Problem 1 (5 points): [GH 3.4.19] *A couple predicts that they will need to save* $\$150,000$ *for their child's college education, and they predict that they will be able to earn about* 9% *interest, compounded monthly, on their investments.*

(a) *If they begin the deposits at the end of each month when their child is a newborn, so that they have* 18 *years of deposits, how large must each deposit be? Round your answer to the nearest cent.*

(b) *If they do not begin making deposits until the child is* 10 *years old, so that they have only* 8 *years of deposits, how large must each deposit be? Round your answer to the nearest cent.*

Solution: For part (a), we have $F = \$150,000$, $r = .09$, $n = 12$, and $t = 18$. Using the systematic savings formula $F = D\left(\frac{\left(1+\frac{r}{n}\right)^{nt}-1}{\frac{r}{n}}\right)$, we thus wish to solve

$$150,000 = D\left(\frac{\left(1+\frac{.09}{12}\right)^{12\cdot 18}-1}{\frac{.09}{12}}\right)$$

for D. Doing so, we find $D \approx \$279.67$.

For part (b), we have $F = \$150,000$, $r = .09$, $n = 12$, and $t = 8$. Again using the systematic savings formula $F = D\left(\frac{\left(1+\frac{r}{n}\right)^{nt}-1}{\frac{r}{n}}\right)$, we thus wish to solve

$$150,000 = D\left(\frac{\left(1+\frac{.09}{12}\right)^{12\cdot 8}-1}{\frac{.09}{12}}\right)$$

for D. Doing so, we find $D \approx \$1072.53$.

Problem 2 (5 points): [GH 3.5.23] *A car dealer offered a Ford Taurus for a total price of* $\$16,378$. *Assume that a* 10% *down payment was required. The customer had a choice of taking out a loan for the remaining cost of the car at* 0.9% *interest compounded monthly or taking a* $\$750$ *rebate to be used to reduce the size of the loan by* $\$750$. *If the rebate were taken, then the buyer could only obtain a loan at* $\$7.95\%$ *interest compounded monthly. In either cas the loan required monthly payments for* 4 *years. For which option are the monthly payments the lowest?*

Solution: The down payment would be $(.10)(\$16,378.00)$ in both cases, or $\$1,637.80$. The amount of the loan, before any rebate, would thus be

$$\$14740.20 = \$16,378.00 - \$1,637.80.$$

If the \$14740.20 were repaid with the 0.9% interest rate, the monthly payments would satisfy

$$\$14740.20 = R\left(\frac{1-\left(1+\frac{.009}{12}\right)^{-12\cdot 4}}{\frac{.009}{12}}\right),$$

and thus be $R \approx \$312.76$.

If the \$750 rebate were taken with the 7.95% interest rate, the principal would be $\$13990.20 = \$14740.20 - \$750.00$ and the monthly payments would satisfy

$$\$13990.20 = R\left(\frac{1-\left(1+\frac{.0795}{12}\right)^{-12\cdot 4}}{\frac{.0795}{12}}\right),$$

and thus be $R \approx \$341.21$.

The 0.9% interest rate with no rebate would thus offer the lower monthly payments.