Math 166 - Week in Review #10

Chapter F - Finance

- Simple Interest interest that is computed on the original principal only
- · Simple Interest Formulas

Interest = I = Prt

Accumulated Amount = A = P + I = P + Prt = P(1 + rt)

NOTATION: I = interest earned, P = principal, r = interest rate (as a decimal),

t = term of the investment in YEARS, A = accumulated amount

- The TVM-Solver CANNOT be used for simple interest calculations.
- Compound Interest earned interest that is periodically added to the principal and thereafter itself earns interest at the same rate.
- The TVM-Solver can be used in problems involving compound interest as follows:
 - **N** = total number of payments made, usually $m \times t$.
 - I% = interest rate in *percent form*. Don't convert to decimal form!!
 - PV = present value (prinicpal, or the amount you start with). Entered as negative if invested, positive if borrowed.
 - PMT = payment (amount paid each period). Entered as negative if paying off a loan, positive if receiving money, 0 if computing compound interest.
 - FV = future value (accumulated amount). This will be 0 if paying off a loan.
 - P/Y = number of payments per year (usually the same as m).
 - C/Y = number of conversions per year (m).
- At the bottom of the screen, you will see PMT:END BEGIN. If END is highlighted, then the TVM Solver calculates everything with payments being made at the end of the period. For virtually all of the problems we will work in class, END should be highlighted.
- You can solve for any quantity on the TVM-Solver by moving the cursor to that quantity and then pressing ALPHA followed by ENTER.
- Effective Rate of Interest The effective rate of interest is a way of comparing interest rates. More precisely, the *effective rate* is the simple interest rate that would produce the same accumulated amount in 1 year as the nominal rate compounded *m* times per year.
- The effective rate of interest is typically denoted by r_{eff} and is also known as the effective annual yield.
- To calculate the effective rate of interest, use the Eff() function on the calculator. This function can be found under Finance-just arrow down until you see C: Eff(.
- The Eff() function has two parameters, the nominal (or annual) interest rate entered as a percent, and the number of conversion, *m*, per year: Eff(nominal rate as a percent, *m*)
- Annuity a sequence of payments made at regular time intervals.
- In this course, we will study annuities with the following properties:
 - 1. The terms are given by fixed time intervals.
 - 2. The periodic payments are equal in size.
 - 3. The payments are made at the end of the payment periods.
 - 4. The payment periods coincide with the interest conversion periods.

1. Jake deposited \$350 into an account paying 3.25% simple interest. How much money is in the account at the end of 4 years? How much interest was earned?

Interest earned =
$$I = Prt = 350(.0325)(4) = (245.50)$$

Accumulated Amount = $P + I = 350 + 45.50 = (395.50)$
after H years

2. When Erica graduated from high school, she received \$500 from her parents as a gift. She then loaned this money to her brother who repaid her 3 months later with a sum of \$510.25. What was the simple interest rate that Erica charged her brother?

$$T = Prt$$

$$10.25 = 500 * r * \frac{3}{12}$$

$$r = 10.25 / (500 * 3 / 12) = 0.082$$

$$8.290$$

- 3. Annette wants to take a trip to Europe when she graduates. She will need \$4,500 for this trip.
 - (a) How much money should Annette deposit now into an account paying 8%/year compounded quarterly if she expects to graduate in 4 years?

$$N=4 \times 4$$
 PMT=D
 $I_{90}=8$ FV=4500 Deposit \$3,278.01
 $PV=?$ PIN=C/N=4

(b) How much interest will she earn in the 4 years?

(c) How much interest will she earn in the third quarter of the second year?

Ist year = 4 quarters

$$2^{nd}$$
 year = 1st, 2nd, 3rd 4th
 3^{sth} water quarter
 1^{sth} water quarters
 1^{sth} and 1^{sth} quarters
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- 4. Lynn, Annette's twin sister, wants to take that same trip to Europe, but she does not have enough money to open the same type of account as Annette. Instead, she plans to make monthly payments to an account paying 8.25%/year compounded monthly.
 - (a) How much should each payment be so that she has \$4,500 at the end of 4 years?

N=12×4	(PMT= ?) [\$79.45]
JN0=8.25	FV = 4500
PV=0	P1Y=01Y=12

(b) How much interest will Lynn earn?

Lynn's total deposit =
$$79.45 \times 12 \times 4 = $3813.60$$

Interest earned = $4500 - 3813.60 = 486.40

- 5. Kira opened an account paying 5.25%/year compounded monthly with \$100 and plans to add \$50 at the end of each month until she has at least \$45,000.
 - (a) How long will it take her to first reach her goal?

How long will it take her to first reach her goal?

$$N = 363$$
. $Ti 85 - 678$
 $So 363$ payments:s not
 $190 - 5.25$ $FV = 45000$
 $PV = -100$ $P/Y = C/Y = 12$
 $N = 363$. $Ti 85 - 678$
 $so 363$ payments:s not
 $enough - she needs$
 364 payments (months)
 $364/12 = 30\frac{1}{3}$ years.

(b) How much will she actually have in the account when she first reaches her goal?

(c) How much interest will Kira earn in the third month of her sixth year of making this investment?

$$5yrs = 5 \times 12 payments = leoparyments \\ lethyr: 1st 2nd 3rd 4th 5th 6th ... minth \\ lethyr: 1st 2nd 3rd 4th 5th 6th ... minth \\ 01 62 63 64 65 66 months \\ 01 62 63 64 65 66 months \\ 01 62 63 64 65 66 months \\ 02 60 60 months \\ 02 60 60 months \\ 02 60 months \\ 02$$

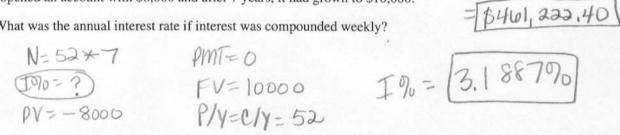
- 6. Benjamin is 25 years old and plans to retire in 40 years. When he retires, he would like to receive monthly payments of \$3,000 from a retirement account for 15 years.
 - (a) How much money should Benjamin deposit at the end of each month from now until he retires to achieve this goal if he secures an account that will pay 6.25%/year compounded monthly for the life of the account?

Skepl: Find starting amount needed for retirement account. $N = 12 \times 15$ PMT= 3000 So start D = 6.25 P = 2.349385.70 FV=0 with account $P = 12 \times 15$ PMT= 3000 So start D = 6.25 FV=349 885.70 P = 0 With 885.70 P = 0 With 885.70 P = 0 PIY=CIY=12 P = 0 At retire-(b) How much will Benjamin deposit into this account? 164.12×12×40= (\$ 78,777.60)

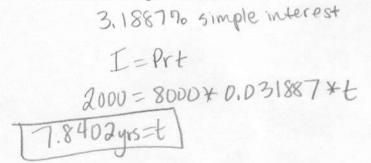
(c) How much interest will be earned over the entire life of the account? Twosteps: OF ind interest earned while saving for retirement @Find interest earned while withdrawing from retirement account.

7. Julian opened an account with \$8,000 and after 7 years, it had grown to \$10,000.

(a) What was the annual interest rate if interest was compounded weekly?



(b) If the annual interest rate found in part (a) was instead a simple interest rate, how long would it take for Julian's \$8,000 to grow to \$10,000?



8. Miles and Keiko are shopping for a new home. They can afford a down payment of \$25,000 and monthly payments of at most \$850. Bank A has offered to finance a loan at 8.75%/year compounded monthly for 30 years, whereas Bank B has offered 8.25%/year compounded monthly for 25 years.

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(a) What is the most expensive house they can afford to buy? Which bank would they have to use for this house? 0

$$\frac{Bank A}{N = 12 \times 30} \quad pmE = -850$$

$$\frac{1}{106 - 3.75} \quad FV = 0$$

$$\frac{(N = 7)}{(N = 7)} \quad pN = 4N = 114$$

$$= 1 \text{ coan } 9 \Rightarrow 103046 \cdot 21$$

$$\frac{1}{106 - 3004} \quad pmE = 133046 \cdot 21$$

$$\frac{1}{106 - 300} \quad pmE = 133046 \cdot 21$$

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period	interest owed	payment	amount toward principal	outstanding principal
0				85000
17	584.38	670.18	85.80	84914.20
2	583.79	1070.18	86.39	84827.81
3	583.19	670.18	86.99	84740.82
4	582.59	670.18	87.59	84653.23

85000 × .0825/12 = 584.38

- 9. If Bank A has a savings account paying 8%/year compounded semiannually and Bank B offers 7.9%/year compounded monthly, which is the better offer?
- Bank A: Eff(8,2) = 8.16% Bank B: Eff(7.9,12) = 8.1924%
 - 10. Juanita decided to purchase a flat-screen HDTV. She makes a down payment of \$250 and secures financing for the balance of the purchase price at a rate of 12%/year compounded monthly. Under the terms of the finance agreement, she is required to make monthly payments of \$125 for 30 months.
 - (a) What was the cash price of the TV? Find Loan ant :

Loan Amt=\$ 3225.96

Cash price = Down pmt + Loanamt = 250 + 3225.96= $\frac{3475.96}{}$

Bank Bis the better offer since it has the higher effective rate.

(b) How much interest did Juanita pay?

- 11. Deanna owes \$1,000 on a credit card that has an interest rate of 22.5%/year compounded monthly. If she pays the minimum payment of \$20 each month,
 - (a) how much of her first payment goes toward interest?

(b) how long will it take her to pay off the card? (Assume no additional charges are made.)

$$\begin{array}{c} (N=?) & PMT=-20 \\ \hline IR = 22.5 & FV=0 \\ PV=1000 & PIY=CIY=12 \\ \hline N=149.2534 & 50149 payments will not be enough - \\ \hline 150$ pmts (months) needed = [12.5ypars] \\ \end{array}$$

Slep! Find monthly payment.

N = 12*30PMF= ?
$$\Rightarrow$$
 \$681.03In-6.75FV = 0PV = 105,000P/y = C/y = 12

(b) How much equity do the Gardners have in their vacation home?

(c) Over the 30-year period, how much interest will the Gardners pay?

$$Interest paid = 245170.80 - 105000 \\ = [$140,170.80]$$

13. Find the effective rate of 6% per year compounded semiannually.