LESSON MAKER PRO

Money in Motion

Track balances and compare interest rates

HIGH SCHOOL · MM.FPM.A.4

MM.FPM.A.4 "Organize and display financial information using geometric sequences to represent compound interest and proportional depreciation, including periodic (yearly, monthly, weekly) and continuous compounding. a..."

NAME _____ DATE _____

WHICH RATE GOES WHERE?

For periodic compounding, multiply the balance by 1 + APR/n each period, where n is 1 for yearly, 12 for monthly, or 52 for weekly compounding. For proportional depreciation, multiply by 1 - annual rate/n each period. APY is the actual one-year growth rate, $(1 + APR/n)^n - 1$, so use APY for r in $A=P(1+r)^t$. For continuous compounding, use APR for r in $A=Pe^{rt}$; its APY is $e^{APR} - 1$, and $e^{\ln(a)}=a$.

WORKED EXAMPLE

You deposit $100 in an account with a 12% APR compounded monthly. What is the balance after 2 months?

1. Monthly rate: 12% / 12 = 1%.
2. Balance: $100(1 + 1/100)^2$.
3. $100(101/100)^2 = 102.01$.

Answer: $102.01

PRACTICE 6 problems

1 You invest $80 at 5% interest compounded yearly. What is the balance after 2 years?

ANSWER _____

2 An account has a 6% APR compounded monthly. You deposit $400. Give the monthly growth factor and the balance after 1 month.

ANSWER _____

3 A device worth $600 loses value at an annual proportional rate of 26%, applied weekly. What is its value after 1 week?

ANSWER _____

4 Find the exact APY of an account with a 6% APR compounded monthly. Leave your answer as an expression.

ANSWER _____

5 An account compounds continuously at an APR of ln(6/5). What is its APY?

ANSWER _____

6 You deposit $700 at a 3% APR compounded continuously. Write the exact balance after 1 year and identify r in $A=Pe^{rt}$.

ANSWER _____

APPLY IT Show your work

1 A used gaming laptop loses 20% of its value each year. Complete the table for years 1 and 2.

GAMING LAPTOP VALUE

Year	Value
0	$750
1	___
2	___

ANSWER _____

2 You save $800 toward a car in an account that compounds continuously at an APR of ln(21/20). Find the APY and your balance after 1 year.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Account A earns 10% interest compounded yearly. Account B compounds continuously at an APR of ln(9/8). Which account has the higher APY, and by how many percentage points? Explain your reasoning.

WORK SPACE AND ANSWER

Money in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	You invest $80 at 5% interest compounded yearly. What is the balance after 2 years?	**$88.20**
2	An account has a 6% APR compounded monthly. You deposit $400. Give the monthly growth factor and the balance after 1 month.	**Growth factor: 201/200; balance: $402**
3	A device worth $600 loses value at an annual proportional rate of 26%, applied weekly. What is its value after 1 week?	**$597**
4	Find the exact APY of an account with a 6% APR compounded monthly. Leave your answer as an expression.	**$(201/200)^{12} - 1$**
5	An account compounds continuously at an APR of ln(6/5). What is its APY?	**20%**
6	You deposit $700 at a 3% APR compounded continuously. Write the exact balance after 1 year and identify r in $A=Pe^{rt}$.	**Balance: $700e^{0.03}$; r = 0.03**

PART 2 · APPLY IT

1. **Year 1: $600; year 2: $480** Multiply by 0.8 each year: 750(0.8) = 600, then 600(0.8) = 480.
2. **APY: 5%; balance: $840** The APY is $e^{\ln(21/20)} - 1 = 1/20$, or 5%. After 1 year, the balance is 800(21/20) = 840.

CHALLENGE

Account B has the higher APY by 2.5 percentage points. Account A's APY is 10%, while Account B's APY is 9/8 - 1 = 12.5%.

Accept equivalent exact expressions for the APY and continuous-compounding answers. For the challenge, distinguish percentage points from percent change.