Financial Math
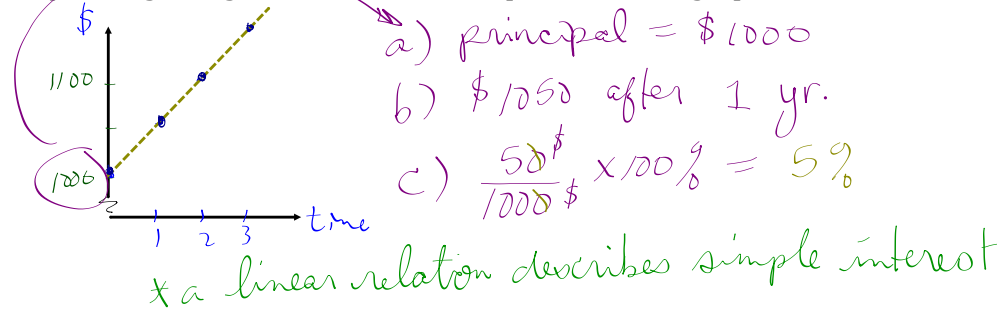## Chapter 1: Investing Money

1.1 Simple Interest

Some definitions to get us started...

1. <u>term</u>: the contracted duration of an investment or loan
2. <u>interest</u>: the amount of   money earned   on an investment or paid on a loan.
3. <u>fixed interest rate</u>: an interest rate that is guaranteed not to change during the term of an investment or lean
4. <u>principal</u>: the original amount of money invested or loaned
5. <u>simple interest</u>: the amount of interest earned on an investment or paid on a loan based on the original amount only (principal) and the simple interest rate... interest is paid out annually, semi-annually, quarterly, monthly, etc...
6. <u>maturity</u>: the contracted end date of an investment or loan, the end of the term
7. <u>GIC</u>: Guaranteed Investment Certificate... a low-risk type of investment that guarantees a certain interest rate so long as the money is invested for the duration of the pre-determined term... essentially, you are lending money to a financial institution
8. <u>Bond</u>: similar to a GIC except that you are lending your money to a government or corporation
9. <u>Stock</u>: by buying a stock, you are actually buying a very small portion of a company... when the company's value increases, so does the value of your stock
10. <u>Mutual Fund</u>: a collection of investments (stocks, bonds, GICs) that are chosen by investment professionals
11. <u>Future Value</u>: the amount, A, that an investment will be worth after a specific period of time
12. <u>Rate of Return</u>: the ratio of money earned (or lost) on an investment relative to the amount of money invested , usually represented as a percent
13. <u>Down Payment</u>: An initial amount of money that is put toward the purchase of an item... the rest is financed (borrowed)

Explore Pg. 6 together... determine equation of the graph

a) principal = $1000
b) $1050 after 1 yr.
c) $\frac{50^\$}{1000\,\$} \times 100\% = 5\%$

* a linear relation describes simple interest

EXAMPLE 1 Solving a simple interest problem

$I = Prt$
interest · principal, interest rate as decimal, time

Marty invested in a $2500 guaranteed investment certificate (GIC) at 2.5% simple interest, paid annually, with a term of 10 years.
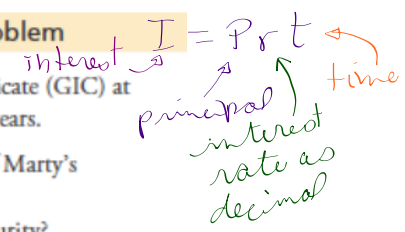
a) How much interest will accumulate over the term of Marty's investment?   2.5%

b) What is the **future value** of his investment at maturity?

c) Use Marty's investment to write an algebraic expression that could be used to determine the future value of any investment earning simple interest.

a) $I = (2500^\$)(0.025)(10)$
   $= \$625$

b) $FV = P + I$
   $= 2500 + 625$
   $= 3125^\$$

c) $FV = 2500 + 62.5t$

EXAMPLE 2 Representing the growth of a simple interest investment

Sunni invested $15 000 in a savings account. Sunni earned a simple interest rate of 8%, paid semi-annually on her investment. She intends to hold the investment for 4.5 years, when she will withdraw all the money to buy a car. Determine the value of the investment at each half year until she withdraws the money. $\frac{1}{2}$ year
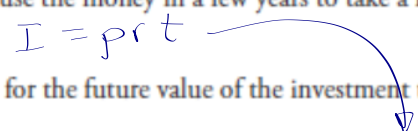
$P = 15000$
$i = 8\% = 0.08$

$I = Prt$
$= (15000)(0.08)(0.5)$
$= 600^\$$

after 0.5 yrs $= 15 600$
1 yr $= 16 200$ $+600$
$\vdots$
4.5 yr $= 20 400$

EXAMPLE 3 Determining the duration of a simple interest investment

Ingrid invested her summer earnings of $5000 at 8% simple interest, paid annually. She intends to use the money in a few years to take a holiday with a girlfriend. $I = prt$

a) How long will it take for the future value of the investment to grow to $8000?

b) What is Ingrid's **rate of return**?

a) $P = 5000$
   $r = 8\% = 0.08$
   $I = 8000 - 5000 = 3000$
   $t = ?$

$\dfrac{3000}{5000(0.08)} = \dfrac{5000(0.08)t}{(5000)(0.08)}$

$\boxed{7.5 = t}$

She must wait 8 yrs since interest is paid annually and when $t = 8$
$I = (5000)(0.08)(8) = 3200^\$$

b) $ROR = \dfrac{I}{P} \times 100\%$
   $= \dfrac{3200}{5000} \times 100\%$
   $= 64\%$

Grant invested $25 000 in a simple interest Canada Savings Bond (CSB) that paid interest annually.

a) If the future value of the CSB is $29 375 at the end of 5 years, what interest rate does the CSB earn?

b) Grant cashed in the bond after 4.5 years because a house he had been admiring came up for sale and he needed a down payment. How much money did he have for the down payment? ✓ ✓? ✓

a) $FV = 29\,375$
$P = 25\,000$
$I = 29\,375 - 25\,000$
$I = 4375\$$
$t = 5$
$r = ?$

$I = Prt$

$$\frac{4375}{(25000)(5)} = \frac{25000\,r\,(5)}{(25000)(5)}$$

$0.035 = r$ $\times 100\%$

$\boxed{r = 3.5\%}$

b) only 4 yrs... $I = (25000)(0.035)(4)$
$= 3500$

⟹ Grant has
$25000 + 3500$
$= 28500$ for his down pmt.

Your Turn

How would the interest rate change in each situation? Explain.

a) If Grant invested principal of $20 000 instead, and the CSB grew to $29 375 in 5 years

b) If it took 8 years for Grant's principal of $25 000 to grow to $29 375

a) $P = 20000$
$I = 9375$
$t = 5$
$r = ?$

$$\frac{9375}{20000(5)} = \frac{20000(5)\,r}{20000(5)}$$

$r = 0.09375$

$r = 9.375\%$

b) $P = 25000$
$I = 4375$
$t = 8$
$r = ?$

$r = 2.1875\%$

Read Key ideas

Homefun pg. 15 #4, 6, 8, 9, 13