

1. **(5 points)** *Borbála opens a savings account (initially empty) with an annual interest rate of 2% compounded quarterly, and every quarter for 15 years she deposits \$1000 into it. How much money will have accumulated in the account by the end of these 15 years?*

This is an accumulative investment, with a periodic contribution of  $A = 1000$ , with  $n = 4$  periods per year, a  $r = 0.02$  interest rate, and running for  $t = 15$  years, to acquire final value

$$F = A \frac{(1+i)^m - 1}{i} = A \frac{\left(1 + \frac{0.02}{4}\right)^{15 \times 4} - 1}{\frac{0.02}{4}} \approx 69770.03$$

so after fifteen years she will have accumulated  $\boxed{\$69770.03}$  in total.

2. **(10 points)** *You put a \$1500 charge on your credit card, intending to pay it off with equal payments for each of the next 3 months. Your credit card charges a 16% annual interest rate, compounding monthly.*

- (a) **(5 points)** *What payment should you make each month to successfully pay off the credit card?*

This is an amortized loan (well, it's one you amortize yourself; the credit card company won't make you do it) with the known initial balance  $P = 1500$ , an annual interest rate of  $r = 0.16$  compounded over  $n = 12$  periods per year, and with payments spread over  $m = 3$  periods. We wish to calculate the periodic contribution  $A$ :

$$A = \frac{Pi}{1 - (1+i)^{-m}} = \frac{1500 \times \frac{0.16}{12}}{1 - \left(1 + \frac{0.16}{12}\right)^{-3}} \approx 513.39$$

so you need to pay about  $\boxed{\$513.39}$  each month.

- (b) **(3 points)** *Using the above result, fill in the following amortization schedule:*

Month	Starting balance	Payment	Interest	Principal repaid	Ending balance
1	\$1,500.00	\$513.39	\$20.00	\$493.39	\$1,006.61
2	\$1,006.61	\$513.39	\$13.42	\$499.97	\$ 506.64
3	\$ 506.64	\$513.40	\$ 6.76	\$506.64	\$ 0.00

- (c) **(2 points)** *Using any of the work above, determine the amount of interest you have paid on the loan in total (i.e. the “finance charge”):*

Using just the work in part (a), we might note that the total resulting from three payments of  $A$  dollars each is a payment is  $3A$  dollars, or \$1540.18. Of that, \$1500 was the original loan principal, so  $\boxed{\$40.18}$  is paid in interest.

Alternatively, we can add up the three “interest” entries in the amortization schedule to get  $20 + 13.42 + 6.76$ , which also gives an answer of  $\boxed{\$40.18}$ .