

# 1010 Personal Finance and Beyond Algebra T/Th Questions

Here are portions of questions from class to help you with your notes or later practice. The wording and ordering may change and we may not have time to cover all of them. Here we actively practice concepts, computational strategies, critical & creative thinking, and communication. Making mistakes is integral to the learning process and enriches our understanding as we extend content and clear up misconceptions.

- **Think** about a possible answer(s) on your own.
- **Pair up:** discuss your thoughts in a group. We may reorganize groups at times.
- Prepare to **share** from your group's discussion. This may take the form of an assertion, question, definition, example, or other connection. It could be something you tried and rejected.
- May be a lag at times—use this to **review** related concepts and examples, and **add** to your notes, or get to know your neighbors.

Appalachian's General Education Program prepares students to employ various modes of communication. Successful communicators interact effectively with people of both similar and different experiences and values and in this class you will practice oral and written communication during class by interacting with various peers and me.

## **lump earnings**

- Suppose we deposit \$1000 in a savings account that pays 5% interest compounded annually for 142 years—how much will we have in total savings?
- Suppose we deposit \$1000 in a savings account that pays 5% interest compounded monthly for 142 years—how much will we have in total savings?
- Which is better interest in this scenario, compounding annually, compounding monthly, or are they the same?
- Which do you think best explains why it does make sense to charge interest?
- Which do you think is most compelling of why it might not make sense to charge interest?
- If you were going to design an independent, self-sustaining, space mission, who travel far away to continually explore the geometry of the universe, would you charge interest within that community (as they are traveling)?
- Real-life situation: Past student was told that her certificate of deposit (CD) will be compounded monthly at 8% for 8 months, and is told that this 8% will apply each and every month (i.e. is the monthly rate). Let's say that she put in \$1000. How much would her CD be worth at the end of 8 months if the annual rate was indeed  $8 \times 12 = 96\%$  instead of 8%?
- What did the bank really mean?
- Which of the following apply to why the lump sum formula holds?
  - we used each short-term compounding period (local) to build upon and derive a global formula for the total savings plus interest
  - we took a process that originally had too many terms (one for each compounding period)
  - we reduced it to something manageable by finding the commonality of multiply by  $(1 + \text{rate})$  and applying the algebra of exponents

– this class is intended to be “plug and chug” so we never derived the lump sum formula—it was presented as mathematical magic

- If a certificate of deposit (c.d.) will be compounded monthly at 3% for 14 years, and William put in \$2000, then what is the formula that represents how much would the c.d. be worth at the end of 14 years?
- If a certificate of deposit (c.d.) will compounded monthly at 3% for 14 months, and William put in \$2000, how much would the c.d. be worth at the end of 14 months (answer in dollars and cents)?  
**Caution:** the previous question asks about 14 years but this problem asks about 14 months.
- What is the problem with Americans keeping their money under their mattress? What does Warren Buffett mean by an economic Pearl Harbor?
- What is the *interest* when \$37 is deposited today into an account that earns 12.99% compounded monthly for 2 years?
- You had a balance of 93 cents... and at an average of two and a quarter percent interest [compounded annually] over a period of 1000 years, that comes to...
- Lisa put in \$100 for one year into a Thrifty Savers 2.3% savings account instead of a 2.25% account, and she earned an extra nickel. What equation represents this scenario?
- Which of the following are true regarding the earned rate of a fund?
- Was the lump sum formula appropriate to use in the case of the Benjamin Franklin fund, when money was going in and out of the account?
- If we put in \$100 now and leave it there for 25 years compounded monthly at 5%, then how much interest, in dollars, will we have earned?
- How much should we put in now as a lump sum if we want the future value (FV) to be \$500 after 14 years of an account paying 1% compounded annually (i.e. what is the present value (PV) of the account)?

### **lump & periodic earnings**

- What is the total savings plus interest when \$25 is deposited into an account every month for 8 months at 1% compounded monthly?

a)  $25(1 + \frac{.01}{12})^{8 \times 12}$

b)  $\frac{25((1 + \frac{.01}{12})^{8 \times 12} - 1)}{\frac{.01}{12}}$

c)  $\frac{25((1 + \frac{.01}{8})^8 - 1)}{\frac{.01}{8}}$

d)  $\frac{25((1 + \frac{.01}{12})^8 - 1)}{\frac{.01}{12}}$

e) none of the above

- For each of the other choices, write a scenario that represents it. So your response will be different scenarios.
- Joan saved early for the first 10 years and then vacationed for the remaining 34 years. Which formulas must be used to calculate her total savings plus interest?
- What is the equation that represents the total savings plus interest when \$100 is deposited into an account each month for 4 years at 3% compounded monthly?
- What is the total interest earned, in dollars and cents, in the last question?
- What is the total savings plus interest when \$100 is deposited today into an account that earns 3% compounded monthly for 4 years?

### lottery decisions

- A Powerball lottery from usatoday.com. said “For the jackpot worth 295 million, if there is one winner, then they will have a choice between 25 annual payments of 11.8 million each (Note that  $25 \cdot 11.8 = 295$ ) or a single lump sum payment of 170 million.” Let’s cut off the “million” to make it easier to work with (if you look at the formulas for lump sum and periodic payment, this is ok to do to adjust the units, since it is multiplication outside the parenthesis). For comparison sake, first set up the equation, with numbers filled in, that represents the total savings plus interest if we took the lump sum and leave the 170 in an account at 5% compounded annually for the 25 years. The rate of 5% is close to the rate that the lottery used when determining the lump sum amount as \$170 million.
- Solve for the total (in millions)
- What is the interest (in millions)? Show work.
- Set up the equation that represents the total savings plus interest, in millions, if we took the annual payment and deposit each 11.8 annual payment into the same type of account at 5% compounded annually for the 25 years.
- Solve for the total (in millions)
- What is the interest (in millions)? Show work.
- Which yields more money? Circle one: lump      periodic
- Which yields more interest? Circle one: lump      periodic
- Search for recent news on: **lottery winner lump** and report back, giving a source.
- As time allows, read the next two pages (a handout on lottery winners) and write down an item you found interesting, disagreed with, or had a question on.
- Decisions, decisions: Which payout option would you select?  
Circle one: \$170 million lump sum      \$11.8 million annual payments

## loans

- On Excel we see

month	Payment	To Interest	To Principal	Loan Balance
119	\$58.18	\$0.76	\$57.42	\$57.17
120	\$58.18	\$ 0.38	\$57.80	(\$0.63)

where the .63 is in red. What is the total amount paid on the loan?

- If we pay an extra \$20 each month on a loan then we will pay...
- We can calculate the total interest in Excel via two of the three methods. Which is **incorrect**?
- Which option would you choose in the condo decisions? They both take the same amount of time—30 years—to pay off.
- If we take out a \$100 loan at 700% compounded monthly for 2 months, the monthly payment would be

a)  $100(1 + \frac{7}{12})^2$

b)  $\frac{100((1 + \frac{7}{12})^{(2 \times 12)} - 1)}{(\frac{7}{12})}$

c)  $\frac{100 \frac{7}{12}}{(1 - (1 + \frac{7}{12})^{-2})}$

d) other

- For each of the other choices, write a scenario that represents it. So your response will be different scenarios.
- If we take out a \$100 loan at 700% compounded monthly for 2 months, what is the payment to interest for the first month in the amortization table?
- Real-life Payday lender in Boone: Within 2 weeks of my next paycheck I can come in and (if I qualify), write a check to them for \$117.50 and receive \$100 cash at that time, so the interest on \$100 is \$17.50. Then, when I get paid, I bring \$117.50 in cash to their office and buy back my check. If I don't show up, they deposit my check, and if it bounces I will owe "returned check charges," plus the amount, and then on to a collection agency with potential civil charges if I don't pay. They told one of our faculty members that their rate was better than a credit card. First, compute the 2-week rate as the percentage of interest. Next, what is the annual rate (multiply the 2-week rate by 26, as there are 26 double weeks in a year) and how does it compare to credit card rates?

**review and reflect** as per Watauga Residential College's focus on experiential, inquiry-based learning:

- If we have a \$800 lump sum to invest for two years, which is the better investment: 7.5% compounded annually or 7.3% compounded monthly? Why?
- Alex works part-time and earns \$100 each week. Alex deposits \$400 at the end of each month in an account which pays 6.8% compounded monthly. If Alex does this consistently for three years, will they have enough to buy the \$15,000 car they are hoping to get?
- If we have maxed out our credit card at \$1000 and are going to pay it off over 3 months at 23% compounded monthly, and the amortization table shows the following, then what is the total interest paid?

month #	end of month payment	interest paid that month	principal paid that month	loan balance
3	346.75	6.49	340.26	(1.71)

- If we take out a payday loan for \$1000 at 700% compounded monthly but can't pay it fully back right away and instead pay it back over 3 months, then what will be the total interest paid on the loan over those 3 months (ignore any extra fees and ignore rounding issues/overbalance the last month although do round to 2 decimal places as usual)?
- You are taking out a loan for \$54,000. The interest rate is 8.25% compounded monthly.
  - a) Find the monthly payments if you get a thirty year loan.
  - b) What are your monthly payments if you get a fifteen year loan?
  - c) How much money will you save with the fifteen year loan?
  - d) Prepare the first row of an amortization table for the thirty year loan.
- If Taylor deposits \$50 at the end of each month into an account paying 1.5% interest compounded monthly for 2 years but then changes the deposit to \$100 each month for 3 more years at the same rate, what will the total savings plus interest be after the entire 5 years?
- On December 8, 2022, the article: *North Carolina teen wins \$1M lottery while heading to 2nd job: 'Everyone was happy'* by Cortney Moore was published in Fox Business. Moore wrote "An 18-year-old has won \$1 million from a scratch-off lottery ticket while heading to his second job in North Carolina... The NC Education Lottery said [the winner Daniel] Radford was presented with two prize options: take an annuity payment of \$50,000 over 20 years [ $50000 \times 20 = 1M$ ] or a lump sum payment of \$600,000." For comparison sake, I used Goal Seek to solve for the rate where the total savings plus interest from the annual periodic payment would be equal to that for the lump sum after 20 years of savings and then rounded a bit: approximately 5.45% compounded annually, which is I think how the lottery decided on the \$600,000!
  - a) If the lump sum of \$600,000 was placed into an account for 20 years at 5.45% compounded annually, then what is the total interest and round to 2 decimal places.
  - b) If the annuity payments of \$50,000 each year were placed into an account for 20 years at 5.45% compounded annually, then what is the total interest and round to 2 decimal places.