

CLO: Students will write recursive formulas for situations involving loans and investments which will help them apply what they know about recursion to real life situations.

Warm - Up

Given the recursive formula, identify if it is a growth or decay situation and write a real life situation for it.

1. $u_0 = 380$

$u_n = u_{n-1} (1 - 0.20)$

\$380 and spend 20% a day, what day will you have no money.

2. $u_0 = 60$

$u_n = u_{n-1} (1 + 0.30)$

Buy a Supreme hat for \$60, every year it increases in value by 30%

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In life you will face many financial situations, which may include car loans, checking accounts, credit cards, long-term investments, life insurance, retirement accounts, and home mortgages. You will need to make intelligent choices about your money and who you can trust. We are going to look at some situations and see if we can figure out how to approach them using recursion.

Loans are money you acquire usually through a bank to help you purchase something.

Investments are mathematically similar to loans. With an investment, deposits are added on a regular basis so that your balance increases.

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Growth and Decay Situation

The balance starts at \$2000 and increases by 7% each year.

Write a recursive formula for this situation, when will the balance triple?

$$U_0 = 2000$$
$$U_n = 1.07 \cdot U_{(n-1)}$$
$$16-17$$

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In the problem we just looked at we found the balance at the end of each year.

A lot of times when dealing with banks they will **compound the interest. The interest on a loan or savings is almost always compounded which can lead to som surprising results.**

In our last problem leaving \$2000 in the bank at a good interest rate for 11 years doubles your money in 17 years your money triples

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Some banks will **compound interest monthly**. How would we write our previous situation with a **compounded monthly interest**?

The balance starts at \$2000 the account has an annual interest rate of 7%, compounded monthly.

Writing a common ratio as $\left(1 + \frac{0.07}{12}\right)$ represents one-twelfth of the interest. When you do this your n is representing months instead of years.

What would the equation look like if it was compounded weekly?

$$\left(1 + \frac{0.07}{52}\right)$$

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You plan to borrow \$22,000 to purchase a new car. The investment must be paid off in 5 years (60 months) the bank charges interest at an annual rate of 7.9%, compounded monthly. Part of each monthly payment is applied to the interest, and the remainder reduces the starting balance or principal.

What is the *monthly* interest rate?

$$\frac{.079}{12} = .00658\bar{3}$$

$$U_n = (1 + .00658\bar{3})U_{n-1} - ?$$

What is the first month's interest on the \$22,000?

$$22000(.00658\bar{3}) = 144.83$$

If you make a payment of \$300 at the end of the first month, what is your remaining balance?

$$300 - 144.83 = \$155.72 \leftarrow \begin{array}{l} \text{directly to balance} \\ \text{of car} \end{array}$$
$$22000 - 155.72 = 21844.28$$

Record the balances for the first six months with monthly payments of \$300, how long would it take to pay off the loan?

$$U_n = 1.00658\bar{3}U_{n-1} - 300$$
$$U_0 = 22000$$
$$U_6 = 21,061.93$$
$$U_{60} = 10628.09$$

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Julie's employer offers an investment plan that invests a portion of each paycheck before taxes are deducted. Gwen gets paid every week. The plan has a fixed annual interest rate of 4.75%, compounded weekly, and she decides to contribute \$10 each week. What will Gwen's balance be in 5 years?

