STRAND C: Consumer Arithmetic

Unit 9 *Consumer Arithmetic*

Student Text

Contents

9 Consumer Arithmetic

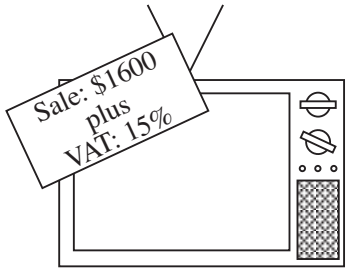
9.1 Buying and Paying

You are familiar with buying items in shops and markets but often, when buying expensive goods, different methods of payment are available.

You might be offered a *hire purchase* agreement: you would pay a deposit and then pay the remainder of the cost of the item in a specified number of (often monthly) instalments. In a *sale*, the cash price might be reduced.

You need to remember that most goods are subject to a government tax, This is often known as VAT (value added tax); the Jamaican equivalent is GCT (general consumption tax) which is currently charged at $17\frac{1}{2}\%$.

Worked Example 1



(a) Calculate the TOTAL amount a customer pays for the television set.

(b) The sale price of \$1600 is 20% LESS THAN the original price.
Calculate the ORIGINAL price of the television set.

Solution

(a) Total amount paid $= \$1600 + 15\% \text{ of } \$1600$

$$= \$\left(1600 + \frac{15}{100} \times 1600\right)$$

$$= \$(1600 + 240)$$

$$= \$1840$$

(b) If the original price is \$$p$, then

$$80\% \text{ of } p = 1600$$

$$\text{that is, } \frac{80}{100} \times p = 1600$$

$$p = 1600 \times \frac{100}{80}$$

$$= 2000$$

So the original price was \$2000.

Check: 20% of \$2000 $= \frac{20}{100} \times \$2000$

$= \$400$

So sale price $= \$2000 - \$400$

$= \$1600$, as expected.

Worked Example 2

The monthly water bill for domestic users is calculated from information shown in the table below.

Fixed charge	J\$350
Charge per gallon	20 cents

Calculate the TOTAL amount of the bill for a month when a consumer used 3850 gallons.

Solution

Total amount of bill $= J\$350 + 3850 \times J\$0.20$

$= J\$350 + J\$770$

$= J\$1120$

Worked Example 3

A printer is advertised for sale at J\$84 000. A discount of 12% is given if it is bought for cash. It can also be bought on hire purchase by paying a deposit of J\$29 400 followed by 24 monthly payments of J\$2300 each. Calculate

(a) the cash price,

(b) the hire purchase price,

(c) the amount saved by buying the printer for cash rather than on hire purchase.

Solution

(a) Cash price $= J\$84000 - 12\%$ of $J\$84000$

$= J\$\left\{84000 - \frac{12}{100} \times 84000\right\}$

$= J\$73920$

Note: it is quicker to calculate the cash price as

88% of J\$84 000 $= J\$\left(\frac{88}{100} \times 84\ 000\right)$

$= J\$73\ 920$

(b) Hire purchase price $= \text{J\$}29\,400 + 24 \times \text{J\$}2300$

$= \text{J\$}(29\,400 + 55\,200)$

$= \text{J\$}84\,600$

(b) Amount saved $= \text{J\$}84\,600 - \text{J\$}73\,920$

$= \text{J\$}10\,680$

Worked Example 4

In selling an article, a shopkeeper made a profit of 20% on his cost price of J$8000. What was the selling price?

Solution

$$20\% \text{ of J\$}8000 = \text{J\$}\left(\frac{20}{100} \times 8000\right)$$

$$= \text{J\$}1600$$

This is the shopkeeper's profit, so the selling price is

$$\text{J\$}8000 + \text{J\$}1600 = \text{J\$}9600$$

Note: it is quicker to calculate

$$120\% \text{ of cost price} = \text{J\$}\frac{120}{100} \times 8000$$

$$= \text{J\$}9600$$

Exercises

1. A store charges $17\frac{1}{2}\%$ GCT on all sales. What is the total cost of a shirt marked at J$1200?

2. In a sale, all prices are reduced by 30%. Calculate the sale price of each of the following items.
   (a) a coat that cost J$5000,
   (b) a T-shirt that cost J$1200,
   (c) a football shirt that cost J$2200.

3. A 12% service charge is added to the cost of food ordered in a restaurant. If the food costs J$2700, what is the total cost, including the service charge?

4. The cash price of a computer in the USA is $696. The hire purchase price is 10% deposit and 15 monthly payments of $45.
   How much more is the hire purchase price than the cash price?

5. The cost of some building materials is J$6480 plus $16\frac{1}{2}\%$ GCT.
   (a) How much GCT is charged?
   (b) What is the total cost of the building materials?

6. A clothing manufacturer determines the selling price of items by adding 32% to the production costs. Calculate the selling price of a dress that cost J$2500 to produce.

7. What is the percentage decrease in the price of a television set which is reduced from $248 to $200? Give your answer to the nearest 1%.

8. An electronic game is sold for J$1998 and the seller makes an 11% profit on the amount he paid for the game. How much did the seller pay for the game?

9. Consumption tax and customs duty are calculated as follows:

Consumption tax	20% of value
Customs duty	50% of value

What is the total tax paid on an article which is valued at $150.00 ?

10. The water authority charges J$350 per month for the meter rent, J$750 for the first 100 litres and J$30 for each additional 10 litres. What is the total bill for 250 litres used in one month?

11. A television set has a sale price of J$18 000. This is a saving of 25% on the original price. What was the original price?

9.2 Earning and Exchanging

This section deals with the important topics of earning money (and paying tax on money earned) and exchanging money into different currencies.

Worked Example 1

BASIC WEEK	
Time	**Wages**
40 hrs	J$32 000

The table above shows how a company pays its workers. Overtime is paid at 50% extra per hour.

Calculate

(a) the basic hourly rate,

(b) the overtime hourly rate,

(c) the total wages for a worker who worked 10 hours overtime in one week,

(d) the number of overtime hours for a worker who earned J$ 56 000 in one week.

Solution

(a) Basic hourly rate $= \text{J\$}\frac{32\,000}{40} = \text{J\$}800$

(b) Overtime hourly rate $= \text{J\$}\left(800 + \frac{50}{100} \times 800\right)$

$= \text{J\$}(800 + 400)$

$= \text{J\$}1200$

(c) Total wages $= \text{J\$}32\,000 + 10 \times (\text{J\$}1200)$

$= \text{J\$}(32\,000 + 12\,000)$

$= \text{J\$}44\,000$

(d) If $x =$ number of overtime hours worked,

$32\,000 + 1200x = 56\,000$

$1200x = 56\,000 - 32\,000$

$= 24\,000$

$x = 20$ hours

Worked Example 2

A man who has a wife and two children earns \$32 000 a year. The annual tax-free allowances are shown in Table 1.

Table 1

	Allowance
Adult	\$900 each
Child	\$400 each
Housing	\$2500 per family

Calculate

(a) his TOTAL annual tax-free allowances,

(b) his annual taxable income.

Table 2 shows the taxes that are due annually.

Table 2

Taxable Income	**Taxes Due**
First \$20 000	\$1200
Remainder	30% of the remainder

(c) Calculate the taxes that he should pay annually.

Solution

(a) Total tax-free allowance $= 2 \times \$900 + 2 \times \$400 + \$2500$

$= \$(1800 + 800 + 2500)$

$= \$5100$

(b) Annual taxable income $= \$32\,000 - \$5100$

$= \$26\,900$

(c) Taxes to pay $= \$1200 + \frac{30}{100} \times \$6900$

$= \$(1200 + 2070)$

$= \$3270$

Worked Example 3

The exchange rates for the Jamaican dollar are shown in the table below.

Currency	**Exchange Rate**
Pound Sterling £	J$130
US $	J$ 90

Using the exchange rate table, calculate how much a person would get for exchanging

(a) £15 sterling into Jamaican dollars,

(b) 3000 Jamaican dollars into pounds sterling,

(c) 300.00 US dollars into Jamaican dollars.

Solution

(a) $£15 \equiv J\$15 \times 130 = J\$1950$

(b) $J\$3000 \equiv £\frac{3000}{130} \approx £23.08$

(c) $\$300 \equiv J\$\,300 \times 90 = J\$27000$

Worked Example 4

An investor bought US \$6650 using EC dollars when the exchange rate was

EC \$1.00 = US \$0.35

For this service, he paid the bank 1% of the amount of EC dollars he spent.

(a) How much EC dollars did the investor spend to obtain US \$6650 ?

A month later he converted the US \$6650 back to EC dollars when the exchange rate was

EC \$1.00 = US \$0.38

For this he paid the bank a fixed service charge of EC \$200.

(b) What profit or loss did the investor make in EC dollars?

Solution

(a) At the exchange rate of EC \$1.00 = US \$0.35, the investor spent EC \$$x$, where

$$x \times 0.35 = 6650$$

$$\text{i.e.} \quad x = \frac{6650}{0.35} = 19\,000$$

This is the amount received, but he also had to pay 1% of this total to the bank (this is often referred to as the *commission* charge).

So he paid

$$\text{EC\$}\left(19000 \times \frac{1}{100}\right) = \text{EC \$190}$$

Hence he spent $\text{EC\$}(19000 + 190) =$ EC \$19 190

(b) Converting back, he received, in EC \$,

$$\frac{6650}{0.38} = 17\,500$$

He also had to pay the service charge of EC \$200, so he finally had

$$\text{EC\$}(17500 - 200) = \text{EC \$17 300}$$

Hence his LOSS was $\text{EC\$}(19190 - 17300) =$ EC \$1890.

Exercises

1. Anna earns J$21 000 per week. She is given a 3% pay increase. How much does she now earn per week?

2. Mrs Ray has a job for which the basic pay is $5.60 per hour, and the overtime rate of pay is $8.40 per hour.

   During a certain week she earned $165.20. She worked 3 hours overtime.

   Calculate

   (a) the amount she earned at the basic rate,

   (b) the number of hours she worked at the basic rate.

3. Mr Henry works a basic week of 40 hours at a rate of J$1600 an hour. His overtime rate is J$400 more than his basic rate.

   Calculate

   (a) his total wage for a basic week,

   (b) his wage for a week in which he worked 47 hours,

   (c) the number of hours he worked during one week if he was paid a wage of J$70 000.

4. Kathy earned $30 000 one year. Her tax allowance was $3295. She did not pay tax on this amount of her income.

   On a further $2570 of her income she did not pay tax, because she paid this amount into a pension scheme.

   She paid tax on the rest of her income.

   (a) How much of her income was taxable?

   She paid tax at 25% on the first $23 700 of her taxable income.

   She paid tax at 40% on the rest of her taxable income.

   (b) Calculate the total amount of tax that she paid in the year.

5. The exchange rate between J$ and UK£ is

   $$\text{J\$120} \equiv \text{UK£1}$$

   (a) How many J$ would you get if you exchanged £27 ?

   (b) How much did you exchange in UK£ if you received J$9120 ?

   (c) How much would J$6900 be exchanged for in UK£ ?

6. Brent exchanged BD \$200.00 for EC currency, using the exchange rate

BD \$1.00 = EC \$1.35.

(a) Calculate the amount he received in EC dollars.

Brent shared the amount of money he received among Pat, Calvin and Lyn.

Pat received $\frac{1}{3}$ of the amount.

Calvin received EC \$108.00.

Lyn received the remainder.

(b) Calculate

(i) Calvin's share as a percentage of the total amount shared,

(ii) Lyn's share as a fraction of the total amount shared.

9.3 Saving

We finish this unit with the important topics of saving and investing money. A key factor here is the interest rate and whether it is *simple interest*, that is, interest paid out each year, or *compound interest*, when the interest is added to the account each year. Compound interest has been dealt with in Unit 3. Here we will concentrate on simple interest, unless otherwise stated.

Worked Example 1

In how many years would \$100, invested at 5% per annum simple interest, amount to \$160 ?

Solution

The interest in one year on the account is

$$\$100 \times \frac{5}{100} = \$5$$

So the balance of the account increases by \$5 per year. To gain $\$(160 - 100) = \$60$ would take $\frac{60}{5} = 12$ years.

Worked Example 2

An antique vase is valued at J\$4000. Its value increases by 5% each year for 3 years.

(a) Find the value after two years.

(b) Show that the value after three years is J\$4630.50.

Solution

(a) After one year, the value of the vase is

$$\text{J\$}\left(4000 + \frac{5}{100} \times 4000\right) = \text{J\$}(4000 + 200)$$
$$= \text{J\$4200}$$

After two years, its value is

$$\text{J\$}\left(4200 + \frac{5}{100} \times 4200\right) = \text{J\$}(4200 + 210)$$
$$= \text{J\$4410}$$

(b) Its value after 3 years is

$$\text{J\$}\left(4410 + \frac{5}{100} \times 4410\right) = \text{J\$}(4410 + 220.50)$$
$$= \text{J\$4630.50}$$

Notes

1. This is, in effect, compound interest as the extra value is added to the original value each year.

2. The calculation can be simplified by taking, for the first calculation,

$$\text{J\$4000} \times \frac{105}{100} = \text{J\$4200}, \text{ etc.}$$

as the new value is $1 + 5\% = 1 + \frac{5}{100} = \frac{105}{100}$.

In the same way, the value at the end of year 2 is

$$\text{J\$}\left(4000 \times \frac{105}{100}\right) \times \frac{105}{100} = \text{J\$4410}$$

and at the end of year 3,

$$\text{J\$}\left(4000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100}\right) = \text{J\$4000} \times \left(\frac{105}{100}\right)^3$$
$$= \text{J\$4630.50}$$

3. In this way, you can generalise to n years, when the value would be

$$\text{J\$4000} \times \left(\frac{105}{100}\right)^n$$

Worked Example 3

Safe Loans Ltd offers loans of \$6000, with repayments of \$350 each month for 18 months.

Calculate:

(a) the interest, in dollars, paid on the loan,

(b) the interest as a percentage of the loan.

Solution

(a) Total repayments $= 18 \times \$350$

$= \$6300$

so interest paid $= \$6300 - \$6000$

$= \$300$

(b) As a percentage of the loan, interest paid $= \dfrac{300}{6000} \times 100\%$

$= 5\%$

Exercises

1. Find the simple interest on J\$4000 invested in a savings account

   (a) paying interest at 6% per annum and invested for 1 year,

   (b) paying interest at 5% per annum and invested for two years,

   (c) paying interest at 8% per annum and invested for 6 months.

2. The interest rate on investments in a bank decreased from $8\frac{1}{2}$ per cent per annum to 6 per cent per annum. Find the difference in annual interest on a deposit of \$2000.

3. How much simple interest is due on a loan of \$1200 for two years if the annual rate of interest is $5\frac{1}{2}$ per cent?

4.

Rate on Fixed Deposits	
2008	**7.8%**
2009	**7.5%**

How much more interest would a fixed deposit of J\$100 000 have earned in 2008 than in 2009?

5. Ben puts \$200 in a savings account. Each year 6% interest is added to the money in his account. How much does he have after

   (a) 1 year, (b) 2 years?

6. A new network of computers costs a firm \$15 000. The value of this computer network depreciates at a rate of 20% per annum.

   What is the value of the network after

   (a) 1 year, (b) 2 years?

7. A car costs \$12 000 when new. Its value depreciates by 10% in the first year and at a constant rate of 5% for each subsequent year. What is its value after

   (a) 1 year, (b) 2 years, (c) 3 years?

8. Selena has \$50 to invest and wants to invest this money for as long as it takes to reach a value of \$100. If the account she chooses pays simple interest at 10% per annum, how long will it take for Selena to reach her target?

9. Secure Loans Ltd offers loans of J\$100 000 with two repayment plans:

   Plan A*:* 12 monthly payments of J\$10 000

   Plan B: 24 monthly payments of J\$5200

   For each of the plans,

   (a) how much interest is paid,

   (b) what is the interest paid as a percentage of the loan?