

New Bedford Public Schools
Division of Adult & Continuing Education

New Bedford High School Evening Extension

2019 – 2020 School Year
Trimester III

Learning Packet #2
for
Quantitative Reasoning

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Due date: May 4, 2020

Simple Interest

Content Objective:

- ★ Students will be able to identify, explain, give examples of, summarize, ask and answer questions about, make connections to, visualize, determine the importance of, and apply what they have learned about *applying and solving Simple Interest problems in the Real World.*

Simple Interest Problems

Interest is money paid for the use of money. If you borrow from the bank to buy a car, the bank will charge you interest for its use. If you open a savings account at the bank, the bank will pay you interest for as long as the account is open. Note: Banks usually charge compound interest not simple interest. See your local accounting teacher for more information.

The interest (I) is the dollar amount earned or owed.

The interest rate (R) is per year (T) unless otherwise noted.

Note: If the time is in months, T can be found using the ratio

$$\frac{\text{number of months}}{12}$$

The principal (P) is the amount borrowed or deposited.

This is the formula to express simple interest:

$$I(\text{nterest}) = P(\text{rincipal}) \times R(\text{ate}) \times T(\text{ime})$$

$$I = P \times R \times T \text{ or } I = PRT$$

Let's do this together:

Solve each of these interest problems:

- 1) You get a student loan from the New Mexico Educational Assistance Foundation to pay for your educational expenses this year.
Find the interest on the loan if you borrowed \$2,000 at 8% for 1 year.
(You may wish to use the percent key on your calculator or change 8% to .08)

Now you try this:

- 2) You are starting your own small business in Albuquerque. You borrow \$10,000 from the bank at a 9% rate for 5 years.
Find the interest you will pay on this loan.

Independent / Collaborative Work:

- 3) You are tired at the end of the term and decide to borrow \$500 to go on a trip to Whatever Land. You go to the bank and borrow the money at 11% for 2 years.
- a) Find the interest you will pay on the loan.
- b) How much will you have to pay the bank at the end of the two years?
4. a) Find the interest on a loan of \$2500 that is borrowed at 9% for 7 months
- b) How much would it cost to repay the loan from 4a) above?
5. Do you understand what interest means? Circle one YES! NO!
6. Have you ever borrowed money from a bank or loan office to buy a car, house, or whatever? Circle one YES! NO!

1) a) The formula for simple interest is: _____

b) Rearrange this formula to find:

i) Time:

ii) The interest rate:

iii) The Principal:

2) If Michael invests \$2000 in the bank at a rate of 5.5% for 6 years how much interest will he make?

3) Kelsey takes out a loan for \$6000 to start a business after high school. The bank charges her 8% interest for the loan. After 5 years how much interest will be added on to the loan?

4) Jessie invests \$3345 in the stock market. Over the 3 years she has this invested she gets an average return of 7.8%. How much will her investment be worth after the 3 years?

5) Scott takes gets a student loan to go to college after high school. If he pays \$750 in interest at a rate of 3%, how much must the loan have been for originally?

Warm Up:

1. To buy a car, Jackie borrowed \$19,000 for 3 years at an annual simple interest rate of 8.5%. How much interest will she pay when she pays the loan off? What is the total amount she will repay?

2. Jack borrowed \$30,000 for 10 years to make home improvements. If he repaid a total of \$54,000 At what interest rate did he borrow the money?

Independent / Collaborative Work:

your first car?

Ready to buy

are going to pay for it?

Know how you

Most Americans borrow money and finance their car through a bank. When you borrow money, you must pay interest. Interest is the cost of using someone else's money. It is expressed as a percentage rate over a period of time. This allow people to make monthly payments over a set period of time.

In this project you get to purchase a vehicle of your choice and use the data given to determine which loan you would choose to finance your purchase.

Let's get ready to shop!

Project Directions:

In this project, you will use your lap top to find a vehicle you would like to purchase. Once you find the vehicle, you will complete, Part One, The Car Project sheet and Part Two, Calculation sheet to determine the best loan for you.

part one**Directions**

1. You will need to find an advertisement for a car, including the purchase price.
2. You may look on the following websites:
 - www.carmax.com
 - www.autotrader.com
 - www.toyotacenter.com
 - www.dartmouthnissan.com
 - www.thecarpalace44.com

My vehicle is a (year) _____ (make) _____
 (model) _____ EXAMPLE: 2013 Nissan Pathfinder

- The website I used was _____

PART TWO**Calculations**

You will need to find the best interest rate for your purchase in order to lower your monthly payments.

To calculate your monthly payment:

$$(\text{Car price}) \times (\text{Interest Rate}) \times (\text{Time in years}) = \text{Total Interest Added}$$

$$\text{Total Interest Added} + \text{Original Car Price} = \text{Total Purchase Price}$$

$$\text{Total Purchase Price} / \text{Length in months} = \text{Monthly Payment}$$

EXAMPLE: I am buying a brand new Jeep Grand Cherokee for \$45,000 at an interest rate of 5%. If I finance my new Jeep for 6 years, my monthly payment will be ...

\$45,000 x 0.05 interest rate = \$2,250 interest per year
 \$2,250 x 6 years = \$13,500 total interest added for 6 years
 \$13,500 + \$45,000 = \$58,000 total purchase price (amount to be financed)
 \$58,000 / 72 months = \$812.50

CHART TO CALCULATE INTEREST RATE AND MONTHLY PAYMENTS

Car Price	Loan	Interest Rate	Time in Years	Total Interest	Total Finance Amount	# of Months	Monthly Payment
	1	8%	6				
	2	9.75%	5				
	3	10.25%	4.5				
	4	18%	2.5				
	5	12.25%	4				

You have 5 loan options listed above. Examine the options closely. Give a detailed explanation of which loan would you use to pay for your vehicle and why? Which loan would you not even consider and why?

Show all work below:

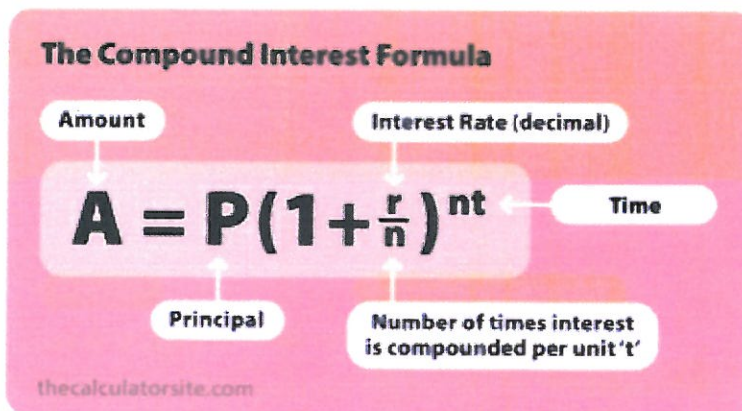
Content Objective:

- ★ Students will be able to identify, explain, give examples of, summarize, ask and answer questions about, make connections to, visualize, determine the importance of, and apply what they have learned about *applying compound interest to investments and loans.*

Homework:**Warm Up:**

Use simple interest to find the ending balance.

- 1) \$34,100 at 4% for 3 years

Direct Instruction / Guided Practice:

The concept of compound interest is that interest is added back to the principal sum so that interest is gained on that already-accumulated interest during the next compounding period. How important is it? Just ask Warren Buffett, one of the world's most successful investors:

"My wealth has come from a combination of living in America, some lucky genes, and compound interest."

Warren Buffett, 2010

A = the future value of the investment/loan, including interest

P = the principal investment amount (the initial deposit or loan amount)

r = the annual interest rate (decimal)

n = the number of times that interest is compounded per unit t

t = the time the money is invested or borrowed for

Try this together:

- 1.) Your 3 year investment of \$20,000 received 5.2% interest compounded semi-annually. What is your total return?

$A =$

$P =$

$R =$

$N =$

$T =$

Try on your own:

- 10.) You invest \$1,900 at 4% and it's compounded semi-annually for 3 years. How much will your \$1,900 be worth in 3 years?

$A =$

$P =$

$R =$

$N =$

$T =$

1. A newborn child receives a \$20,000 gift toward a college education from her grandparents. How much will the \$20,000 be worth in 17 years if it is invested at 7% and compounded quarterly?
2. If you invest \$10,000 in a bank which one is a better investment?
 - a) 9% compounded monthly
 - b) 9.3% compounded annually
3. If an investment company pays 6% compounded semiannually, how much should you deposit now to have \$10,000 5 years from now?
4. At age 27, Jill deposited \$4,000 into an IRA, where it earns 9.8 % interest compounded monthly. What will it be worth when she is thirty-five?

Hot Wheels: Activity 1



You have finished car shopping and have found the perfect car. After negotiating, the total cost of the car is \$24,000. You do not have the cash, but have been approved for financing.

Financing Options

Local Bank

Option 1: 4.9% compound interest for 5 years

Option 2: 3.9% compound interest for 4 years

Car Dealer

Option 3: 0% compound interest for 3 years

Option 4: 5.9% compound interest for 6 years.

List the three basic components of a loan.

Which option do you think is the best deal and why?

You have a budget for car payments of \$350 a month. Do you think you can afford this car? How?

Interest Rates in the Real World-Buying a Used Car

New Material:

When you buy a car or a house, your monthly payment is calculated by a method called *amortization*. Amortization is the process of paying off a debt by making a given number of equal payments at specified intervals (usually monthly). These payments include the compound interest. With each payment, the amount of interest declines (as the unpaid balance on the loan declines), while the amount paid toward principal increases. If equal payments are made monthly, then the payment amount is calculated according to the following formula:

$$\text{payment} = \text{LoanAmount} \times \frac{\text{InterestRate}}{12} \times \frac{1}{1 - \left(1 + \frac{\text{InterestRate}}{12}\right)^{-12t}}$$

where t is the number of years to repay the loan.

The preceding monthly payment formula looks pretty formidable, but if we use some variables and do a little algebra, it begins to look a bit better. Let P represent the amount borrowed (the *principal*), and m represent the *monthly* interest rate (that is, $m = \text{interest rate}/12$). Then your monthly payment is given by

$$\text{payment} = \frac{P \cdot m}{1 - (1 + m)^{-12t}}$$

Consider an example. Your rich (and generous) uncle agrees to lend you \$3000 at the incredibly low interest rate of 3%, amortized over 2 years. Your monthly interest rate is $0.03/12 = 0.0025$, and your monthly payment is

$$\text{payment} = \frac{(3000)(0.0025)}{1 - 1.0025^{-24}} = 128.94(\text{dollars}).$$

How do you figure out how much of each payment goes to interest and how much to principal? Each month you must calculate the interest on the current loan balance. If the monthly interest rate is 0.0025 and the initial balance is \$3000, then the first month's interest is \$7.50. So of the first payment, only \$121.44 is applied toward the principal, leaving a new balance of \$2878.56. Using the monthly interest rate of 0.0025 on this new balance gives a second month's interest of \$7.20. So, \$121.74 is applied toward principal, leaving a new balance of \$2756.82.

Hot Wheels: Activity 2a

You need to compare the different financing options to get the best deal. Assume you have no cash and will be financing all of the new car worth \$24,000.

Local Bank

Option 1: 4.9% compound interest for 5 years

Option 2: 3.9% compound interest for 4 years

Option 1

Find the monthly payment

Find the total amount to be repaid.

How much is the total interest?

Option 2

Find the monthly payment

Find the total amount to be repaid.

How much is the total interest?

Which option has the lower monthly payment? Which option has a lower total cost? Why?

Hot Wheels: Activity 2b

Car Dealer

Option 3: 0% compound interest for 36 years
Option 4: 5.9% compound interest for 72 years.

Option 3

Find the monthly payment

Find the total amount to be repaid.

How much is the total interest?

Option 4

Find the monthly payment

Find the total amount to be repaid.

How much is the total interest?

Which option has the lower monthly payment? Which option has a lower total cost? Why?

Hot Wheels: Compare

Fill in the chart below displaying your results for the four different options..

Chart 1

Option	Annual Interest Rate (%)	Term (Months)	Monthly Payments	Total Cost of Car (\$)
1				
2				
3				
4				

Referring to Chart 1, which option,

Has the lowest monthly payments?

Has the lowest total cost of the car?

Do you think that the lowest total payment always results in a lower total cost?

Hot Wheels: Reality

After all your hard work negotiating your dream car to \$24,000, you now realize you cannot afford it. The car dealer really wants your business and asks you how much you can afford each month. You tell him about \$350 a month. He walks off to his manager's office and comes back with the paper work.

If your monthly car payment is \$350 and it is for 9 years, how much is the compound interest?

What is the total cost of the car?

Is this a good deal?

You decide you want to finance the \$24,000 car for 6 years at 5.9%. To keep your monthly payments at \$350, how much of a down payment will you need?