

Write the formula, then
All work can be done in
your calculator.

Name _____

Date _____

Advanced Algebra

Unit 1: Sequence and Series Assignment #7

Learning Target: I can model Real World Situations with Recursive Models

1) After financial aid and scholarships, you only need to take out an \$8000 loan to pay for the first year of college. The interest on your loan is 3.5% annual interest compounded monthly. You plan to make a payment of \$300 each month toward the loan.

- Write a recursive sequence for this financial situation.
- How many months before the loan is paid off?

$$U_0 = 8,000$$

$$U_n = \left(1 + \frac{.035}{12}\right) \cdot U_{(n-1)} - 300$$

$$n \geq 1$$

} need to
go to
sequence
Mode

27	\$239.76	end of 27 months
28	-59.54	over paid

27 months @ 300
1 Final Month \$240.46

2) You plan to take out a \$10000 loan to pay for your vehicle. The interest on your loan is 1.5%, compounded monthly. You plan to make a payment of \$200 each month toward the loan.

- Write a recursive sequence for this financial situation.
- How many months before the loan is paid off?

$$U_0 = 10,000$$

$$U_n = \left(1 + \frac{.015}{12}\right) \cdot U_{(n-1)} - 200$$

$$n \geq 1$$

} need to
enter in
Sequence
Mode

51 months	\$132.48
52	-67.36

51 months At \$200
1 month At 132.65

3) Nancy bought a used car for \$18,500. The value of the car will be less each year because of depreciation. The car depreciates at the rate of 16% per year. What is the value after 6 years?

$$y = U_0 \cdot r^x$$

$$y = 18,500 (1 - .16)^x$$

$$y = 18,500 (.84)^x$$

Final answer after 6 years

\$6,499.01

4) The Smiths have a small pool and are doing a chlorine treatment. The recursive formula below gives the pool's daily amount of chlorine in grams.

$$\begin{cases} U_0 = 300 \\ U_n = (1 - .15) * U_{(n-1)} + 30 \\ n \geq 1 \end{cases}$$

a) Explain that the real-world meaning of the values 300, .15 and 30 represent in this formula.

b) Describe what happens to the chlorine level in the long run (This means find the limit of this recursive formula, CLICK IT OUT)

a) $U_0 = 300$ is the starting amount of chlorine that is in the pool.
 The 15% represents the amount of chlorine that is lost
 The 30 represents the amount that you put in daily
 b) The limit is 200 grams of chlorine after many days.

5) Sal invested \$24,000 into a bank account. This account earned interest. The APR on this account was 3.4% compounded monthly. He decides to make monthly withdraws of \$100 every month (this means he takes money out of the account).

a) Write the recursive formula for this problem.

$$\begin{cases} U_0 = 24,000 \\ U_n = \left(1 + \frac{.034}{12}\right) * U_{(n-1)} - 100 \\ n \geq 1 \end{cases}$$

This is shifted geometric
 "click it out"
 or Use Sequence Mode

b) What is his balance after 1 year?

\$ 23,609.96

c) What is the long-run balance of this scenario...meaning what is the LIMIT of this problem.

\$0 The Account is going toward 0 after many years.

6) The Forever Green Nursery owns 7000 white pine trees. Each year, the nursery plans to sell 12% of its trees and plant 600 new ones.

Write the shifted geometric Sequence for this scenario:

$$U_0 = 7,000$$

$$U_n = (1 - .12) \cdot U_{(n-1)} + 600 \quad n \geq 1$$

a) Find the number of pine trees owned by the nursery after 10 years?

5,557.00 Trees

b) Find the number of pine trees owned by the nursery after many years. (This is another way to ask for the LIMIT of the sequence...CLICK IT OUT)

5000 Trees

7) Consider a \$1000 investment at an annual interest rate of 6.5% compounded quarterly. Find the balance after :

What is the direct equation for this scenario in the form $y = U_0 \cdot r^x$

a) 10 years \$ 1905.56

b) 20 years \$ 3,631.15

c) 30 years \$ 6,919.38

$$y = 1000 \left(1 + \frac{.065}{4} \right)^{40}$$

$$y = 1000 \left(1 + \frac{.065}{4} \right)^{80}$$

$$y = 1000 \left(1 + \frac{.065}{4} \right)^{120}$$

8) Find the balance of a \$1,000 investment, after 10 years, at an annual interest rate of 6.5% when it is compounded
a) Annually

Direct Equation

$$y = 1000(1 + .065)^x$$

Answer after 10 years

\$ 1877.14

b) Monthly:

Direct Equation

$$y = 1000\left(1 + \frac{.065}{12}\right)^x$$

120

Answer after 10 years

\$ 1912.18

c) Weekly:

Direct Equation

$$y = 1000\left(1 + \frac{.065}{52}\right)^x$$

1520

Answer after 10 years

\$ 1914.76

Note: We should be seeing that the more times we compound something, the higher the value. Do you think this will go on forever or is there a limit? You should see that the value that it goes up by is getting smaller and smaller so YES there is a limit.

9) You borrow \$10,000 at an annual interest rate of 10%, compounded monthly, and you make monthly payments of \$300.

a) Write the recursive to describe this

$$U_0 = 10,000$$

$$U_n = \left(1 + \frac{.10}{12}\right) \cdot U_{(n-1)} - 300$$

$$n \geq 1$$

b) What is the balance after 2 years?

24 clicks

$$\boxed{\$4269.84}$$

c) How long does it take to pay off?

$$\begin{array}{r} 39 \mid 63.63 \\ \hline 40 \mid -235.8 \end{array}$$

40 Total Months

d) What was the total amount you ended up paying

11,763.63

$$39 \text{ Month} \times 300$$

+

$$1 \text{ Month } 63.63$$

$$\$1,1763.63$$