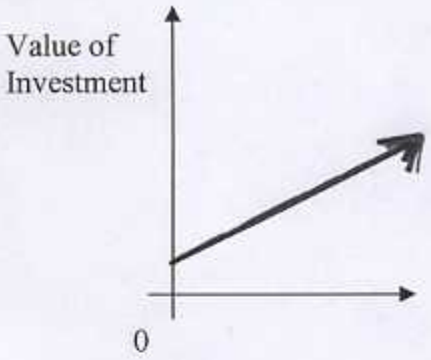
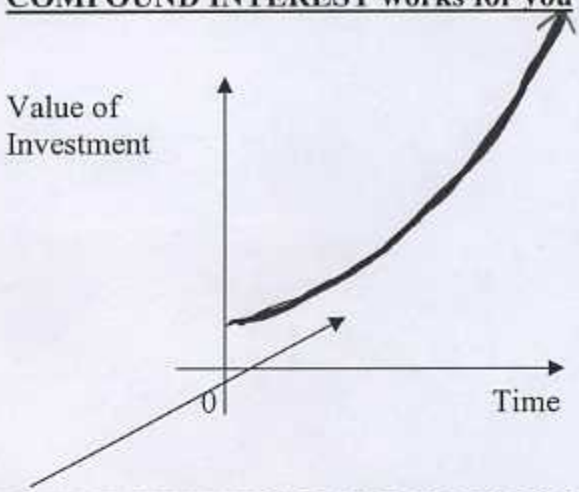
chapter 08

SIMPLE INTEREST



chapter 09

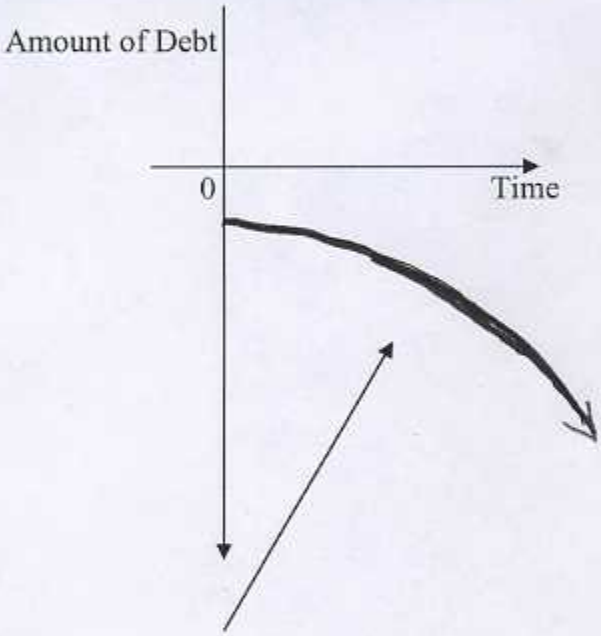
COMPOUND INTEREST works for you



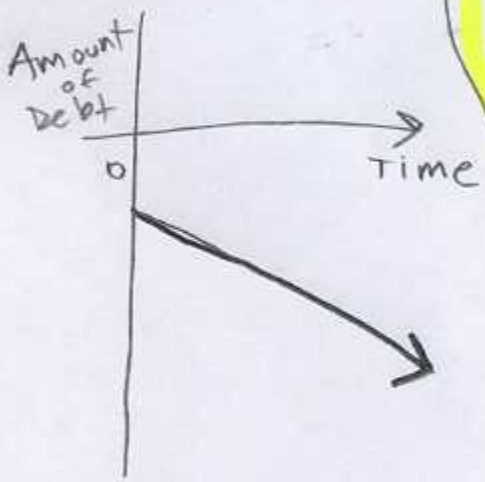
When you invest like putting $ in bank

THE POWER OF COMPOUND INTEREST WORKING FOR YOU

COMPOUND INTEREST works against you



simple Interest



When you borrow like take out loan

THE POWER OF COMPOUND INTEREST WORKING AGAINST YOU

Fundamental truth of finance:

- A dollar received now is worth more than a dollar received later

Chapter 8: Simple Interest

8.1) Basics of Simple Interest

Interest:
- Interest is rent paid on money
- Firms, businesses and individuals borrow money in order to invest the money and earn a higher rate of return than the interest rate
- Firms, businesses and individuals invest money to earn interest

Interest is the fee you pay to borrow $

Principal:
- Amount borrowed, lent out, or invested

Simple Interest:
- Interest paid on only the principal

chapter 8

Compound Interest:
- Interest paid on principal and past interest

chapter 9

Simple Interest Rate:
Annual % rate paid or received

Annual Rate ! !

a. Solve for simple interest

$$I = P * R * T$$

Interest = Principle x Simple Interest Rate x Time in years

I = Simple interest
P = Principal
R = Interest Rate
T = Time in years

I = P * R * T = PRT

**Time given in years. If time given in days or months, you must convert it to a fraction of a year.

**If rate given in %, you must convert to a decimal or fraction.

Example:
Hank's Auto shop takes out a loan from the bank for $10,000 in order to buy new equipment. Hank is considering whether he should take out the loan for 6 months at 7% or 1.5 years at 10%. Find the simple interest on both loans.

1st Loan

Loan for 6 months at 7%

Principal = $10,000
Time = 6 Months
Rate = 7% ⇒ .07

Step 1: convert 6 months to a percentage of a year

$$\text{Time} = \frac{6 \text{ months}}{1 \text{ year (12 months)}} = \frac{6}{12} = \frac{1}{2} = .5$$

Time must always be in years

Step 2: Find interest

$$I = P * R * T = \$10{,}000 * .5 * .07 = \$350.00$$

2nd Loan

Loan for 1.5 years at 10%

Principal = $10,000
Time = 1.5 years
Rate = 10% ⇒ .1

$$I = P * R * T = \$10{,}000 * .1 * 1.5$$

$$= 1500.00$$

The interest on the first loan is $350.00 for ½ year & the interest on the second loan is $1500 for 1.5 year.

b. Calculate maturity value

Maturity Value:

- Amount that is paid when the loan is repaid

$$M = P + I$$

Maturity Value = Principal + Interest
M = P + I

Example:
Christina takes out a $6500.00 loan for 30 months at 10% interest in order to by a used Jetta. Find the interest due on the loan and the maturity value.

Step 1: Find the interest

$I = P * R * T$

$\text{Interest} = 6500 * .1 * \frac{30}{12}$

$= \$1,625$

Principal = $\$6,5000$
Rate = $10\% \Rightarrow .10$
Time = 30 months
Time = $30/12$ years

with months, simply place months over 12 to get time in years!!

Step 2: Find the maturity value

$M = P + I$

$\{\text{Maturity value}\} = \$6,500 + \$1,625$

$M = \$8,125$

c. **Determine the number of days from one date to another, using the actual number of days in the month**

Use knuckle trick, memory, or card in your wallet

Important:
- Do not use the day of the loan ✓
- However, you must use the day that the loan is repaid ✓

Example:
Find the number of days from November 4 to February 21

	Nov 4	Dec 1	Jan 1	Feb 1
	Nov 30	Dec 31	Jan 31	Feb 21
Days:	26	31	31	21

Total Days = $26 + 31 + 31 + 21 = 109$ days

d. Find exact and ordinary interest

I = PRT

Exact Interest:

T = # of days in the loan period/365

Most of the world uses 365!!!...

Ordinary Interest or Banker's Interest:

T = # of days in the loan period/360

This method is rarely used. It is too bad that the textbook uses it so much

Example:
Find the exact interest and the banker's interest given the following data:

Principal = $10,000
Simple interest = 10%
Loan taken out on January 1
Loan paid back on July 31

Step 1: Find the number of days the loan is out

{Count days from Jan 1 to July 31 (Non-leap year)} = 211

Step 2: Find Exact Interest

$\{\text{Exact Interest}\} = 10000 * .1 * \frac{211}{365} = 578.082192$

$= \$578.08$

Step 3: Find Banker's Interest

$\{\text{ordinary Interest}\} = 10000 * .1 * \frac{211}{360} = 586.1111$

$= \$586.11$

****Assume for this textbook Ordinary/Banker's interest will be used.**

Hold over from past

ordinary Interest is always bigger

e. Define the basic terms used with notes

Promissory Notes:

- A legal document in which on person or firm agrees to pay:
  - A stated amount of money
  - Plus interest computed at a stated rate
  - At a stated time in the future
  - To another person or firm

- A promissory note is the written record of a loan

Maker or Payer or Debtor of the note:
The person borrowing the money

Payee or Creditor of the note:
The person lending the money

Term:
Length of time until the note is due

Face Value or Principal:
The principal amount due – the amount written of the face of the promissory note.

Simple Interest Note:
A promissory note for a loan in which the interest is calculated using the simple interest formula:

$I = PRT$ = Face Value x Simple Interest Rate x Time

Collateral:
Assets pledged to back the loan. If the loan is not paid off, the maker of the loan has the right to sell the pledged assets and use the proceeds to pay off the loan.

f. Find the due date of a note

- When the term for a loan is given in days, count the number of days from the day after the promissory note issue date.
- When the term for a loan is given in months, the loan is due on the same day the loan is made, after the number of months has passed
  - If the date should be at the end of the month, but that day does not exist, use the last day of the month, as it exists, as the due date
  - ****When the loan term is given in months, do not convert the time to days in order to find the due date.**

Example:
When is a 6-month loan made on January 15 due?
It is due on the 15th, 6 months later:
July 15 is the due date.

Example:
When is a 3-month note made on January 31 due?
It is due on April 31, but April 31 does not exist.
The due date becomes April 30.

8.2) Finding Principal, Rate, and Time

The key to all these problems is to remember the formulas:

1. $I = PRT$ $\quad I = P * R * T = \text{Interest}$ — 1st Formula
2. $P = I/RT$ $\quad P = \frac{I}{(R * T)} = \text{Principal}$ — 2nd formula
3. $R = I/PT$ $\quad R = \frac{I}{P * T} = \text{Rate (simple)}$ — 3rd formula
4. $T = I/PR$ $\quad T = \frac{I}{P * R} = \text{Time in years}$ — 4th Formula

a. Find the principal

$I = PRT$

$P = I/RT$

** Cover with your finger to find formula — Visual Trick to Remember Formula

Example:
Gardenia borrows a principal amount that earns $50 interest for the lender, the simple interest rate on the loan is 10%, and the loan is out for 180 days. Find the principal amount.

(Use 360 days in year for this one)

$P = I/RT$

$I = 50$

$R = .1$

$T = 180/360 = .5$ years

$$P = \frac{50}{(.1 * \frac{180}{360})} = \frac{50}{(.1 * .5)} = \frac{50}{.05} = 1000$$

From the data presented, we calculated the principal to be $1000.00

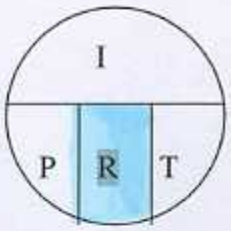
Check the answer with $I = PRT$

$50 = 1000 * .1 * 180/360 = 50$

b. Find the rate

$I = PRT$

$R = I/PT$



** Cover with your finger to find formula

Visual Trick to remember Formula

Example:
Gardenia borrows $750 and pays $75 interest. If the loan is out for 270 days, find the interest rate.

$P = 750$

$I = 75$

$T = \frac{270}{360} = .75$ years

use 360 days in year for this one

$$R = \frac{I}{P*T} = \frac{75}{(750*\frac{270}{360})} = \frac{75}{(750*.75)} = \frac{75}{562.5} = .1\overline{3}33$$

$\Downarrow$

$13\frac{1}{3}\%$

From the data presented, we calculated
The simple Interest Rate is $13\frac{1}{3}\%$

Check the answer with $I = PRT$
$75 = 750 * .133333 * 270/360 =$ [redacted] 75

c. **Find the time**

I = PRT

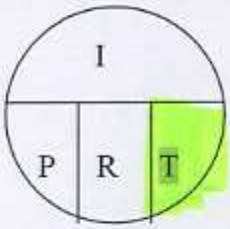
T = I/PR (in years)

Really unrealistic

Important:
"T" will be given as a fraction of a year. Multiply that fraction by 360 to get the number of days:

T = I/PR (in years) → T = I/PR x 360 (in days)

But this is what the book uses



** Cover with your finger to find formula

Visual trick to remember formula

Example:
Gardenia deposits $10,000 in a savings account at an interest rate of 10%. If she earns $750 interest, how many days did she leave the money in the account?

P = 10,000
R = 10% ⇒ .1
I = 750

$$T = \frac{I}{(P * R)} = \frac{750}{(10000 * .1)} = \frac{750}{1000} = .75 \text{ years}$$

use 360 days in a year for this one

{Time in Days} = .75 * 360 = 270 days

From the data presented, we calculated the The time in days to be 270 days.

Check the answer with I = PRT
750 = 10,000 * .1 * 270/360 = $750

8.3) Simple Discount Notes

a. Define the basic terms used with simple discount notes

Simple Discount Notes or "Interest in Advance Notes":

- The bank collects the interest in advance
- The borrower pays the full face value back on the due date
- The borrower receives the face value minus the interest on the day that the funds are disbursed.
- The amount the borrower receives is called "Proceeds"
- The interest in advance is called "bank discount" or "discount"
- Proceeds = face value – bank discount

Amount borrower receives

Interest paid in advance to bank

Amount Borrower must pay back on due date

Compare Simple Interest Note and Simple Discount Note:

Type of Note	Amount Received		Interest		Repayment amount
Simple interest	Face value or Principal	+	Interest	=	Maturity value
Simple Discount	Proceeds	+	Bank Discount	=	Face Value or Maturity Value

** The face value and the maturity value are the same for a S. discount note

The idea of a Simple Discount Note is:

(1) You go to bank and ask to Borrow $1000.
(2) The bank says: "we will give you $900 today and then you must pay back $1000 in 1 year.
(3) You say: "why only $900, if I have to pay back $1000"
(4) Bank says: "we collect interest up front (100)!"

Simple Discount:

Bank Discount = Maturity Value * Discount Rate * Time ← Formula
B = MDT

B = Bank Discount
M = Maturity Value = Face Value
D = Discount Rate
T = Time in years

↔ variables in formula Defined

Proceeds = Maturity Value – Bank Discount (Proceeds = Face value – Bank Discount) Formula
P = M – B

P = Proceeds
M = Maturity Value
B = Bank Discount

↔ variables in formula Defined

Example:
If you take out a loan with a maturity value (face value) of $2000 and the bank discount is $150, what are the proceeds?

step 1 (maturity value / face value) = $2000
Bank Discount = $150

step 2 $P = M - B = 2000 - 150 = 1850$

step 3 The proceeds are $1,850 and we have to pay a Bank Discount of $150 and pay back $2000 on the due date

b. Find the bank discount and proceeds

Example:
Cynthia Thomas signs an $8500, 9-month note. If the bank discounts the note at 9%, find the amount of the discount and proceeds.

Bank Discount

$M = 8500$
$T = 9 \text{ months} \Rightarrow \text{years} = \frac{9}{12}$
Discount Rate $= 9\% \Rightarrow .09$

Step 1: find the bank discount

$B = M * D * T$
$= 8500 * .09 * \frac{9}{12} = 573.75$

Proceeds $= M - B = 8500 - 573.75 = 7926.25$

The interest in advance is called "bank discount" or "discount"
B = MDT = 8500 x .09 x 9/12 = $573.75

Step 2: Find the proceeds

Even though we must pay back $8,500, the bank only gave us 7926.25. This is because the took out the Bank Discount (Interest) of 573.75, before they gave us the proceeds.

c. Find the face value

If you know the proceeds you want, how do you figure out the amount to borrow, the maturity value or face value?

$P = M - B$
$B = M - P$

$B = MDT$

why?

$B = B$
$MDT = M - P$
$P = M - MDT$
$P = M(1 - DT)$
$M = P/(1 - DT)$

$M = P/(1 - DT)$

Formula for find the proceeds

$$M = \frac{P}{(1 - D*T)}$$

$P = M - B$

$B \equiv M - P$

$B = MDT$

$MDT = M - P$

$MDT - M = -P$

$M - MDT = P$

$M(1 - DT) = P$

$$M = \frac{P}{(1 - DT)}$$

Why formula is True

Don't Need to KNOW this

Example:
Mike Modigliani needs $4000 to buy a machine. Find the amount he needs to borrow (maturity value) if he plans to repay the note in 180 days and the bank charges a 12% discount rate.

(use 360 days)

Step 1

Proceeds = $4000

Maturity value: $M = ?$

Time in years: $T = \frac{180}{360} = .5$

Discount Rate: $D = .12$

Step 2

$$\text{Maturity value} = \frac{\text{proceeds}}{\left(1 - \left(\text{Discount Rate}\right) * \text{Time}\right)} = \frac{4000}{(1 - .12 * .5)}$$

$$= \frac{4000}{(1 - .06)} = \frac{4000}{.94} =$$

$4255.3191 = 4255.32$

Step 3

If Mike Needs proceeds of $4000, the face value would have to be $4255.32.

d. Find the effective interest rate on a simple discount note

	Simple Interest Note	Simple Discount Note
Face Value	$7500	$7500
Interest	$225 ✓	$225 ✓
Amount available to borrower	$7500 ✓	$7275 ✓
Maturity value	$7725	$7500

The trick is to find out the effective interest rate for each 90 day loan. (use 360 days in year)

Formula for finding the interest rate:

$I = PRT$

$R = I/PT$

$$R = \frac{I}{P*T}$$

OR

$$D = \frac{B}{P*T}$$

R = Interest Rate or Bank Discount Rate
I = Interest or Bank Discount
P = Principal or Proceeds
T = Time in years

Simple Interest Note:

$$R = \frac{I}{P*T} = \frac{225}{7500 * \frac{90}{360}} = .12 \Rightarrow 12.00\%$$

Principal

Simple Discount Note:

$$D = \frac{B}{P*T} = \frac{225}{7275 * \frac{90}{360}} = .123711 \Rightarrow 12.37\%$$

**Because you paid the same amount of interest but received fewer initial funds.

Proceeds