



MATH 140: WEEK-IN-REVIEW 13 (CHAPTER 6.2)

1. If Peter deposits \$100 at the end of each month into a savings account earning interest at a rate of 5.65% per year compounded monthly, how much will he have at the end of 20 years (assuming no deposits or withdrawals are made during that period)? How much total interest will he have earned?

TVM Solver

$$N = m * t = (12)(20) = 240$$

$$I\% = 5.65$$

$$PV = 0$$

$$PMT = -100$$

$$FV = ? \quad 44\,335.39205$$

* round to nearest CENT*

$$P/y = C/y = 12$$

PMT: **END** BEGIN

\$44,335.39 at the end of 20 years

$$\text{Total Interest} = FV - N * PMT$$

$$= 44,335.39 - (240)(100)$$

$$= \boxed{\$20,335.39}$$



2. You wish to retire with $\$1,000,000$ in a retirement account, which you will make equal monthly deposits during the 45 years that you work. If the account will pay interest at a rate of 6.25% per year compounded monthly, how much should you deposit at the end of each month in order to have your million?

 $t = 45$

PMT = ?

I%

TVM Solver

$$N = (12)(45) = 540$$

$$I\% = 6.25$$

$$PV = 0$$

$$PMT = ? - 335.3637584$$

$$FV = 1,000,000$$

$$P/Y = C/Y = 12$$

PMT: END BEGIN

Deposit \$335.36 at the end of each month



3. You are looking to buy a new car and have only \$1,250 for a down payment. The car you wish to buy has a purchase price of \$25,500. If the best financing option you find charges interest at a rate of 3.25% per year compounded monthly, how much should you pay each month in order to pay off the car in 60 months, assuming you use the money you already have for a down payment? In 48 months? In 36 months? How much do you end up paying in interest with each of these options?

TVM Solver, 60 months

$$N = 60$$

$$I\% = 3.25$$

$$PV = 24,250$$

$$PMT = ? - 438.440056$$

$$FV = 0 \text{ (loan paid off)}$$

$$P/y = C/y = 12$$

$$PMT: \text{END BEGIN}$$

$$PV = \text{Loan amt}$$

$$= \text{Purchase Price} - \text{Down payment}$$

$$= 25,500 - 1,250$$

$$= 24,250$$

$$\boxed{\$438.44 \text{ per month}}$$

$$\begin{aligned} \text{Interest} &= N * PMT - PV \\ &= 60 * 438.44 - 24,250 \\ &= \boxed{\$2,056.4} \end{aligned}$$

TVM Solver, 48 months

$$N = 48$$

$$I\% = 3.25$$

$$PV = 24,250$$

$$PMT = ? - 539.44104$$

$$FV = 0$$

$$P/y = C/y = 12$$

$$PMT: \text{END BEGIN}$$

$$\boxed{\$539.44 \text{ per month}}$$

$$\text{Interest} = N * PMT - PV = \boxed{\$1,643.12}$$

TVM Solver, 36 months

$$N = 36$$

$$I\% = 3.25$$

$$PV = 24,250$$

$$PMT = ? - 707.8942441$$

$$FV = 0$$

$$P/y = C/y = 12$$

$$PMT: \text{END BEGIN}$$

$$\boxed{\$707.89 \text{ per month}}$$

$$\text{Interest} = N * PMT - PV = \boxed{\$1,234.04}$$



4. How much should you deposit at the end of each ^{m=4}quarter into an account earning interest at an annual ^{I%}rate of 4.25%, compounded quarterly, in order to have \$45,000 at the end of 5 years?
FV t=5

TVM Solver

$$N = 4 * 5$$

$$I\% = 4.25$$

$$PV = 0$$

$$PMT = ? - 2031.285438$$

$$FV = 45000$$

$$P/y = C/y = 4$$

$$PMT: \text{END} \text{ BEGIN}$$

Deposit \$2031.29 at the end of each quarter

5. You were given \$1,000 at your college graduation party. You decide to deposit the entire amount into an account earning interest at an annual interest rate of 3.75%, compounded monthly, on your first day of work. From each paycheck of your new job, you deposit \$100 at the end of each month into the same account. If you continue making these deposits and do not withdraw any money from the account, how much money will be in the account after 15 years? How much total interest does the account earn?
t=15

PV

TVM Solver

$$N = 12 * 15 = 180$$

$$I\% = 3.75$$

$$PV = -1000$$

$$PMT = -100$$

$$FV = ? 25,866.02831$$

$$P/y = C/y = 12$$

$$PMT: \text{END} \text{ BEGIN}$$

\$25,866.03 after 15 years

$$\begin{aligned} \text{Interest} &= \text{Future Value} - \text{Total Deposits} \\ &= \underset{FV}{25,866.03} - (\underset{PV}{1000} + \underset{N * PMT}{180 * 100}) \\ &= \boxed{\$6,866.03} \end{aligned}$$



6. You go on a shopping spree and use a credit card which charges interest at an annual rate of 24% compounded monthly. If you make no additional charges to the card, your required monthly payment will be \$101 for 233 months.

(a) How much did you charge (to the nearest dollar)?

TVM Solver PV

$$N = 233$$

$$I\% = 24$$

$$PV = ? \quad 4999.94 \rightarrow \$5,000 \text{ (nearest DOLLAR)}$$

$$PMT = -101$$

$$FV = 0 \text{ (paid off)}$$

$$P/Y = C/Y = 12$$

$$PMT: \text{END} \text{ BEGIN}$$

(b) How much total interest will you end up paying?

$$\text{Interest} = \text{Amnt paid} - \text{Loan amnt}$$

$$= N * PMT - PV$$

$$= 233 * 101 - 5000$$

$$= 23,533 - 5,000$$

$$= \$18,533$$



7. Fiona recently purchased a car by making a \$2,000 down payment and securing a loan for the remaining amount which charges interest at a rate of 4.5%, compounded monthly, and requires monthly payments of \$375 over 5 years. What was the purchase price of Fiona's car?

$$\text{Purchase price} = \underbrace{\text{Loan amnt}}_{PV = ?} + \underbrace{\text{Down payment}}_{\$2,000}$$

TVM Solver

$$N = 12 * 5 = 60$$

$$I\% = 4.5$$

$$PV = ? \quad 20114.76763$$

$$PMT = -375$$

$$FV = 0 \text{ (paid off)}$$

$$P/y = C/y = 12$$

$$PMT: \text{END} \text{ BEGIN}$$

$$\text{Purchase price} = 20,114.77 + 2,000$$

$$= \boxed{\$22,114.77}$$



8. Ten years ago, Jonas made a down payment on a house of 20% of the purchase price and secured a bank loan of \$175,000 to finance the remaining amount. The mortgage was for a term of 30 years, with an interest rate of 7.5% per year compounded monthly on the unpaid balance to be amortized through equal monthly payments.

(a) What was the purchase price (cash value) of Jonas's house?

$$\begin{aligned}\text{Purchase price} &= \text{Loan Amnt} + \text{Down payment} \\ &= 175,000 + 0.2(\text{Purchase price})\end{aligned}$$

$$\Rightarrow \text{Purchase price} = \frac{175,000}{0.8} = 218,750$$

The purchase price on the house was \$218,750

(b) How much does Jonas pay per month towards the mortgage?

TVM Solver

$$N = 12 \times 30 = 360$$

$$I\% = 7.5$$

$$PV = 175,000$$

$$PMT = ? - 1223.62539$$

$$FV = 0$$

$$P/Y = C/Y = 12$$

$$PMT: \text{END} \text{ BEGIN}$$

Jonas pays \$1,223.63 per month towards the mortgage



(c) What is the outstanding principal on Jonas's house now?

$$N = 12 \times 10 = 120$$

$$I\% = 7.5$$

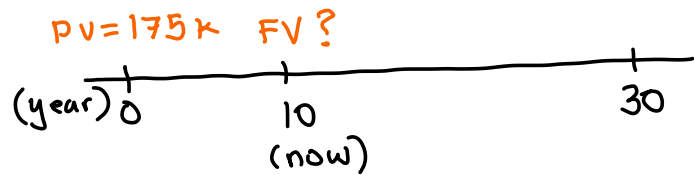
$$PV = 175000$$

$$PMT = -1223.63$$

$$FV = ? - 151,891.2275$$

$$P/y = C/y = 12$$

PMT: **END** BEGIN



Outstanding balance = \$151,891.23

(d) How much equity does Jonas have in the house now?

$$\text{Equity} = \text{Purchase price} - \text{Amnt owed now}$$

$$= 218,750 - 151,891.23$$

$$= \$66,858.77$$

(e) How much total interest will Jonas pay over the life of the loan?

$$\text{Interest} = N \times PMT - PV$$

$$= 360 \times 1223.63 - 175000$$

$$= \$265,506.80$$



- (f) At this time, interest rates have dropped to 5.2% per year compounded monthly on a 15 year mortgage and Jonas is thinking about refinancing. If he refinances, what will his new monthly payments be?

TVM Solver

$$N = 12 * 15$$

$$I\% = 5.2$$

$$PV = 151891.23$$

$$PMT = ? - 1217.0302$$

$$FV = 0$$

$$P/y = C/y = 12$$

$$PMT: \text{END} \text{ BEGIN}$$

New monthly payments
\$1,217.03

- (g) How much money, if any, will Jonas save by refinancing (assuming no additional refinancing costs)?

* Look at the remaining time * 20 yrs left on old loan

$$\text{Without refinancing: } (12)(20)(1223.63) = \$293,671.20$$

$$\text{with refinancing: } (12)(15)(1217.03) = \$219,065.40$$

$$\text{Amnt saved} = \$293,671.20 - \$219,065.40$$

$$= \$74,605.80$$



9. Eugenia buys a new \$1,500 television by paying 15% down payment and financing the remaining amount. The terms of her finance agreement state that the unpaid balance will be charged interest at a rate of 18% per year, compounded monthly, and the money is to be repaid over a period of 20 months with equal installments made at the end of each month.

(a) How much will Eugenia pay each month? $PMT = ?$

TVM Solver

$$N = 20$$

$$I\% = 18$$

$$PV = 1275$$

$$PMT = ? - 74.2633$$

$$FV = 0$$

$$P/Y = C/Y =$$

$$PMT: \text{END} \text{ BEGIN}$$

$$\begin{aligned} PV &= 85\% \text{ of } 1500 \\ &= (0.85)(1500) \\ &= \$1,275 \end{aligned}$$

\$74.26 per month

(b) How much of the first payment goes towards paying down the loan? $r = 0.18$

$$\text{Towards interest} = I_1 = \left(\frac{r}{m}\right)PV_0, \quad PV_0 = 1,275$$

$$\begin{aligned} I_1 &= \left(\frac{0.18}{12}\right)(1,275) = 19.125 \\ &= \$19.13 \end{aligned}$$

$$\begin{aligned} \text{Towards loan} &= PMT - I_1 \\ &= 74.26 - 19.13 \\ &= \$55.13 \end{aligned}$$



(c) Fill in the first six lines of the amortization schedule.

End of Period	PMTs remaining	Payment (PMT)	TO Interest	TO Principal	Outstanding Principal	EQUITY
0	20	0	0	0	1275	225
1	19	74.26	19.13	55.13	1219.87	280.13
2	18	74.26	18.30	55.96	1163.90	336.09
3	17	74.26	17.46	56.80	1107.10	392.90
4	16	74.26	16.61	57.65	1049.45	450.55
5	15	74.26	15.74	58.52	990.93	509.07

constant decrease increase decrease increase

$$I_1 = \frac{r}{m} PV_0 = \frac{0.18}{12} (1,275) = 19.13, \quad PMT - I_1 = 55.13, \quad PV_1 = PV_0 - (PMT - I_1) = 1219.87$$

$$I_2 = \frac{r}{m} PV_1 = 18.30, \quad PMT - I_2 = 55.96, \quad PV_2 = PV_1 - (PMT - I_2) = 1163.90$$

$$I_3 = \frac{r}{m} PV_2 = 17.46, \quad PMT - I_3 = 56.80, \quad PV_3 = PV_2 - (PMT - I_3) = 1107.10$$

$$I_4 = \frac{r}{m} PV_3 = 16.61, \quad PMT - I_4 = 57.65, \quad PV_4 = PV_3 - (PMT - I_4) = 1049.45$$

$$I_5 = \frac{r}{m} PV_4 = 15.74, \quad PMT - I_5 = 58.52, \quad PV_5 = PV_4 - (PMT - I_5) = 990.93$$

(d) How much equity will Eugenia have in her TV after 1 year?

$$E_5 = 1500 - 990.93 = 509.07$$

Equity = Purchase price - What is owed

TVM Solver

$$= 1500 - 555.93$$

$$N = 12$$

$$= \$944.07$$

$$I\% = 18$$

$$PV = 1275$$

$$PMT = -74.26$$

$$FV = ? - 555.93$$



$$PV = (0.8)(150,000)$$

10. Matt bought a new house in 2005 for \$150,000. He put 20% down and financed the remaining balance with a 30 year mortgage at an annual interest rate of 5.58%, compounded monthly, on the unpaid balance.

(a) What were Matt's required monthly mortgage payments when he bought the house?

$$N = 12 \times 30 = 360$$

$$I\% = 5.58$$

$$PV = 120,000$$

$$PMT = ? - 687.3821$$

$$FV = 0$$

Monthly payments: \$687.38

(b) How much of his first payment went towards interest? How much of his first payment went towards the principal?

$$I_1 = \frac{r}{m} PV_0 = \frac{0.0558}{12} \times 120,000$$

$$= \$558 \text{ (towards interest)}$$

$$PMT - I_1 = 687.38 - 558 = \$129.38 \text{ (towards loan)}$$

(c) In 2010, after 5 years, Matt decided to refinance his house with a 25-year mortgage with an annual interest rate of 3.5%, compounded monthly, on the unpaid balance. What are his new required monthly payments?

$$N = 12 \times 5 = 60$$

$$I\% = 3.5$$

$$PV = 120,000$$

$$PMT = -687.38$$

$$FV = ? - 111,069.77$$

$$\text{Amnt owed in 2010} = \$111,069.77$$

$$N = 12 \times 25$$

$$I\% = 3.5$$

$$PV = 111,069.77$$

$$PMT = ? - 556.041$$

$$FV = 0$$

New monthly payments:
\$556.04



(d) Before refinancing, how much equity did Matt have in his house?

$$\text{Equity} = \text{Purchase price} - \text{What is owed}$$

$$= 150,000 - 111,069.77$$

$$= \boxed{\$38,930.23}$$