Math 11: unit 8: FINANCE

Unit 8.1: Investments and Loans

A. Simple Interest

Re:

p=principal
I= interest
r= interest rate (% charged for the money borrowed...given as an annual rate)
T= time in years. If given days, weeks or months, need to convert to years.

Ex: Mr. Chan borrowed $20,000 to buy a Ding Tea franchise. He is charged an annual rate of 5% simple interest, for 6 years.
  i) calculate the interest Mr. Chan paid on the loan.

  ii) What is the total amount that Mr. Chan pays back?

  iii) Assuming he repaid the loan monthly, how much did he have to pay each month?

  iv) Instead of 6 years, he repaid the loan in 8 months. How much interest was earned on the loan?

B. What is a 'discount loan'?

-interest is calculated first, and then is deducted from the amount you borrowed…results in an overall higher interest rate.

Ex: To buy a Ding Tea franchise, Mr. Chan received a 'discount loan'.   He borrowed $20,000 at an annual interest rate of 5% over 6 years.

 i) calculate the interest

 ii) how much money does Mr. Chan actually receive?
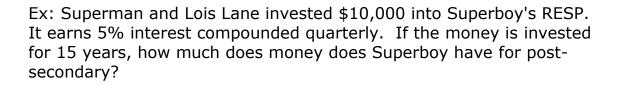
 iii) Calculate the actual interest rate.

C. Compound interest
   -let's compare:

Simple interest	Compound interest

Formula:

A= final amount (principal and interest)
P=principal
r=rate of yearly interest
t= years
n = # of times interest is compounded
   annually =   quarterly =   bimonthly =
   monthly =   biweekly =   daily =

-see WB pg 313 how the compound interest formula is derived.

Ex: Superman and Lois Lane invested $10,000 into Superboy's RESP. It earns 5% interest compounded quarterly. If the money is invested for 15 years, how much does money does Superboy have for post-secondary?

    D.   What is the 'rule of 72'?
-dividing **72** by the annual rate of return, investors obtain a rough estimate of how many years it will take for the initial investment to double.

    ex: by using the rule of 72, how long would it take for Superboy's RESP to double in value?

WB pg 315 #1-4: choose 2 from each
            #5, 7, 9, 10, 11

Math 11: unit 8.2: Effective Interest Rates, Stocks, and Bonds

A. What is the definition of 'effective interest rate'?

-effective annual interest rate is the interest rate that is actually earned or paid on an investment, loan or other financial product due to the result of compounding over a given time period.

-formula: $E = \left(1 + \frac{r}{n}\right)^n - 1$

where E = effective rate
r = annual interest rate
n = number of periods in 1 year

Ex: which is the better investment: stock in Riocan which pays 4.0% compounded monthly, or stock in Telus which pays 4.1% compounded annually?

B. What is the definition of 'nominal interest rate'?

-it is the stated interest rate
ex: Mr Chan's interest rate to borrow money to buy a Ding Tea franchise is 5%....5% is the nominal interest rate.

C. Stocks!
   -buying stocks, or shares, of a company means you become 'share holder', or a part owner of company. How much of the company you own depends on the total number of shares.

Ex: Amazon has about 490 million shares. Jeff Bezos owns 16% of the shares.
  i) how many shares of Amazon does Jeff Bezos own?

  ii) 1 share of Amazon is worth $1980. Based on his Amazon share holdings, how much is Jeff Bezos worth?

D. How do we calculate the value of a stock?
   -there are many ways to calculate the value of a stock, and whether it is worthwhile to buy. One way is to look at 'p/e ratio'

Note: $$p/_e = \frac{price\ per\ share}{annual\ earnings\ per\ share}$$

   Ex: 1 share of Amazon = $1980.
       annual profit of Amazon: $11.2 Billion
       number of shares in Amazon: 490 million

       so: p/e ratio for Amazon =

   -we compare p/e ratios with companies within the **same** industry to help decide which is the better buy.

-p/e ratio is sometimes called 'price multiplier' because it refers to the price a person is willing to pay for $1 of earnings from the company.

    ex: for Amazon, the p/e ratio is: _____...means you are willing to pay $_____ for $1 of earnings.

-if a company is not making a profit, there is no p/e ratio.

    Ex: in groups, find the p/e ratio (show steps; cite source of info) for:
       1. i) Apple   iii) Google
         ii) Facebook   iv) Alibaba

    2. Based on p/e ratio alone, which do you consider to be the best buy?

  E. What is 'dividend yield' on a stock?

-some companies pay a 'dividend': distribution of part of a company's earnings to its shareholders.
  ie: you get 'paid' to own part of the company.

-advantage of dividends: impose greater money management on company...if don't pay/cut dividend, shareholders lose confidence and will sell shares... the company is worth less and harder for people/banks to trust them.

-disadvantage of dividends: because it gives part of its earnings to shareholders, the company will have less money to reinvest in itself to expand/grow/be more efficient.

$$...\text{so dividend yield} = \frac{annual\ dividend\ per\ share}{stock\ share\ price}$$

Ex: Calculate the dividend yield for Scotia Bank:
  -annual dividend per share: $3.48
  -stock share price: $69.90

  -therefore, dividend yield =

-in comparison:

　　　i) savings rate at

　　　ii) inflation rate in Canada:

　F. How do we buy/sell stocks?

-through a brokerage (ie: Questrade) or through a bank brokerage.

-fees or commission to buy/sell can depend on how much you have with the brokerage, how often you trade, and what you are buying (stocks, options, bonds, etc)

Ex: Johnny Canuck bought 50 shares in Royal Bank at $104 per share. His brokerage charges a commission of $9.99 per trade.

　i) Because of the buying and selling commissions, what is Johnny's break-even price per share?

　ii) Johnny sells all his shares at $115 per share. How much profit did he make?

G. What are 'bonds'?

-a loan made by an investor to a borrower (a company or government- municipal, provincial or federal). Has terms of interest and payment.
-see WB pg: 328-239 for more background

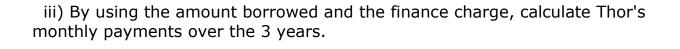-bonds pay simple interest…so use:

-do WB pg 330, #2-5, 8, 11, 13

Math 11: unit 8.3: Loans
   A. Why do we pay with instalments when buying something?

 -some things we buy are very expensive (ex: car, house/apartments) and
 we are not able to pay it all at once, so we may put a down payment, and
 pay the rest (of the loan) over time.

 -we make payments on this loan

 -main disadvantage: pay interest…so end up paying more over time.

   B. Vocabulary (see WB pg 334):

 i) down payment:

 ii) fixed instalment loan:

 iii) amount financed:

 iv) installment price:

 v) finance charge:

 Ex: Thor bought a Tesla Model X for $130,000.

   i) Thor put down a down payment of $10,000.   What is the amount
 financed?

   ii) Royal Bank is willing to give Thor a car loan of 4%. Thor will repay the
 loan over 3 years. Calculate the finance charge.

iii) By using the amount borrowed and the finance charge, calculate Thor's monthly payments over the 3 years.

iv) What is the total instalment price for the Tesla X?

B. What is 'Annual Percentage Rate' (APR)?

-APR represents the simple interest the borrower pays, after taking into account compound interest, fees, insurance, etc, that may be associated with the transaction.

-ex: From https://www.scotiabank.com/ca/en/personal/rates-prices/mortgages-rates.html:

Variable Rate Mortgages

	Posted Rate
Scotia Ultimate Variable Rate Mortgage - 3 Year Closed Term	4.250%[1]
Scotia Flex Value Mortgage-Closed 5 Year Term	4.150%[2]
Scotia Flex Value Mortgage-Open 5 Year Term	5.750%[3]

-note that the 'ultimate variable rate mortgage - 3 years' is 4.25%...but the APR is 4.35%. This means the actual simple interest rate for the mortgage is 4.35% when you take into account compounding interest and the $300 appraisal fee.

-to simplify calculations, we can use the table in the WB pg 335 to help us do calculations:

Ex: Thor borrowed $120,000 to buy his Tesla X, at 4% interest over years. Find his actual monthly payments.

  ex: Using Thor's 36 monthly payments of $_____ from part A, calculate the approximate APR (using the table from pg 335).

C. Credit cards:

-see WB pg 336 for an example. Note that they use the effective annual interest formula from pg 318 to find the interest rate.

  D. Pay day loans.
-don't do it!

-please read https://www2.gov.bc.ca/gov/content/family-social-supports/borrowing-money/expensive-loans/payday-loans
… note: in BC, the maximum a pay day loan company can charge is $15 for every $100 borrowed over 2 weeks. This works out to an annual interest rate of 391% (APR)

    …to do a rough estimate, we can use the simple interest formula:

$$\text{so: } I = \$15 \qquad\qquad t = 14 \text{ days…so } \frac{14}{365}$$

$$P = \$100 \qquad\qquad\qquad r = ?$$

-WB: pg 337-339: pick 10

Math 11: unit 8.4: Canadian Mortgages

  A. Vocabulary! - see WB pg 340, and

  i) real estate:

  ii) mortgage:

  iii) fixed rate mortgage:

  iv) variable rate mortgage:

  v) amortization:

  B. How are monthly mortgage payments calculated?

 -see WB pg 342, and we have:

$$E = \frac{L \cdot r (1+r)^n}{(1+r)^n - 1} \text{ with } i = \left(1 + \frac{r}{2}\right)^{\frac{1}{6}} - 1, \text{ where } E = \text{payment} \qquad i = \text{effective interest rate for monthly payment}$$

 L = loan
 r = annual interest rate
 n = time in years

Ex: Valkyrie is rebuilding Asgard for $1500000. She has $50000 to use as a down payment for the renovations. She received a secured mortgage from the Bank of Freya at 3% for 20 years to fund the rebuild.

i) find the down payment.

ii) find the amount of the mortgage

iii) what is the monthly payment?

iv) what is the total cost of the mortgage?

v) find the total interest paid

vi) what is the total cost to rebuild Asgard

-WB pg 344 #1abc, 2-4