Find the half-life of caffeine in a pregnant woman's bloodstream.

$$\text{Half-life} = \frac{\ln 0.5}{\ln 0.93} \approx 9.6 \text{ hours}$$

3. The oldest and largest wildlife survey in the world is the Christmas Bird Count sponsored each year by the National Audubon Society. In Athens, Georgia, volunteers counted the number of American Goldfinches and I have recorded their results from 1992 to 1995 in the table below.

year	1992	1993	1994	1995
# goldfinches	256	175	139	110

(a) Use the regression features of your calculator to find a formula for the exponential function which best fits this data. Each number in your formula should be correctly rounded off to two places after the decimal point. It will be helpful to let $t = 0$ in 1992.

If we let $g(t)$ represent the number of goldfinches t years after 1992, we get $g(t) \approx 244.91(0.76)^t$

(b) According to the formula found in part (a), by what percentage is the population of goldfinches decreasing each year?

$$24\%$$

4. Given the discrete dynamical system $u(n) = 0.875u(n - 1)$ with $u(2) = 490$, find an explicit formula for the function $u(n)$.

$$u(n) = 640(0.875)^n$$

5. Find an explicit formula for this discrete dynamical system.

$$u(n) = 0.8u(n - 1) + 10 \text{ and } u(0) = 70$$

$$u(n) = 20(0.8)^n + 50$$