Pre-Calculus 11 LG 13/14

FINANCIAL LITERACY

INTRODUCTION:

Last year in your grade 10 math course, we had you investigate different types of income, understand the income tax amounts you were required to pay on that income and then you budgeted to purchase a vehicle.

As you grow into adulthood, you will find yourself likely dealing with both simple & compound interest associated with both investments and loans with your bank. You will likely find yourself in a situation where you are either renting a condo, townhouse, or a house – or approaching your bank to obtain a long-term loan (called a mortgage) to purchase the place. You will also likely obtain a credit card and be making regular payments on money which you owe.

LEARNING GUIDE EXPECTATIONS:

On the completion of this learning guide you will be able to:

1) understand the differences between simple and compound interest
2) understand the advantages and pitfalls of obtaining and using credit cards for purchases; and demonstrate your learning by completing and presenting to your teacher a project on credit card usage.
3) use technology to accurately calculate regular payments involving compound interest on loans, credit cards and mortgages
4) understand the advantages and disadvantages for either renting or owning your own home; and demonstrate your learning by completing and presenting to your teacher a project on acquiring housing.

EVALUATION:

You are ready to progress to the next learning guide when you can demonstrate your understanding of the above expectations. Your mark will be based on two projects.

RESOURCES NEEDED:

THSS Math 11 (Foundations 11 or Pre-Calculus 11) Learning Guides.

www.thssmath.com

LEARNING ACTIVITIES:

Expectation #1: Understand the differences between simple and compound interest.

Watch and take notes on instructional video on Simple Interest.

Read the section SIMPLE INTEREST (below) and complete the practice questions 1-5.

Watch and take notes on instructional video on Compound Interest.

Read the section COMPOUND INTEREST (below) and complete the practice questions 1-5.

In your math journal, explain the differences between simple and compound interest.

Expectation #2: Understand the advantages and pitfalls of obtaining and using credit cards for purchases.

Watch and take notes on instructional video on Credit Cards.

Read the section (below) titled CREDIT CARD USAGE.

CREDIT CARD PROJECT

Using the links provided in the CREDIT CARD USAGE section, work through the section titled CREDIT CARD PROJECT.

Collect your findings and organize them in a fashion which you then present to your teacher. Ensure that you examine the advantages and disadvantages of using credit cards, as well as specifics on which credit card you may have chosen and your rationale for doing so.

Your project may take on a number of forms; either written form or using PowerPoint are two suggestions.

Expectation #3: Use technology to accurately calculate regular payments involving compound interest on loans, credit cards and mortgages

Watch and take notes on instructional video on Investments and Loan.

Read the section (below) titled CALCULATING REGULAR PAYMENTS ON LOANS and MORTGAGES. Work with a TVM Solver to complete the practice questions 1-2.

Expectation #4: Understand the advantages and disadvantages for either renting or owning your own home

Read the section (below) titled BUYING A HOME.

HOUSING PROJECT

Using the links provided in the BUYING A HOME section, work through the section titled HOUSING PROJECT.

Collect your findings and organize them in a fashion which you then present to your teacher. Ensure that you examine the advantages and disadvantages of renting versus owning a home, as well as making note of the questions posed to you.

In short, you will:

1) Research an appropriate career of interest
2) Determine the affordability of a home
3) Research a sample home for purchase in your region of choice
4) Calculate the costs of home ownership in addition to mortgage payments
5) Consider the option of renting (rather than owning) your home.

Your project may take on a number of forms; either written form or using PowerPoint are two suggestions.

OPTIONAL ACTIVITY:

Read the section **GOING FURTHER: CALCULATING COMPOUND INTEREST ON INVESTMENTS**. Extend the activities mentioned in the scenario where are you making extra monthly payments to shorten the term of the mortgage.

SIMPLE INTEREST

Simple Interest is a way of determining the interest calculated just on the principal amount. The formula to calculate simple interest is:

$$I = Prt$$, where

I is the amount of interest earned (or charged)
P is the principal (the original amount of money)
r is the annual interest rate as a decimal
t is the time in years

Simple interest is usually not used in loans from financial institutions.

Example 1:

Greg borrows $2000 for 5 years at 4% simple interest.

a) How much interest must he pay after 5 years?

Solution: From the given information, we know the following:

- The interest rate (*r*) is 4% which written as a decimal is 0.04.
- The principal (*P*) amount is $2000
- The time (*t*) is 5 years.

We need to solve for the interest (*I*), so entering the information into the formula gives:

$I = Prt$
$I = 2000 \times 0.04 \times 5$
$I = \$400$

So, Greg will have $400 in interest to pay back after 5 years.

b) How much money will Greg have to repay after 5 years?

Greg will need to payback the principal plus the interest.
So the amount (*A*) he has to pay back is: $A = P + I$.
$A = 2000 + 400 = 2400$
Greg will have to pay back $2400.

Example 2:

Carol put $1000 in the bank, earning simple interest of 4.5%/year. How much interest does the bank owe her after 10 years?

Solution: From the given information, we know the following:

- The interest rate (*r*) is 4.5% which written as a decimal is 0.045.
- The principal (*P*) amount is $1000
- The time (*t*) is 10 years.

We need to solve for the interest (*I*), so entering the information into the formula gives:

$I = Prt$
$I = 1000 \times 0.045 \times 10 = \$450.00.$

She will earn $450 in interest.

Example 3:

If Natalie borrowed \$3000 for 3 years and paid \$350 in interest, what was the interest rate?

Solution: From the given information, we know the following:

- The interest (I) is \$350.
- The principal (P) amount is \$3000
- The time (t) is 3 years.

We need to solve for the interest rate (r)

I = Prt

350 = 3000 x r x 3

350 = 9000 x r

$$\frac{350}{9000} = r$$

0.039 = r

The interest rate, therefore, is 3.9%.

Practice Questions

1. If you borrow \$2000 for 3 years at 4.5%
   a) What is the simple interest?
   b) How much money would you have to pay back at the end of 3 years?
2. If you deposit \$1500 in a bank at 3.4% simple interest, how much money would you have in the bank after 5 years?
3. If you wanted to earn \$250 in simple interest over 3 years, how much money would you need to invest if you were offered a 2.8% interest rate?
4. How long would you need to invest \$4000 at 2.3% simple interest if you wanted to make \$400?
5. If you owed \$4562 after 4 years of 3.1% simple interest, what was the original loan?

Answers: \$270 & \$2270; \$1755; \$2976.19; 4.35 yrs (4 yrs, 127 days); \$4058.72

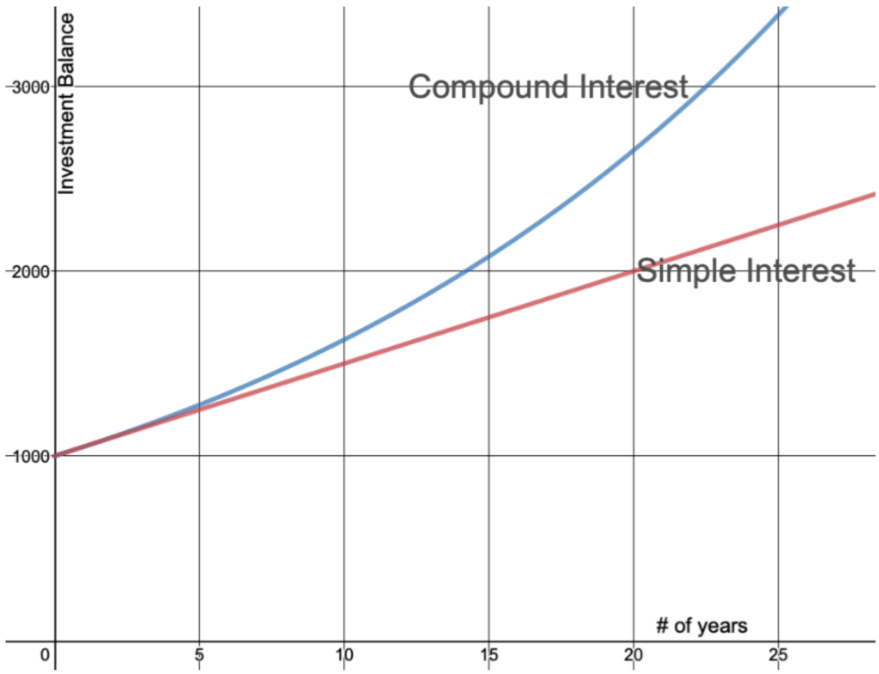
COMPOUND INTEREST

Compound Interest is more commonly used in financial calculations, where the calculations of the interest are on both the original investment amount (the principal) and any accumulated interest to date as well.

For example, if you had $100 in a bank account and the bank pays a (generous) 10% rate of interest each year, you would have $110 in the account at the end of the first year. The next year, you would then earn 10% interest on $110, so the amount paid out to you would be $110*0.10 = $11 (instead of the regular $10). There is now $121 in the account. If this were a simple interest account as you studied previously, you would have accrued only $120 to this point.

While this extra dollar does not seem like a lot, the power in compound interest is accruing interest over very long periods of time. The graph below shows a $1000 investment at 5%/year for a period of up to 25 years with both simple interest and compound interest.

The simple interest scenario pays out $50 per year to the account holder; in the compound interest scenario, this $50 amount is deposited back in the account to further earn interest.



The formula to calculate compound interest is:

$A = P(1 + i)^n$, where

A is the amount accumulated, including all the interest

P is the principal (the original amount of money invested)

i is the interest rate used for each compounding period as a decimal

n is the number of calculations made during the compounding period

Compound interest is used in most financial situations, whether it be for investments or for personal loans, car loans or housing (mortgages).

Investors are often interested in the amount of time it will take for an investment to double in value. In other words, if $1000 is invested at a certain percentage rate, we want to know how long it takes for the investment to double in value. To *roughly* estimate how much time is required, we use *The Rule of 72*.

> **Rule of 72:** In dividing 72 by the annual (compound) interest rate, investors obtain an estimate of how many years it will take for the initial investment to double in value.

Example 1:

Tonya invests $3000 at an annual interest rate of 6% for 5 years, compounded annually (once per year).

a) What is the total investment worth after the 5 years?
The principal (P) is $3000.
The interest rate (6%) as a decimal, i=0.06.
Since interest is calculated once per year for 5 years, we have n=5.
$A = P(1+i)^n = 3000x(1+0.06)^5 = 3000x(1.06)^5 = 3000x1.338226 = \$4014.68$
Tonya's $3000 investment has grown to $4014.68.

b) What is the total amount of interest she earned?
Of this $4014.68 amount, there is $3000 of it which is the principal amount. By subtracting that as $4014.68 - $3000 we obtain $1014.68 which is the total interest earned.

c) Tonya's friend Nancy invested the same amount of money (P) at a different bank with the same interest rate, but that bank offers *monthly* interest calculations instead. Redo the calculations to see if Nancy makes more or less money than Tonya.
The principal (P) is also $**3000**.
The annual interest rate (6%) is divided across 12 months/year, i = 0.06/12 = **0.005** (or ½%).
The interest is calculated 12 times/year for 5 years, we have n = 12x5 = **60** total calculations.
So, rather than doing 5 calculations of 6%, we do 60 calculations of ½%.
$A = 3000x(1+0.005)^{60} = 3000x(1.005)^{60} = 3000x1.348850 = \$4046.55$.
So, Nancy earns $4046.55 – $4014.68 = $31.87 more than Tonya just by incurring more frequent interest calculations.

Example 2:

Kevin sought out a bank loan of $5000 for a used car with a 4% interest rate which is compounded semi-annually (twice a year). What this the total amount he owes at the end of a 3-year loan?

We have a 4% annual interest rate but the interest owing is calculated twice per year. This will mean that i = 0.04/2 = 0.02 (or 2%) for each calculation. Also, since interest is calculated twice per year for 3 years, we have n=2x3 = 6 total calculations on his principal of $5000. So we have,

i = 0.04/2 = **0.02**   n = 2*3 = **6**   P = **5000**
$A = P(1+i)^n = 5000x(1+0.02)^6 = 5000x(1.02)^6 = 5000x1.12616 = \$5630.81$.

To receive $5000 worth of value for the loan, Kevin needs to pay out $5630.81, so there is $630.81 in interest incurred by carrying the loan.

Note: do you see the number 1.12616 in the previous calculations? If you ignore the leading "1", the value 0.12616 as a percentage is 12.616%. This is the *effective* rate of interest over the 3 years.

Example 3:

Shelley wants to purchase a brand new MacBook computer for $3000 in 2 years but she doesn't quite have enough money at this time. However, she has located an exceptional investment opportunity that pays 8%/year. If interest is calculated daily (assuming 365 days in the year), what is the initial amount that she needs to invest in order to arrive at the final amount of $3000?

In this case, we know the final amount A=3000, but not the initial Principal amount (P). For daily interest, the interest rate (i) we end up using is a seemingly paltry 0.08/365 = 0.000219 (a rate per day) but we are going to perform n = 365 x 2 = 730 calculations across the two years, one each day.

When dealing numbers of this scale, it is important to enter these numbers into your calculator and let the calculator carry all your results – and then you only perform your rounding in the last step. In the calculation below, try enter only the bolded expression into your calculator.

The formula $A = P(1+i)^n$ can be re-written to solve for P by dividing both sides by $(1+i)^n$. So we can rearrange this formula to:
$P=A/(1+i)^n$ = $\mathbf{3000/(1+0.08/365)^{(2x365)}}$ = $3000/(1.000219)^{730}$ = 3000/1.17349 = $2556.48.

To get the final result of $3000 of savings, Shelley needs to have $2556.48 to invest for two years.

Example 4:

How long will it take for Malcolm's investment of $9000 to double at an interest rate of 6%?

By *The Rule of 72*, we use the value of "6" as a divisor of 72: That is, it will take 72/6 = 12 years for Malcom's investment to double in value. Notice how this rule does *not* depend on the amount of the initial investment, nor we do we use "0.06" as a divisor.

Practice Questions:

1. Gordon has $8000 for a long-term invest at 4%, compounded annually, for a total 20 years.
   a) Without using an interest formula, guess what his investment will be worth after the 20 years.
   b) Calculate the total value of the investment after 20 years.
   c) Gordon takes his time to find a more valuable investment, and finds one for 6% instead. Redo your calculations for the total value of the investment.

2. Sam invests $800 at 3%/year compounded monthly for 5 years. Determine the total amount of interest she will earn.

3. What is the cost a $20000 new car loan at 6.5%/year, compounded monthly, for 4 years?

4. Using *The Rule of* 72, how many years will it take for an investment of $4000, invested at 3%/year to double in value?

5. Mark is seeking out an investment that will double his money in 15 years. What interest rate does he need to find?

   Answers: Just over $16000 at 18 years by the Rule of 72, $17528.99, $25657.08; $129.29; $5920.41; 24 years; 4.8%

In the last (optional) section of this learning guide, we'll revisit calculating compound interest on investments where you're also contributing money on a regular basis.

CREDIT CARD USAGE

Credit cards mainly offer a certain degree of convenience. You are not required to carry large amounts of cash around in order to make a purchase. You can use a credit card to make a purchase while travelling, in-store, over the phone, or online, and you have the ability to make sizable purchases as required. Your bank also offers you some degree of protection over fraudulent use of your card (and definitively so after you've reported a dubious transaction or after you report your card lost or stolen). Some cards even offer automatic breakage insurance on items purchased with the card, or the incentive of collecting points in anticipation of rewards.

With a credit card, however, you can spend money which you do not have which is a dangerous proposition. Contrast this with a debit card, where the amount you pay is withdrawn from your account immediately and you wouldn't be able to spend money you don't have.

As long as you pay off the full balance of a credit card each month and don't use it for cash advances, you will not incur any interest charges. Many financial institutions also offer an attractive option of setting up your bank accounts so that the credit card is *automatically* and fully paid off each month; there is no worry of missing a payment or incurring any interest charges.

If you just pay off the minimum amount each month, you'll remain in good standing with the credit card company, but start incurring high interest charges (often over 18%) on the unpaid amount. In the worst case, if you use the credit card to obtain a cash advance, be warned that you will *immediately* be paying an even higher interest rate (around 22%).

If you use a credit card wisely each month, you will be building up a *credit history* which will help you obtain further borrowing power at lower interest rates down the road. As a conscientious credit card user, you will be seen as a lower risk than someone who has not used their credit wisely; a person who has missed payments or has not made the required minimum payment each month will be seen as a higher risk. Unfortunately, you do not gain credit history by "responsibly" using a debit card.

With using the credit card, you may be gaining points towards some travel or merchandise rewards that you can redeem at a later date, but that often comes at the cost of an annual fee to use the card.

Finally, the government has recently realized that some consumers have been caught in undesirable situations where they have been unable to pay off their entire credit card balance every month. To assist in this matter, they've created this online tool to assist consumers in understanding the implications of carrying a credit card balance:
http://itools-ioutils.fcac-acfc.gc.ca/ccpc-cpcc/ccpc-cpcc-eng.aspx

Example:
You have a $1000 credit card balance with an 18% annual interest rate. In each of the following scenarios, (1) how much interest do you pay and (2) how long does it take to pay the balance off? Use the online tool to answer these questions.

Scenario 1: You make the minimum payment of $30 (or less) every month.
Scenario 2: In addition to your $30 minimum, you add $5 per month
Scenario 3: You decide to pay $100 each month to pay off the debt
Answers: $798.89 (10y0m); $512.52 (6y2m); $91.62 (11m)

CREDIT CARD PROJECT

1) Choose and Research

A. Choose 3 credit cards to research meeting the following criteria:
   a) regular bank credit card with no rewards or annual fees.
   b) rewards credit card
   c) store credit card (i.e. The Brick, Ikea, Home Depot, Hudson's Bay, etc.)

B. Research the 3 cards you have chosen and list the stats for each:
   a) interest rates
   b) annual fee
   c) perks and rewards

2) Comparing Cards

A. Scenario 1
   You put an amount of $1,000 per month on the credit card for two years and pay it off in full each month. Determine which card is best in this scenario. Justify your answer.

B. Scenario 2
   After using your credit card for a couple of years you find yourself owing $6,000 on the card. You decide that you will not use the credit card until it is paid off. Use the itools software to run the following 3 options for paying off your balance:
   a) Balance – enter $6,000
      Annual Interest Rate – enter the percent on one of your credit cards
      i) Option A: lowest payment option allowed by Canadian Law ($180)
      ii) Option B: add an additional $5 per month to the minimum payment ($185)
      iii) Option C: fixed monthly payment $50 more than the initial amount ($230)

   How long will it take to pay off the balance for each of the 3 options (___years, ___months)? How much total interest do you end up paying for each option? Record this information in a table.

   Run the above process (all 3 options) on the other two credit cards you chose, using a balance of $6,000 for each and the specific interest rate for each card.

   For Scenario 2, where you are carrying a balance on your credit card, which card was the best to use? Justify your answer (why is it the best?).

3) Advantages and Disadvantages

A. What are the advantages and disadvantages of owning a credit card?

B. Based on all the aspects of credit cards, what advice would you give someone who is getting a credit card for the first time (be specific)?

CALCULATING REGULAR PAYMENTS ON LOANS and MORTGAGES

Usually when you take out a loan, you will make monthly payments to pay off the loan. The length of time required to pay off the loan will depend on the interest rate, the compounding period of the interest, and the amount of the monthly payment. The calculations are quite tedious, so usually a financial calculator is used when monthly payments are involved.

These financial calculators are either available online or as an "app" in a more capable graphing calculator. Look for the term "TVM Solver" or "TVM Calculator" (which stands for Time-Value-of-Money). Here is an example of an online calculator:
http://www.hvks.com/Numerical/webfinance.html

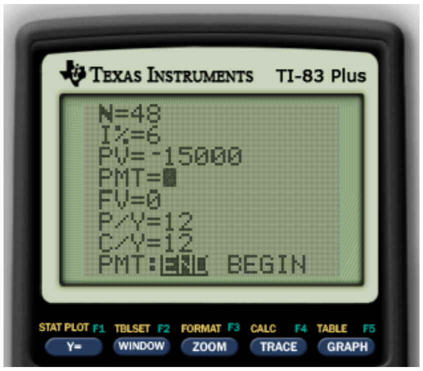
A sample real-world problem might involve you obtaining a $15000 car loan, payable over 4 years where an annual interest rate of 6% interest is calculated (compounded) monthly. The bank is requiring you to make your payments at the end of each month, and the "unknown" part is the amount of money you would need to pay each month. In the process of negotiating a loan, you come up with terms to the loan that you would feel comfortable with.
Some terms you will need, which are common to all of these types of calculators, are the following:

Present Value ("PV") – what is the starting value of the loan or investment? In our case, this is a debt so enter it actually as a negative amount (-15000).
Payment ("PMT") – how amount of money is regularly paid against the loan (or invested)? In our case, we don't yet know this amount, so we leave this blank.
Future Value ("FV") – what is the desired amount at the end of the loan/investment? In our case, we want to pay the loan off, so we enter zero for this.
Annual Rate ("I%" or "IR") – this is the annual interest rate – in our case 6%, entered as "6"
Periods* ("N" or "NP") – this is the number of payment periods what will take place. In our case, doing monthly payments over 4 years would amount to 48 total periods.
Compounding ("C/Y") – this is the frequency with which interest is calculated (in our case, monthly)
Payment Timing (BEGIN/END) – when is the payment made during the month (in our case, it's at the end of the month). Unless otherwise mentioned, we always assume it's at the end of the month.

*Some calculators specify "**N**" as the number of payments and have a separate "**P/Y**" (number of payments per year). In our case, N=48 and P/Y=12 (as we're doing 12 payments per year) .

All TVM-style problems will be set up so that just one piece of information is missing. In this sample problem, we left the payment value blank.

Below are screen shots from a common TI-83 calculator (left) and a Casio calculator (right) using the TVM Solver with this problem:



Let's assume for now that we're using the online TVM Solver. If we enter all the other values into the solver and then press the "PMT" button to calculate that value, that field populates with 352.28. This means that we will be paying $352.28 per month (for 48 months) to pay off the loan including the principal amount.

How expensive was the loan? This can be calculated by multiplying the monthly rate by the number of months: $352.28/month x 48 months = $16909.44. Of that amount, we subtract the principal of $15000 to discover that we paid $16909.44 - $15000 = $1909.44 in interest overall.

The *effective* interest rate was $1909.44/$15000 = 0.1273, or 12.73% over the 4 years.

The longer the loan is at a given interest rate, the lower the monthly payments will be — but the loan will be more expensive overall. For that reason, it is important to choose a loan that you can reasonably pay off in the *shortest period of time possible*.

For example, a $4500 loan at 5%/year in which you are paying $100/month back over 4 years will overall be about $220 more expensive than a loan of $200/month over 2 years.

Practice Questions:

1. Tanya receives a business loan for $125,000, to be paid back at a rate of 3.5% compounded monthly over 10 years. Using the TVM solver,
    a. What are her monthly payments?
    b. What is the total cost of the loan over the 10 years?
    c. How much does she pay in interest over that time period?

2. Nancy goes for a similar loan, but obtains a rate of 3.0%. How much less interest does she pay over the 10 years?

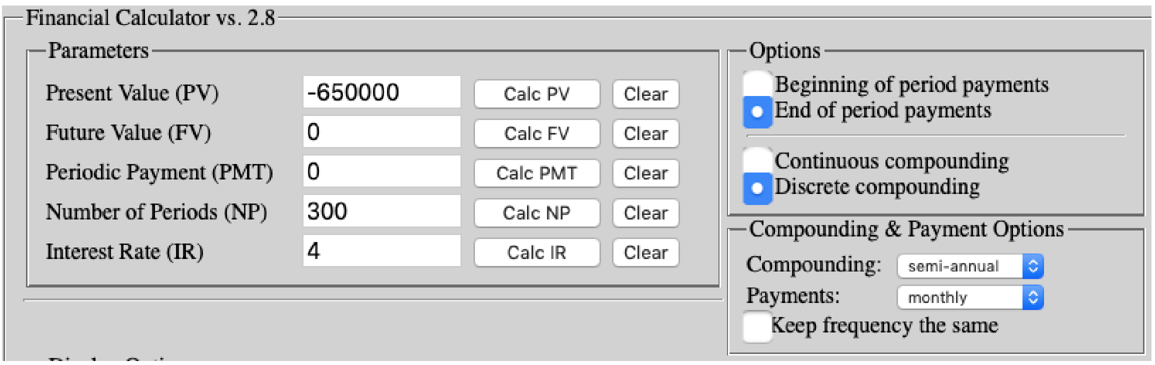
Answers: $1236.07, $148,328.40, $23,328.40; $3487.20

BUYING A HOME

The term *mortgage* is generally applied to loans obtained for purchasing homes or real estate. Mortgages are often the most sizable loan a person obtains and are typically stretched out over very long periods of time (25+ years) so as to make the monthly payments more manageable.

Let's say you are purchasing a $750,000 home. You have a $100,000 down payment and so you are asking the bank for a $650,000 mortgage at 4%/year for 25 years, compounded semi-annually (2 times per year) -- typically, in Canada, most mortgages are calculated *semi-annually*. You pay back the mortgage in monthly installments.

In our case, this will be 25*12 = 300 payments over the 25 years. Using the basic online TVM solver we would enter the following information (as in the image):



If you press the "Calc PMT" button to calculate the monthly payment, we see that we attain $3419.13 per month. So, this $650,000 mortgage will cost $3419.13 x 300 = $1,025,739 over the term of the loan… that's $375,739 just in interest! This is an overall *effective* interest rate of $375,739/$650,000 = 57.81%.

How depressing!

> *Challenge:* For a moment, let's say that you spent an entire week pursuing a lower interest rate making a couple dozen phone calls, and you finally found a bank offering you a 3.8% rate instead of 4%. *Would it be worth all the hassle?*
>
> Let's find out: change the interest rate in the online solver and calculate how much you'd save over (1) one month, (2) one year, and (3) the full term of 25 years (300 months). *Was this what you expected?*

Practice:
You have located a $400,000 condo in Maple Ridge, and you have a $50,000 down payment. Your bank is offering you a 25-year mortgage at 4.5%/year, compounded semi-annually. Using the TVM solver, calculate your monthly payments, your total payments over 25 years (not including the down payment) and, finally, determine your overall effective interest rate.

Answer: $1937.16/month; $581,148; 66.04%.

How do the payments change if you pay bi-weekly (once every two weeks) – ie. 650 times?

Some other costs of home ownership:
The monthly cost of the mortgage is the largest overall expense that a homeowner incurs.

However, in addition to the mortgage costs, there are other costs to consider as a homeowner. These costs are generally broken down into three or four categories:

1) School & Property taxes*. The municipality or city in which the home is located will charge you an annual property (and school) tax on the home. For 2019 in Maple Ridge, you'd pay an annual tax of $1837 on a $400,000 condo.
2) Water/Sewer/Recycling fees*. For 2019, this was $1031 on a detached home, and similar for a condo.
3) Maintenance & Upkeep. This would vary widely based on the age of the home. Also, townhouses and condos would likely be subject to a "communal" monthly strata/maintenance fee in the $175-$400 range.
4) Insurance. It is generally advisable for the homeowner to carry insurance in the event of fire or flood damage, etc. Many policies cost around $1000/year.

Home ownership is not cheap! Your mortgage amount and all of other these costs figure into the "housing" amount that you should be spending as a percentage of your overall income.

*The B.C. Home Owner Grant for 2019 reduces the total of (1) & (2) by $570.

Here's a quick summary of some of the pros and cons of renting or owning a home:

	Rent	Own
Pros	- no property tax - no maintenance fees - lower insurance costs - can leave and someone else watches the property - rent increases limited to CPI (≈2%) - can move to a new place as desired - fewer utility payments	- build equity (investement) - customize home with renovations - forced savings for the future - ability to defer property taxes (as a senior citizen)
Cons	- limited ability to customize home with renovations - not able to build equity - inconsistent neighbours - uncertainly of eviction	- huge interest costs paid to the bank - property taxes (high expense) - repair/maintenance costs - higher insurance costs - utility expenses - tax/utility increases not under your control

Consider the general guideline about housing:

When renting: you should not be spending more than 25% of your *net* income should go to rent (this can be 35% if you're not intending to "save up" for a home purchase)

When owning: no more than 30-40% of your monthly *gross* income should go to housing (however, given the real estate market in the Lower Mainland, many homeowners are being forced into spending more than 40% on housing).

Question: what if that same condo were available for *renting* at $2000/month? In this case, you wouldn't be responsible for the fees above (apart from cheaper tenant's insurance at about $40/month for your belongings). Would you rent instead? Why or why not? Is buying the condo and renting it out an option? Why or why not?

A few final notes on mortgages:
In reality, lenders will never offer you a fixed interest rate for the entire 25-year term of a mortgage. They will either offer you a variable-rate interest rate for 5 years which goes up or down periodically (linked to the prime interest rate), or offer you higher “fixed” rate for between 1 and 10 years.

In either case, at the end of each “term” you are presented with a new set of options to choose from. However, once the mortgage agreement has been signed, it is generally not advisable to renegotiate the agreement as there are stiff financial penalties for doing so.

A variable-term mortgage is typically less expensive, but doesn’t offer you the security of knowing the exact amount you’re paying each month as the prime rate does go up or down over time. On the other hand, a fixed-rate term is more expensive but protects you from fluctuations in the interest rates.

In September 2019 when this was being prepared, the prime interest rate was 3.95% -- so a variable mortgage being the prime rate minus 0.65% for a 5-year term would be 3.3% as of this writing. The fixed-rate 3-, 5-, 7- and 10-year mortgages were 2.99%, 2.94%, 4.14% and 4.39%, respectively. *Of all these options, which would you pick? Why?*

HOUSING PROJECT

In the future, finding a place to live is going to occupy a large amount of your time. Knowing what is out there, and what you can afford is critical to being able to find the location that you want to make your home. This project is designed to help you discover possible avenues into the housing market.

At the end of this project you will bring all of your research to your teacher for assessment. In the end, you will make a choice of the housing options you have evaluated — and be prepared to explain why this choice is your best option (there is no wrong answer if you can support it). You will be able to choose how you will be marked with your teacher.

The Career Path

In order to start out in your search for a house, you must first have a job/career that will help you afford to purchase your home. Since most of you are not sure about your path into the workforce, we have found a helpful resource that identifies possible careers that might capture your interest. From the website listed below, choose a career that you may see yourself enjoying as a future occupation. You will be required to include a description of the career and the annual salary in your project.

www.workbc.ca/Jobs-Careers/Explore-Careers.aspx

The different careers can be searched by category, or alphabetically. A job that you will like will be related to the things that you are interested in doing like hobbies, activities, or courses. Choose any career that holds your interest. The salary can be found on the career page that you choose by selecting the "Earnings and Outlook" button.

How much house can you afford?

Once a job has been selected, you need to determine how much house you can afford. The website: www.ratehub.ca/mortgage-affordability-calculator has the tools you need in order to find out what type of property that you can look to own. In this section we are looking for the maximum value of the house you can afford, the amortization period, the interest rate, the cash needed, and your total monthly payment, and monthly expenses. Including the ratehub affordability calculation would be useful with your presentation.

On RateHub, enter your annual income on the "Input" tab, then press the "Affordability" tab. *Make sure you're using a laptop, or using a phone in "landscape" mode to see the results.*

Looking for your home

Using the website www.Realtor.ca , choose the city you wish to live in and search for a property that fits your budget. This house will have a value equal to, or below, the maximum mortgage amount from the affordability calculator. You can choose a house or apartment, and then you are able to use the mortgage calculator at the top of the page to find out your monthly payments.

Cost of owning a home

The cost of owning a home is an expensive proposition. There are many essentials to pay for in order to make your home a comfortable place to live. The costs to consider are:

- Mortgage payment and Insurance
- Strata fees
- Utilities: gas, electricity, internet, cable, …
- municipal fees; water sewer, garbage
- property tax (can be found at assessment BC by address)
- repair and maintenance (2% of the value of the home per year)

Determine how much per month the overall expenses are going to reduce your paycheck.

Renting a home

Using www.craigslist.org , find a rental property with the same number of bedrooms and bathrooms. We are going to compare renting costs versus owning costs. What are the costs associated with renting? Most costs are covered by the rent, but you still have to pay the utilities. Determine how much you would be paying per month to rent a similar home to the one you chose above.

Decision time

Which is more appealing for you, owning or renting? Make your choice and be prepared to defend the decision using the evidence you seen in this activity, and your educated opinion.

Extra

It is interesting to see how mortgage payments can affect the length of time you have to pay the bank back. There is a calculator that can show you this at www.dominionlending.ca . This calculator is called the Mortgage Payoff Calculator, and you can use it to see how increasing payments can shorten the life of the typical mortgage. 25 years is a long time, and obtaining your house quicker should be a goal for anyone. You will have money left over after you calculate the affordability, and it is interesting to see how the graphs change when you add some extra payments.

A sample house purchase:

In Maple Ridge, an actual house was recently on the market for $598,000. Purchasing this home would require a mortgage with a monthly payment of about $2,285/mo. It was a single family detached home that is $1,775 square feet -- a 3 bedroom, 3 bathroom house on a 0.167 acre lot (7275 square feet).

Here are some sample costs associated with that purchase in Maple Ridge:

	5% down payment	10% down payment	15% down payment	20% down payment
Monthly Mortgage Payment	$2636	$2497	$2351	$2153

(Having a mortgage "insured" is often a requirement of the bank, in which case there is a required minimum down payment of 5%).

Some sample monthly costs to consider:

Property Tax :	$312.42	(or $3,749/year)
Insurance :	$85.00	
Natural Gas :	$110.00	
Electricity :	$140.00	
Cable :	$75.00	
Internet :	$100.00	
Phone:	$45.00	
Garbage pick up :	$50.00	
Repair/Maintenance*:	$996.67	(or $11960/year)

* Just a note about repair and maintenance costs. These tend to be larger amounts that aren't recurring costs. This is general care that happens over the lifetime of the house, and may or may not occur in a given year, but needs to be budgeted into the cost of home ownership:
  - new roof, new furnace, new hot water heater, paint, lawn care, appliances, etc…

(Using 5% down without repair and maintenance)
Total Monthly Cost: **$3553.42**

(including repair and maintenance)
Total Monthly Cost: **$4550.09**

GOING FURTHER: CALCULATING COMPOUND INTEREST ON INVESTMENTS (with regular payments)

If you were to deposit \$1000 into an account that would pay 3% interest/year for 5 years, how much would you earn? From the compound interest formula $A=P(1+i)^n$ you learned earlier, you would have come out with $A = 1000(1+0.03)^5$ = $1000*(1.03)^5$ = \$1159.27. On your investment of \$1000, you earned \$159.27 over the 5 years.

This could also be attained with the TVM solver where PV=1000 (the starting principal), N=5 (the number of years), and I%=3. You then solve for the "Future Value (FV)". In this case, you will see -1159.27; you can ignore the negative in this case. The amount obtained from the TVM Solver is otherwise identical to that from the compound interest formula.

Now, if we are also adding amounts to the savings as it goes on, then the compound interest formula won't work for us; we *need* the TVM Solver.

Let's add \$50 to the investment once per year – we would have "50" for the PMT amount. The investment now comes out to \$1424.73, an increase of \$265.46 over the previous case. You put \$50 for each of 5 years – so, above that \$250, you gained an extra \$15.46 in interest.

> *Challenge:* For a moment, let's say that were to instead add \$50 *per month* to your \$1000 investment. Using the advanced online TVM solver, see if you come out with a reasonable final investment ("future value") – hint: it should be between \$4000-\$5000.

This exercise is particularly important and demonstrates the power of compound interest, even if you are depositing small amounts into the account on a regular but long-term basis.

As a teenager, if you committed to starting an account with \$1000 – and then saving \$50/month, *could you do that?* Let's say you took the time and researched and found an investment that provided a 6% return every year – *would you do it? Do you have an idea how much money you would have by the end of 50 years? How much of that money did you put in?* Use the advanced TVM Solver to find out. *Were you surprised?*

<u>Exercise:</u> You have been gifted \$10000 and can also commit to depositing an extra \$50/month into that account for the next 10 years at 5% compounded annually. *How much will that account be worth at the end? How much interest did you earn?* Answer: \$24,007.10, \$8007.10.

<u>Mortgages revisited</u>: Some mortgage companies allow you to "double-up" on your payments. With the advanced TVM solver (in your \$400k condo example), double the \$1937.16 PMT amount, and then calculate how much sooner the mortgage is paid out – to do this, press the **Calc NP** (Periods) button. *How much interest did you save?*