

Mathematics of Personal Finance
Grade 11, College Preparation
MBF3C

Sample Exam

KU _____
PS _____
CM _____
AP _____

Total:

General Instructions

- a) You will need a graphing calculator. You may not share a calculator.
- b) If you are having trouble thinking about what mathematics to connect to any problem, let your teacher know. You may be given a hint. Such hints will be taken into account when scoring your paper, but it is wiser to accept a hint than leave a problem poorly answered.
- c) Make sure you follow directions from the **Key Words and Phrases** list. Sometimes these directions have been bolded and underlined to draw your attention to them.
- d) In Parts B and C, when using a calculator, write down the numbers and operations that you carried out on the calculator.
- e) In Parts B and C, your teacher will look to see how much relevant mathematics you have been able to show for each question posed.
- f) Your solutions in Parts B and C will be assessed for communication. The communication of your thinking and your use of mathematical conventions and language will be assessed using the criteria shown below.

Criteria Assessment of Communication	Level				
	R	1	2	3	4
Using mathematical symbols, labels, units and conventions					
Using mathematical vocabulary					
Integrating narrative and mathematical forms of communication					
Explaining and justifying with clarity					
Overall	_____ out of _____				

Part A: Multiple Choice Questions:

- a) Be sure to read the problem and all four answer choices for each question carefully.
 - b) Always choose the best answer. Circle only one answer for each question.
 - c) There are 10 questions in this section. Use about 15 minutes to do these 10 questions. Do not spend too much time on any one question.
-

1. Which statement is true?

- a) Canada Savings Bonds are guaranteed and are cashable at any time.
- b) Common stocks are guaranteed and are cashable at any time.
- c) Blue-chip stocks are a high-risk investment.
- d) Mutual funds are a "pool" of investors' money in bonds.

2. Yvonne calculates the following expression to determine the present value of an annuity:

$$\frac{350 [1 - (1 + 0.035)^{-16}]}{0.035}$$

The present value of the annuity is:

- a) negative
- b) between \$0 and \$4000
- c) between \$4000 and \$10 000
- d) over \$10 000



Hint: Use a calculator

3. Which statement is true?

- a) $y = 3x$ is linear and $y = 3^x$ is quadratic.
- b) $y = 6x + 7$ is linear and $y = x^2$ exponential.
- c) $y = 4x$ is linear and $y = 4^x$ is exponential.
- d) $y = 2^x$ is quadratic and $y = x^2$ is exponential.

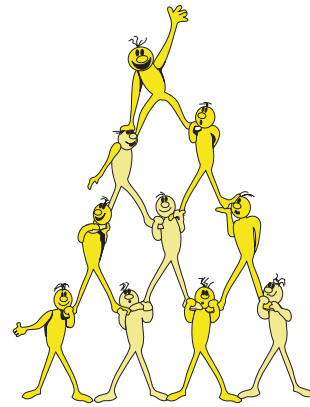
4. The bottom row of the people pyramid picture has 4 people. If the bottom row had 100 people, which formula would you use to determine the *total number* of people in the pyramid?

a) $S_n = \frac{n}{2}[2a + (n-1)d]$

b) $t_n = ar^{n-1}$

c) $S_n = \frac{a(r^n - 1)}{r - 1}$

d) $t_n = a + (n-1)d$



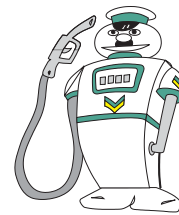
Hint: $1 + 2 + 3 + 4 = 10$ people

5. Jay and his friends plan to drive to a concert.

- a return trip to the concert is 225 km
- Jay's car uses an average of 7.8 L/100 km
- gas costs 69.5¢/L

How much will the gas cost for a return trip to the concert?

- a) \$20.05
 b) \$25.25
 c) \$12.20
 d) none of the above

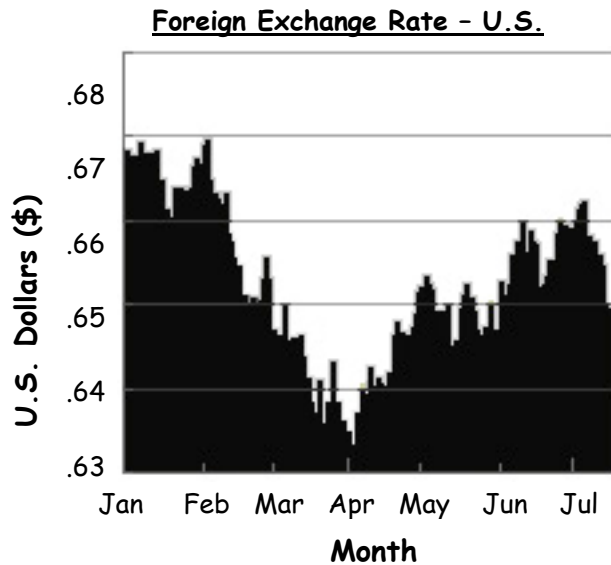


6. Solve for x: $2^{3x-1} = 4^{x+5}$

The value of x is:

- a) $\frac{4}{3}$
 b) 3
 c) 11
 d) none of the above

7. The following graph shows the value of \$1 Canadian in U.S. dollars over a period of time.



Some Canadians plan shopping trips to make purchases in the U.S. Use the information in the graph to determine which statement is true.

- a) It was better to shop in January than March.
 - b) It was best to shop in April.
 - c) Prices don't change so it doesn't matter when you shop.
 - d) None of the above
8. Which of the following is related to an arithmetic sequence?
- a) linear growth
 - b) simple interest
 - c) constant rate of change
 - d) all of the above
9. Which of the following is an example of exponential growth?
- a) a salary that increases \$1000 every year
 - b) an investment that grows at the rate of 7% compounded semi-annually
 - c) the number of hours of daylight each day of the year
 - d) the height of a homerun baseball

10. Which of the following statements is true?

- a) Purchasing a new car usually has a higher overall cost in the long run than leasing the same car.
- b) At the end of the lease period you will own the car.
- c) Leasing rates usually depend on the expected number of kilometres of usage over the lease period.
- d) The monthly payments for a lease are usually higher than monthly payments for a new car loan.



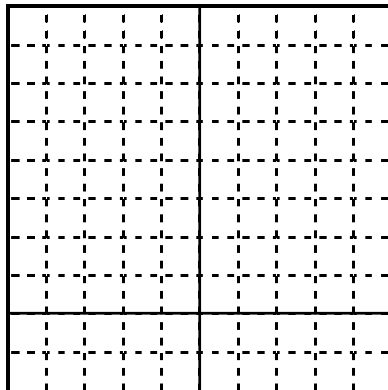
Lease
or
Purchase?

Part B: Short Answer Questions

- a) Show all of your work (even rough work).
- b) There are 10 questions. You will have about 60 minutes to do the questions. That means you have about 6 minutes for each question. Budget your time accordingly.
- c) When using a calculator, write down the numbers and operations that you carried out on the calculator.
- d) Your solutions will be assessed for communication.

1. Sketch the graphs of $y = 2^x$ and $y = \left(\frac{1}{2}\right)^x$.

Describe any special features and compare the rate of growths.



2. Simplify each algebraic expression:

a) $(5a^2)^3$

b) $5(a^2)^3$

c) $\frac{12a^6b^6}{-4a^{-2}b^3}$

d) Demonstrate your knowledge by creating and simplifying your own example:

3. Cindy bought a \$500 **regular** (simple) interest Canada Savings Bond (CSB).
 Sean bought a \$500 **compound** interest CSB.
 Both bonds have 7-year terms.

<u>Cindy's Bond</u> \$500 CSB 7-year term, 5% Regular Interest per annum		
Year	Interest	Accumulated Interest
1	\$25	\$25
2	\$25	\$50
3	\$25	\$75
4	\$25	\$100
5	\$25	\$125
6	\$25	\$150
7		

<u>Sean's Bond</u> \$500 CSB 7-year term, 5% Compound Interest per annum		
Year	Interest	Accumulated Interest
1	\$25.00	\$25.00
2	\$26.25	\$51.25
3	\$27.56	\$78.81
4	\$28.94	\$107.75
5	\$30.39	\$138.14
6	\$31.91	\$170.05
7		

Complete both charts.
 Explain why Sean's bond made more interest.

4. *This question refers to the bonds in question 3.*

The accumulated interest for Cindy's and Sean's bonds form sequences:

Cindy's Bond:	25, 50, 75, 100, ...
Sean's Bond:	25.00, 51.25, 78.81, 107.75, ...

State the type of each sequence: arithmetic, geometric or neither.
Give reasons for your answer.

5. *This question refers to Sean's bond in question 3.*

The following sequence shows the total value of Sean's bond each year.

Sean's Bond

\$500, \$525.00, \$551.25, \$578.81, \$607.75, \$638.14, \$670.05

Use numbers from the sequence and some calculations to **explain** how you know that Sean's bond has exponential growth.

6. Joan inherited \$8000 from her grandparent's estate.
Joan needs \$10 000 in 3 years to pay for college expenses.

What rate of interest, compounded quarterly, is necessary for \$8000 to grow to \$10 000 in 3 years?

Show your work.



7. Jake has a *Chargmee* credit card.

Interest is 18% simple interest per annum on:

- the unpaid balance from the previous bill
- cash advances.

Interest is **not** charged on **purchases** made during the current month.



Chargmee

Jake received this statement:

Date	Previous Balance	Payments/ Credits (-)	Cash Advances (+)	Pur- chases (+)	Interest (+)	New Balance (=)
June 24	\$243.74	\$50.00				\$193.74
July 3				\$175.60		
July 7			\$150.00			
July 24					\$4.13	\$523.47

Is the new balance of \$523.47 correct?

Show your work to support your answer.

Hint:
June has 30 days

8. Julian is going to buy a new car. He has to finance \$25 000 at an interest rate of 2%, compounded monthly over 5 years.

Find the monthly payment required.

Show your work.

If you use the TVM Solver,
complete the screen then
state your final answer.

```

N=
I% =
PV =
PMT =
FV =
P/Y =
C/Y =
PMT: [ ] BEGIN

```


9. Derrick is purchasing a new computer from *Digiplus Solutions*.

Derrick can choose an instalment plan where he will make monthly payments of \$80 for 2 years to pay for the computer. The monthly payment is based on an interest rate of 14% per annum compounded monthly.

If Derrick didn't choose the instalment plan, what would he pay in cash?

Show your work.



If you use the TVM Solver, complete the screen then state your final answer.

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N=
I% =
PV =
PMT =
FV =
P/Y =
C/Y =
PMT: ☐ END ☐ BEGIN
  
```

10. Paula and James have rented a 2 bedroom apartment for 5 years. They pay rent plus utilities. Since they are expecting their first child, they are considering buying a house. They saved \$3000 last year and \$2500 the year before for their down payment.

Apartment Costs	House Costs
Rent: \$1150/month	Mortgage: \$260/week
Gas: \$900/year	Electricity: \$230/month
Electricity: \$550/year	Water: \$55/month
Appt Parking: \$30/month	Property Taxes: \$1980



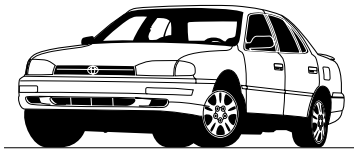
Should they buy the house? Justify your answer.

Part C: Extended Response Questions

- a) Show all of your work (even rough work).
 - b) There are 2 questions. You will have about 30 minutes to do the questions. That means you have about 15 minutes for each question. Budget your time accordingly.
 - c) These questions are designed to allow you an opportunity to show what you know and what you can do. Provide as much information as you can to show your understanding.
 - d) There are many different ways to solve a problem. Use your broad range of mathematical knowledge to present a complete and creative solution to each question.
 - e) When using a calculator, write down the numbers and operations that you carried out on the calculator.
 - f) Your solutions will be assessed for communication.
-

1. On his 13th birthday, Jordan's uncle invested \$8000 for him. His uncle guaranteed Jordan a return of at least 10% compounded annually.

Jordan wants to buy a car. A new car costs \$14 000. The purchase price of the car increases \$500 every year.



- a) Complete the table to determine if Jordan will have enough money to buy a new car in four years. **State your conclusion.**

Year	Jordan's Investment (\$)	New Car Price (\$)
0	\$8 000	\$14 000
1	\$8 800	\$14 500
2	\$9 680	\$15 000
3		
4		

- b) If we look at year one,
- Jordan's investment made \$800
 - The price of the new car went up by \$500.
- This means Jordan gained \$300 towards a new car.

Jordan reasoned the following:

*I need another \$6 000 to buy a new car now (year 0).
I gain \$300 each year.*

$$\frac{6000}{300} = 20$$

I will have to wait twenty years to buy a new car.

Jordan's reasoning is faulty. Explain.

- c) Use any suitable method (such as tables, graphs, algebraic models etc.) to determine when Jordan will have enough money to buy the new car.

2. Archana and Avanish are married and expecting their first child. Therefore they have decided to buy a house. They made an amortization table using a spreadsheet. Part of the table is shown below.

	A	B	C	D	E	F
1	Amount of Mortgage:		\$ 120,000.00			
2	Yearly Interest Rate (%):		7.50			
3	Amortization Period (yrs):		25			
4	Monthly Interest Rate (%):		0.615452392			
5	Monthly Payment:		\$877.87			
6						
7						
8	Payment	Monthly	Amount of	Amount of	Amount left	
9	Number	Payment	Interest Paid	Principal Paid	to Pay	
10	0				\$ 120,000.00	
11	1	\$877.87	\$ 738.54	\$ 139.32	\$ 119,860.68	
12	2	\$877.87	\$ 737.69	\$ 140.18	\$ 119,720.50	
13	3	\$877.87	\$ 736.82	\$ 141.04	\$ 119,579.45	
14	4					

- a) The mortgage Archana and Avanish chose was an open mortgage. What is the difference between an open mortgage and a closed mortgage?
- b) Fill in row 4 of the spreadsheet.
- c) Mortgage rates in Canada are given as an annual percent, compounded semi-annually and paid monthly.

Use this information to calculate the monthly interest.

Show your work.

Hint: Your answer will be 0.615452392%. This rate is shown in the spreadsheet.

d) **Recap:**

Arachana and Avanish's mortgage is for \$_____. It is amortized for _____ years with an annual interest rate of _____% compounded _____ and paid _____.

Determine the total interest Archana and Avanish will pay over the full 25 years of their mortgage.

Show your work.

e) At the end of the first 5 years of the mortgage, Avinash and Archana made a one-time payment of \$10 000. The interest rate and the monthly payment stayed the same. Use your graphing calculator to determine the *interest saved* by making the \$10 000 payment.

Show your work. Use the screen displays to show the work you did with your graphing calculator.

Screen DisplaysExplanations

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N=  
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PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT:END BEGIN
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