Chapter 5 - 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?

$$I = Prt = 350(.0325)(4)$$

$$\boxed{I = \$45.50}$$

$$A = P + I = 350 + 45.50 = \boxed{\$395.50}$$

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?

find r

term is in YEARS

$$I = Prt$$

$$10.25 = 500r\left(\frac{3}{12}\right)$$

$$\boxed{r = 0.082}$$

simple interest rate was 8.2%

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

$N = 4*4$
$I\% = 8$
$PV = ?$
$PMT = 0$
$FV = 4500$
$P/Y = C/Y = 4$

$\boxed{\$3278.01}$

(comes back negative because she needs to deposit this amt.)

Interest earned =
$4500 - 3278.01$
$= \boxed{\$1221.99}$

4. Lynnette, 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. How much should each payment be so that she has $4,500 at the end of 4 years? How much interest will Lynnette earn?

$N = 4*12$
$I\% = 8.25$
$PV = 0$
$PMT = ? \rightarrow \boxed{\$79.45}$
$FV = 4500$
$P/Y = C/Y = 12$

(will come back as negative)

Lynnette's total deposit =
$(79.45)(4*12) =$
$\$3813.60$

Interest earned:
$4500 - 3813.60$
$= \boxed{\$686.40}$

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. How long will it take her to first reach her goal? How much will she actually have in the account when she first reaches her goal?

$N = \longrightarrow$ $N = 363.7986$

$I\% = 5.25$

$PV = -100$

$PMT = -50$

$FV = 45000$

$P/Y = C/Y = 12$

Kira needs 364 payments to have a FV of at least \$45,000.

$364/12 = 30.3333333333$

$\boxed{\text{30yrs 4months}}$

$N = 364$

$I\% = 5.25$

$PV = -100$

$PMT = -50$

$FV = ? \longrightarrow \boxed{\$45,049.64}$ (comes back as positive)

$P/Y = C/Y = 12$

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?

Step 1 - Find out how much Ben will need in the account when he retires.

N = 15*12
I% = 6.25
PV = ? → $349,885.70 (comes back as negative)
PMT = 3000
FV = 0
P/Y = C/Y = 12

Step 2: Find the monthly payment that he should make for the next 40 years so that he has $349885.70 at retirement.

N = 12*40
I% = 6.25
PV = 0
PMT = ? → $\boxed{\$164.12}$ (comes back as negative)
FV = 349885.70
P/Y = C/Y = 12

(b) How much will Benjamin deposit into this account?

$$(164.12) * 12 * 40 = \boxed{\$78,777.60}$$

(c) How much interest will be earned over the entire life of the account?

Total interest earned = interest earned before retirement + interest earned during ret.

$$= (349885.70 - 78777.60) + (3000*180 - 349885.70)$$
$$= 540000 - 78777.60$$
$$= \boxed{\$461,222.40}$$

Total interest earned can also be found as

Interest earned = total amt Ben withdraws during retirement - total amt Ben deposited into the account

$$= 3000*180 - 78777.60$$
$$= 540000 - 78777.60$$
$$= \boxed{\$461,222.40}$$

7. 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.

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

Bank A

N = 12*30
I% = 8.75
PV = ⟶ \$108,046.21
PMT = −850 (comes back as positive)
FV = 0
P/Y = C/Y = 12

Bank B

N = 12*25
I% = 8.25
PV = ⟶ \$107,806.44 (comes back as positive)
PMT = −850
FV = 0
P/Y = C/Y = 12

108046.21
+ 25000

$\boxed{\$133,046.21}$

↑ most expensive house they can afford. (Bank A)

(b) Miles and Keiko ultimately make a down payment of \$25,000 on a \$110,000 home and finance the balance through Bank B. What monthly payments should they make to pay off the house in 25 years? How much interest did they pay?

N = 25*12
I% = 8.25
PV = 110000 − 25000 = 85000 ⟵ amt of the loan
PMT = ⟶ $\boxed{\$670.18}$ (comes back as negative)
FV = 0
P/Y = C/Y = 12

Total amt paid for house:

25000 + 670.18 (25*12) = \$226,054

Amt paid in interest: 226,054 − 110,000

= $\boxed{\$116,054}$

(c) Refering to part (b), create an amortization schedule for the first 4 months of the loan.

period	interest owed	payment	amount toward principal	outstanding principal
0	—	—	—	85000
1	584.38	670.18	670.18 − 584.38 85.80	84914.20 ⟵ 85000 − 85.80
2	583.79	670.18	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

84914.20 * .0825/12 = \$583.79

8. What is the present value of a sum of $5,000 due in 6 years at an interest rate of 6.75%/year compounded continuously?

← solve for P

$$A = Pe^{rt}$$

$$5000 = Pe^{(.0675)(6)}$$

$$P = 5000 / e^{(.0675 * 6)}$$

$$\boxed{P = \$3,334.88}$$

Dirty trick:

N = (1E99) * 6

I% = 6.75

PV = ? → $\boxed{\$3334.88}$

PMT = 0

FV = 5000

P/Y = C/Y = 1E99

9. 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?

solve for I%

m = 52

N = 7 * 52

I% = 3.1887%

PV = −8000

PMT = 0

FV = 10000

P/Y = C/Y = 52

(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?

find t

$$I = Prt$$

$$2000 = 8000(.031887)t$$

$$t = 7.8402 \text{ years}$$

about 7 years and 10 months

10. 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?

We need to find the effective rate (effective annual yield) for each.

Bank A: Eff(8, 2) = 8.16%

Bank B: Eff(7.9, 12) = 8.1924%

$\boxed{\text{Bank B is better.}}$

11. 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?

Need to find the original amt of the loan.

comes back as positive

N = 30

I% = 12

PV = ⟶ amt of loan = \$3225.96

PMT = −125

FV = 0

P/Y = C/Y = 12

Total cost of TV =

3225.96 + 250 = $\boxed{\$3475.96}$

(b) How much interest did Juanita pay?

Total amt paid for TV

= 250 + 125 * 30

= \$4000

Interest paid = \$4000 − 3475.96

= $\boxed{\$524.04}$

12. 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?

owes \$1000 total.

After 1 month, she will owe $1000 * (.225/12)$

$= \boxed{\$18.75}$

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

N = ? → 149.2534

I% = 22.5

PV = 1000

PMT = −20

FV = 0

P/Y = C/Y = 12

She will need to make 150 payments

$150/12 = 12.5$ years

12 years + 6 months to pay off the card.

13. The Gardners purchased a vacation home 15 years ago. At the time of the purchase, they were able to make a down payment of 20% of the purchase price and then secured a loan of $105,000 to finance the remaining amount. The loan was to be amortized with monthly payments over 30 years at an interest rate of 6.75%/year compounded monthly.

(a) What is the current outstanding principal on the loan?

Step1 – Calculate the monthly payment.

N = 30 * 12
I% = 6.75
PV = 105000
PMT = ? → $681.03
FV = 0
P/Y = C/Y = 12

(comes back as negative)

Step2: Calculate amt still owed on the loan.

N = 15 * 12
I% = 6.75
PV = 105000
PMT = −681.03
FV = ⟶ $76959.57
P/Y = C/Y = 12

(comes back as negative because you still owe the bank this amt – you must pay to the bank.

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

we need to find this

Equity = value of the house – what you still owe

To find the value of the house:
We made a 20% down payment and got a loan for $105000, so $105000 is 80% of the total cost of the house:

105000 = .8 (cost of house)

$131,250 = cost of house

Equity = 131,250 − 76959.57
= $\boxed{\$54,290.43}$

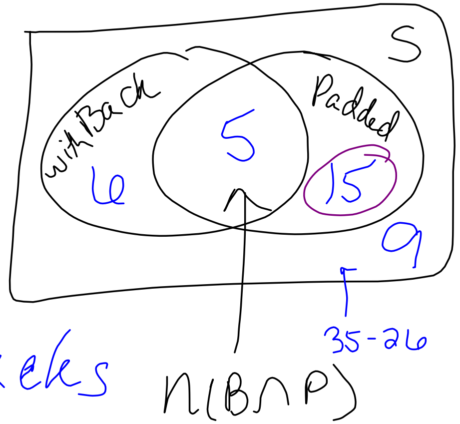
Title: May 1 - 6:04 PM (13 of 14)

35 different stools total

11 had backs (B)

20 were padded (P)

26 padded or have backs



What is the probab that a padded stool is backless?

$$P(B^c \mid P) = \frac{P(B^c \cap P)}{P(P)} = \frac{15/35}{20/35} = \boxed{15/20}$$

$n(B) = 11$, $n(P) = 20$, $n(P \cup B) = 26$

$$n(P \cup B) = n(P) + n(B) - n(P \cap B)$$

$$26 = 20 + 11 - n(P \cap B)$$

$$5 = n(P \cap B)$$