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MATH 108  
Spring 2023  
HW 3: Due 02/06

*“A billion here, a billion there, and pretty soon you’re talking about real money.”*  
—Everett Dirksen

**Problem 1.** (10pt) Suppose that the CPI in 2021 was approximately 278.802 while the CPI in 2022 was approximately 296.797.

- (a) Find the inflation rate from 2021 to 2022.
- (b) Assuming that the CPI accurately reflects the prices of goods as a whole, how much would you estimate a good that cost \$69.99 in 2021 would cost in 2022?
- (c) Assuming that the inflation rate from 2021 to 2022 stayed constant, how much more do you estimate goods would cost in 2030 than in 2022?

**Solution.**

- (a) We have...

$$\frac{296.797}{278.802} = 1.064544 = 1 + 0.064544$$

Therefore, the inflation rate was approximately 6.45%.

- (b) We would expect the good would cost approximately 6.45% more, i.e. that it would cost...

$$\$69.99(1 + 0.064544) = \$69.99(1.064544) \approx \$74.51$$

- (c) If the inflation rate stayed constant, the cost of goods would rise by approximately 6.45% each year for the next 8 years. But then a good that cost  $P$  dollars this year would then cost  $P(1.064544)^8 = P(1.64934) = P(1 + 0.64934)$ . Therefore, goods would cost 64.93% more in 2030 than in 2022.

**Problem 2.** (10pt) Anita needs a short term loan to cover some temporary expense increases. She takes out a short-term, 5 month loan for \$1100 that earns 9.4% annual simple interest.

- (a) How much will she owe in total at the end of the five months?
- (b) If Anita knows she will only be able to pay at most \$1300 at the end of the five months, what is the most she can take out on the loan now?

**Solution.**

- (a) We have...

$$F = P(1 + rt) = \$1100 \left( 1 + 0.094 \cdot \frac{5}{12} \right) = \$1100(1.03917) = \$1143.08$$

Therefore, she will owe \$1,143.08 at the end of the five months.

- (b) We have...

$$P = \frac{F}{1 + rt} = \frac{\$1300}{1 + 0.094 \cdot \frac{5}{12}} = \frac{\$1300}{1.03917} = \$1251$$

Therefore, the most she can take out on the loan is \$1,251.

**Problem 3.** (10pt) Emmanuel is taking out a loan to help purchase a new delivery truck to help expand his small business. He decides on a truck that costs \$67,049. There is a \$160 processing/service fee for the truck. After this is added, he will pay 7% sales tax. He will take out a simple discount note to pay for this delivery truck. The note will have a period of 9 months at an annual interest rate of 8.3%.

- (a) How much will the truck cost in total?
- (b) What are the maturity and proceeds for this note?
- (c) How much does he owe at the end of the 9 months?
- (d) How much does he pay for the truck in the end, i.e. how much in total does he pay for the loan?

**Solution.**

- (a) After the \$160 processing/service fee, the truck costs  $\$67049 + \$160 = \$67209$ . But then there is a 7% sales tax, after which the price is  $\$67209(1 + 0.07) = \$67209(1.07) = \$71931.63$ . Therefore, the truck will cost \$71,913.63.
- (b) The maturity for this loan is the loan amount, which will be the total amount for the truck. By (a), this is \$71,913.63. Emmanuel will receive this amount minus the discount (interest) for this loan. The discount is  $D = Mrt = 71913.63(0.083)\frac{9}{12} = \$4476.62$ . Then the amount Emmanuel receives is  $\$71913.63 - \$4476.62 = \$67437.01$ .
- (c) After 9 months, Emmanuel must pay back the original loan amount (he has already paid the discount, i.e. the interest), which is \$71,913.63.
- (d) In total, he pays the loan plus the discount (the interest). Therefore, the total is  $\$71913.63 + \$4476.62 = \$76390.25$ .