LESSON SUMMARY

CXC CSEC MATHEMATICS	Lesson
UNIT Four: **Consumer Arithmetic**	**5**

Mathematics for Buying, Selling, Borrowing and Investing

Textbook: Mathematics, A Complete Course by Raymond Toolsie, Volume 1

(Some helpful exercises and page numbers are given throughout the lesson, e.g. Ex 5f page 182)

INTRODUCTION

As productive individuals, in our daily lives we are always involved in buying selling or investing .There may also be times when we will have to take loans from a lending institutions. This lesson deals with some of the important computational task involved in these processes. It involves the application of the skills developed in the previous lessons to our daily transactions. In buying or selling goods it is important to be able to determine profit or loss and one should also be able to calculate interest from investments made or the interest to be paid on a loan.

OBJECTIVES

At the end of this lesson you will be able to:

a) Calculate discount, sales tax, profit or loss
b) Solve problem involving marked price (or selling price), cost price, percentage profit, loss or discount.
c) Solve problems involving payments by instalments as with hire purchase and mortgages
d) Solve problem involving simple interest, compound interest, and depreciation.

4.1 Profit and Loss, Discount

Profit and Loss

If a business man buys an article and sells it for more than what he paid for it he makes a profit. If he sells the article for less than what he paid for it he makes a loss. The price the business man pays for the article is called the cost price while the price he sells the article for is called the selling price or marked price.

The following formulae will be helpful:

For Profit:

$$The\ profit = The\ selling\ price - The\ cost\ price$$

$$The\ profit\ \% = \frac{The\ profit}{The\ cost\ price} \times 100\%$$

$$The\ selling\ price = The\ cost\ price + The\ profit$$

For Loss:

$$The\ loss = The\ cost\ price - The\ selling\ price$$

$$The\ loss\ \% = \frac{The\ loss}{The\ cost\ price} \times 100\%$$

$$The\ selling\ price = The\ cost\ price - The\ loss$$

It follows from the above that given the profit per cent:

$$The\ profit = \frac{The\ profit\ \% \times The\ cost\ price}{100\%}.$$

Try writing a formula for the loss given the loss per cent.

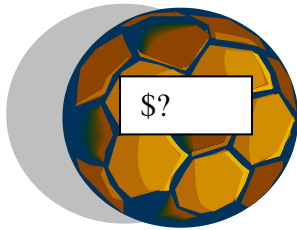The above formulae can be used to solve the following examples.

Example: 1. A dealer buys 50 apples for $40 and sells them for $1.20 each. Calculate his percentage profit. (Ex 5f page 182)

Solution: $The\ selling\ price = \$1.20 \times 50$

$= \$60.$

$The\ profit = \$60 - \$40$

$= \$20.$

$The\ profit\ \% \ (or\ percentage\ profit) = \dfrac{20}{40} \times 100\%$

$= 50\%.$

2.

The cost price of a soccer ball is $65. If the loss per cent was 20%, what was the loss? Also calculate the selling price.

Solution: $20\% = \dfrac{The\ loss}{\$65} \times 100\%$

$The\ loss = \dfrac{\$65 \times 20\%}{100\%}$

$= \$13.00$

$The\ selling\ price = \$65 - \$13$

$= \$52.$

Discount

A discount is a percentage off the selling price of an article given to a customer. Therefore the customer buys the article at a reduced price (or sale price). Sometimes a cash discount is given if a customer pays for an article in cash. Therefore the customer pays the cash price for the article. The following formulae are useful:

$$The\ discount = x\%\ of\ the\ selling\ pice$$

$$The\ discounted\ price = The\ selling\ price - The\ discount$$

Example:

1. A boutique is offering a 15% discount for cash. Calculate the cash price for a dress with a marked price of $125. (Ex 5h page 185)

Solution: The discount = 15% of $125.

$$= \frac{15}{100} \times \$125.$$

= $18.75

The cash price $= \$125 - \$18.75$

= $106.25

2. In a sale, a cassette recorder was sold for $2071 after a discount of 5% was given. Calculate the marked price of the cassette recorder.

Solution: the selling price is 95% of the marked price, i.e. $\dfrac{\$2071}{marked\ price} = \dfrac{95}{100}$

$$marked\ price = \frac{\$2071 \times 100}{95}$$

= $2180

ACTIVITY 1

1. Mr. Khan bought a refrigerator for $2 560. Calculate the selling price of the refrigerator if he adds a profit of 20%. A 10% discount is offered for cash. Calculate its cash price.

4.2   Simple and Compound Interest.

Simple Interest.

There are times when an individual will have to borrow money from a bank or invest money in a bank. The amount borrowed or invested is called the principal. Interest is charged on the principal at a given rate over the period of the loan. If the principal stays the same over the period of the loan then the interest paid to the bank is simple interest.

If it is an investment and interest is not added to the principal during the period of the investment, the principal remains the same. The interest paid to the investor here is also simple interest.

The simple interest is given by $I = \dfrac{PRT}{100}$.

$I =$ **the interest.**

$P =$ the principal, i.e. the amount barrowed or deposited.

$R =$ the rate of interest charged on the loan. This is charged as a certain per cent per annum.

$T =$ time, i.e. the length or period of the loan. If it's a deposit, T is how long it remained in the account. When using T in the calculation it must be in years. Therefore if T is given as 6 months it is used as $\dfrac{6}{12} = \dfrac{1}{2}$ a year in the formula.

The principal is $P = \dfrac{100I}{RT}$.

Try and come up with the formulae for R and T.

The amount accruing, $A = P + I.$

Example:

1. A man invested $600 at 8% per annum simple interest for 5 years. (Ex 5s page 213)

Calculate:

(a) the simple interest payable.

(b) the total amount of money the man collected at the end of the 5-year period.

Solution:

a) $I = \dfrac{\$600 \times 8 \times 5}{100}$

$= \$240$ (Try working this with the per cent key on the calculator.)

b) $A = \$600 + \$240$

$= \$840$.

2. The simple interest on $15 000 for 9 years is $6750. Calculate the rate per cent per annum.

Solution:

$R = \dfrac{100 \times \$6750}{9 \times \$15000}$

= 5% per annum.

Compound Interest.

If interest is added to the principal it grows. When interest is recalculated on the new principal, the interest attracted here is called compound interest.

The compound interest formula is $A = P\left(1 + \dfrac{R}{100}\right)^{n}$

A = the amount of money accruing after n years

P = the principal

R = the rate per cent per annum

n = the number of years for which the money was invested.

Also $compound\ interest, C.I. = A - P.$

Depreciation

The value of an asset such as a car depreciates every year. The depreciation formula

is: $A = P\left(1 - \dfrac{R}{100}\right)^n$. The amount by which a value depreciates is given by $D = P - A$.

A = the value of the asset after n years.

P = the initial cost of the asset.

R = the rate of depreciation per annum.

n = the number of years for which the asset was depreciated.

Example:

1. Calculate the compound interest on investing $600 for 2 years at 7% per annum. (Ex 5t page 219)

Solution: $A = \$600\left(1 + \dfrac{7}{100}\right)^2$

$= \$600(1.07)^2$ By using your calculator | 1.07 | y^x | 2 |

$= \$600 \times 1.1449$

$= \$686.94$

Hence C.I. $= \$686.94 - \$600$

= $86.94

2. Calculate the book value of a new maxi taxi costing $44 000 after 3 years if it
   depreciates each year by 13%. (Ex 5u page 223)

Solution: $A = 44\,000\left(1 - \dfrac{13}{100}\right)^{3}$

$= 44\,000(0.87)^{3}$

$= 44\,000 \times 0.6585$

= $28 974.13

ACTIVITY 2

1. Which is the better investment?

   (a) $1 200 at 9% simple interest for 2 years.
   (b) $1 200 at 8% compound interest for 2 years.

2. Calculate the book value of a new mini bus costing $43 000 after 5 years if it
   depreciates each year by 12%.

Sale tax, Hire purchase and mortgages

Sale tax

An example of sale tax is value added tax or VAT. This is a tax paid on goods and
services.

Example:

A DVD game player is priced at $2800 plus value added tax (VAT) at 15%. How many dollars does the DVD game player actually cost the customer? (Ex 5i page 186)

Solution:

The customer pays $(1 + 15/100)$ of $2800

$= 1.15 \times \$2800$

$= \$3220.$

Hire purchase

This allows a customers to purchase much need goods with smaller monthly instalments if they cannot immediately pay the full cash price. The customer usually pays a down payment and interest is then added to the unpaid balance. The hire purchase price is higher than the cash price.

The hire purchase price

$= The\ down\ payment + The\ outstanding\ balance + The\ interest\ charged$

Example:

The marked price of a freezer is $3000.00. There is a discount of 15% for cash payment. To obtain the freezer on hire purchase, a deposit of $595.00 and 18 monthly instalments of $159.50 each are required. (Ex 5j page 189)

Calculate:

a) The cash price

b) The total amount paid if bought on hire purchase

c) The difference between the cash price and the hire purchase price as a percentage of the marked price.

Solution:

a) The cash price is 85% of $3000. (why?)

$$= \frac{85}{100} \times \$3000$$

= $2550.

b) $the\ hire\ purchase\ price = \$595.00 + (\$159.50 \times 18)$

$= \$595.00 + \$2871.$

= $3466.

c) $the\ difference = \$3466 - \$2550$

= $916.

$$This\ as\ a\ percentage\ of\ the\ marked\ price = \frac{916}{3000} \times 100$$

=30.5%

Try to determine the interest charged in the above example.

Mortgage

This a long term loan a person obtains from a bank to purchase a car or a house. A down payment is made to the owner of the house (or car) by the borrower and the bank finances the balance.

A luxury apartment is priced at $235 000. An 85% mortgage can be obtained over a 20-year period. (Ex 5k page 192)

Calculate:
   a) the deposit payable
   b) the loan amount needed
   c) the total amount of money paid to the bank if each monthly payment was $2 829
   d) the total amount paid for the house.
   Solution:

a) $The\ deposit\ is\ 15\%\ of\ \$235\ 000 = \frac{15}{100} \times \$235\ 000$
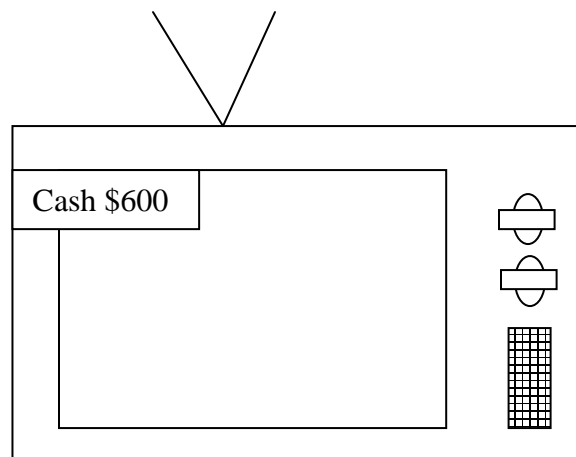
$= \$35\ 250.$

b) $The\ loan\ amount\ needed = \$235\,000 - \$35\,250$

$= \$199\,750.$

c) $The\ total\ amount\ paid\ to\ the\ bank = 20 \times 12 \times \$2829$

$= \$678\,960.$

d) $The\ total\ amount\ paid\ for\ the\ house = \$35\,250 + \$678\,960$

$= \$714\,210.$

ACTIVITY 3

CXC questions.

1. A store charges 6% VAT on all sales. What is the total cost of a shirt marked at $30?
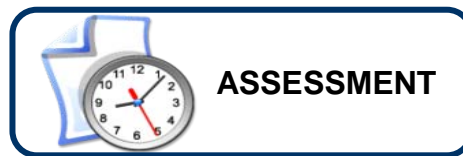
2.

Cash $600

Hire Purchase Plan:

Pay down $60
$55 monthly for 12 months

Mr Jones purchased the TV advertised in the diagram by using the hire purchase plan instead of paying cash. How much more than $600 does Mr Jones pay by using the hire purchase plan?

ASSESSMENT

1. A shopkeeper buys a stove from a manufacturer. The shopkeeper sells the stove for $150.00 at a profit of 20%.

   (a) How much did the shopkeeper pay the manufacturer for the stove?

   (b) If the shopkeeper gives 10% discount for cash, how much does a customer pay for the stove?

2. A man wishes to invest $1500. He can buy saving bonds which pay simple interest at the rate of 8% per annum or he can start a savings account which pays compound interest at the same rate. Calculate, to the nearest cent, the difference between the amounts of the two investments at the end of 3 years.

CONCLUSION

We have looked at the basic arithmetic involved in buying, selling, making an investments or securing a loan. We are also recipients of services for which we have to pay rates. The following lesson looks at some basic Mathematics involved in determining rates, including foreign exchange rates.