

MATH: Compound Interest Pitfalls

Compound interest is great...until it isn't. The same mathematical principle that helps you build wealth in saving and investing can also work against you when it comes to debt. Understanding the power of compound interest will help you avoid some costly financial pitfalls and have it work in your favor.

Math Topics
<ul style="list-style-type: none"> Compound Interest

Personal Finance Topics
<ul style="list-style-type: none"> Credit Card Debt Payday Loans Pyramid Schemes



Part I: Examples

- ❖ **Teacher Tip:** We are excluding any fees for missed payments in the examples below. This is discussed in question #5.

Example 1: Colin has two credit cards:

- On Card A, he owes \$4,000
- On Card B, he owes \$7,000

He decides to put all his effort into paying off Card B with the higher balance for 9 months. He does not make any payments on the Card A during that time. The annual interest rate on Card A is 16% compounded daily. How much is Colin's balance on this card?

Setting up the equation:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = Value after 9 months (this is what we are solving for)

P = \$4,000 (the initial value)

r = 16% = 0.16 (16% annual interest)

n = 365 (how often it compounds)

t = .75 years (9 months = $\frac{3}{4}$ of a year)

Solving the equation:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = 4,000\left(1 + \frac{0.16}{365}\right)^{365 \cdot 0.75}$$

$$A = 4,000(1 + 0.000438)^{273.7}$$

$$A = 4,000(1.000438)^{273.75}$$

$$A = 4,000(1.127357)$$

$$A = 4,509.43$$

Solution: Colin's credit card balance will be \$4,509.43. That's almost \$510 in **interest** in just 9

months!

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Part II: Practice Problems

Complete the following practice problems and show your work in the space provided. Then, write your final solution in the answer boxes. Round to the nearest whole dollar.

Question 1	Answer
<p>Gail has \$5,500 in credit card debt, but she is low on funds right now because she is temporarily working fewer hours at work. She decides to wait until she is in a better financial place and makes no payments on the card for 6 months. Her APR is 20% compounded daily. How much will Gail's credit card balance be in 6 months?</p> <p>(NOTE: assume Gail makes no new purchases with her card during this time)</p>	

Question 2	Answer
<p>Unfortunately, Gail's work situation is not better in 6 months as planned. What will her balance be if she instead waits 18 months to start paying back her credit card?</p>	

Question 3	Answer
<p>Mark is shopping for furnishings for his new apartment. At checkout the cashier said he could save some money if he signed up for a store credit card. Mark thought that sounded like a good idea! He was not sure of his new mailing address so he put down his last address, his mom's house. In the excitement of moving into his new apartment, Mark forgot he had signed up for the card.</p> <p>Three months later, Mark's mom came to visit and brought some of his mail. There was a bill for \$450 from this forgotten card. Mark was not happy! The APR on the card is 35% compounded monthly. How much was the original purchase?</p>	

Question 4	Answer
<p>Leo's rent is due a few days before he expects to receive his paycheck from work. He takes out a payday loan for \$200 to cover some of his rent and will pay it back when he gets his paycheck. The lender charges \$15 for every \$100 borrowed, which needs to be paid back in 2 weeks.</p> <ol style="list-style-type: none"> What is the percent rate for this 14-day loan? Using the percent rate you found in part A, calculate what the APR (annual percent rate) for this loan would be. Using the APR you found in part B, determine how much Leo will owe on the loan if he takes 2 months to pay it back. 	

Part III: Reflection

- The questions above do not take into account any fees for missed payments. Hypothesize where a monthly late payment fee would fall into situations like the ones above.

6. Your cousin is asking for tips on how to avoid financial pitfalls with credit. What are two main takeaways that you would want to share with them?

Part IV: BONUS

7. Pyramid schemes grow by requiring members to recruit other members. Each level of recruitment brings more and more members into the scheme. In this example, let's say:

- Two people collaborate to form a pyramid scheme (level 0)
- They both recruit 3 additional members each (level 1)
- Each member of level 1 also recruits 3 members (level 2) and this pattern continues for subsequent levels

A. Although the context is different, how is this problem connected to the math in questions #1-4?

B. How many new members would there be at the recruitment level 6?

C. Pyramid schemes are not sustainable. Use a mathematical model (table, equation, graph, diagram, etc.) to justify why they will ultimately fail.