MATHEMATICS LITERACY

BOOK 3

MATHEMATICS IN MATHEMATICAL

GRADE 12

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Read to Lead
A Reading Nation is a Leading Nation

2030 NDP

Foreword

In order to improve learning outcomes the Department of Basic Education conducted research to determine the specific areas that learners struggle with in Grade 12 examinations. The research included a trend analysis by subject experts of learner performance over a period of five years as well as learner examination scripts in order to diagnose deficiencies or misconceptions in particular content areas. In addition, expert teachers were interviewed to determine the best practicesto ensure mastery of thetopic by learners and improve outcomes in terms of quality and quantity.

The results of the research formed the foundation and guiding principles for the development of the booklets. In each identified subject, key content areas were identified for the development of material that will significantly improve learner's conceptual understanding whilst leading to improved performance in the subject.
The booklets are developed as part of a series of booklets, with each bookletfocussing onlyon one specific challenging topic. The selected content is explained in detail and include relevant concepts from Grades 10 - 12 to ensure conceptual understanding.

The main purpose of these booklets is to assist learners to master the content starting from a basic conceptual level of understanding to the more advanced level. The content in each booklets is presented in an easy to understand manner including the use of mind maps, summaries and exercises to support understanding and conceptual progression. These booklets should ideally be used as part of a focussed revision or enrichment program by learners after the topics have been taught in class. The booklets encourage learners to take ownership of their own learning and focus on developing and mastery critical content and skills such as reading and higher order thinking skills.

Teachers are also encouraged to infuse the content into existing lesson preparation to ensure in-depth curriculum coverage of a particular topic. Due to the nature of the booklets covering only one topic, teachers are encouraged to ensure learners access to the booklets in either print or digital form if a particular topic is taught.

TABLE OF CONTENTS PAGE

1.How to use this booklet

Purpose

To a large extent, the National Diagnostic Reports highlight the same problems that learners experience when answering National Examination question papers.

Among other things, these reports highlight the following problems:

“Candidates multiplied R16 by 0,070 instead of dividing R16 by 0,070.”
“…experienced problems with reverse VAT calculations.”
“…most learners subtracted instead of adding.”
“Candidates struggled to convert Botswana pula to South African rand.”

In answering Mathematical Literacy questions, you should always use mathematical calculations. After the 'knowns' and the 'unknowns' have been extracted, a mathematical calculation needs to be made. The purpose of this booklet is therefore to help you to do these mathematical calculations in the Mathematical Literacy examinations, as well as when doing the exercises found in textbooks.

We will be using a 'DUP-MUD' machine to do these mathematical calculations. Initially, you will use this machine to help you to do these calculations. Later, when you have practised with the machine, you will be doing these calculations without drawing the machine.

Please note that the solution is not the machine, but rather the calculation done after using the machine; therefore, **marks will only be awarded for the calculation and not for the machine.**

Each section starts with examples, followed by fully calculated answers.

The activities based on the examples will follow, to allow you to practise the skills you have acquired after reading the example.

The answers to all the activities are provided in Section 6: Check Your Answers

3. Examination tips for Mathematical Literacy

3.1 Paper 1 (set in a familiar context)

- **5 Questions**
    - Question 1
        - 30 marks (±5)
        - Level 1 type questions only
        - All 5 application topics
    - Question 2
        - Finance
        - Level 1 to 3 type questions
    - Question 3
        - Measurement
        - Level 1 to 3 type questions
    - Question 4
        - Maps, plans and other representations from the real world
        - Level 1 to 3 type questions
    - Question 5
        - Data handling
        - Level 1 to 3 type questions

- **Mark allocation per topic in Mathematical Literacy P1**
    - Finance (± 52 marks)
    - Measurement (± 30 marks)
    - Maps, plans and other… from the real world (± 23 marks)
    - Data handling (± 37 marks)
    - Probability (minimum 8 marks)

- **Cognitive levels for Mathematical Literacy P1**

  All levels have a range of ±5%

    - Level 1: 90 marks (60% of P1)
    - Level 2: 53 marks (35% of P1)
    - Level 3: 7 marks (5% of P1)
    - Level 4: 0 marks (0% of P1)

3.2 Paper 2 (set in both a familiar and an unfamiliar context)

- **4 OR 5 Questions**
  - Question 1
    - Integrated application topics
    - Level 2 to 4 type questions
  - Question 2
    - Integrated application topics
    - Level 2 to 4 type questions
  - Question 3
    - Integrated application topics
    - Level 2 to 4 type questions
  - Question 4
    - Integrated application topics
    - Level 2 to 4 type questions

    AND / OR
  - Question 5
    - Integrated application topics
    - Level 2 to 4 type questions

- **Mark allocation per topic in Mathematical Literacy P2**
  - Finance (± 52 marks)
  - Measurement (± 30 marks)
  - Maps, plans and other… from the real world (± 23 marks)
  - Data handling (± 37 marks)
  - Probability (minimum 8 marks)

- **Cognitive levels for Mathematical Literacy P2**

  All levels have a range of ±5%

  - Level 1: 0 marks (0% of P2)
  - Level 2: 37 marks (25% of P2)
  - Level 3: 53 marks (35% of P2)
  - Level 4: 60 marks (40% of P2)

3.3 Allocation of examination marks (i.e. Paper 1 and Paper 2 combined)

Cognitive levels:

Level 1: 90 marks or 30% for P1 and P2 combined

Level 2: 90 marks or 30% for P1 and P2 combined

Level 3: 60 marks or 20% for P1 and P2 combined

Level 4: 60 marks or 20% for P1 and P2 combined

3.4 Key features of a Mathematical Literacy Paper 1 examination.

Paper 1 is the easier question paper of the two, for the following reasons:

- **90** of the **150** marks are allocated to **Level 1** type questions
- It is set in a familiar context.
- Question 1(30 marks ±5) comprises Level1 type questions only, with a short description of the context

You will be able to score these marks if you **work through past examination papers**, **work** in the classroom **every day,** and **complete all tasks** given by the educator.

Examples of these Level 1 type questions are listed in the following past DBE examination papers:

2017 June examination P1

2017 November examination P1

2018 March examination P1

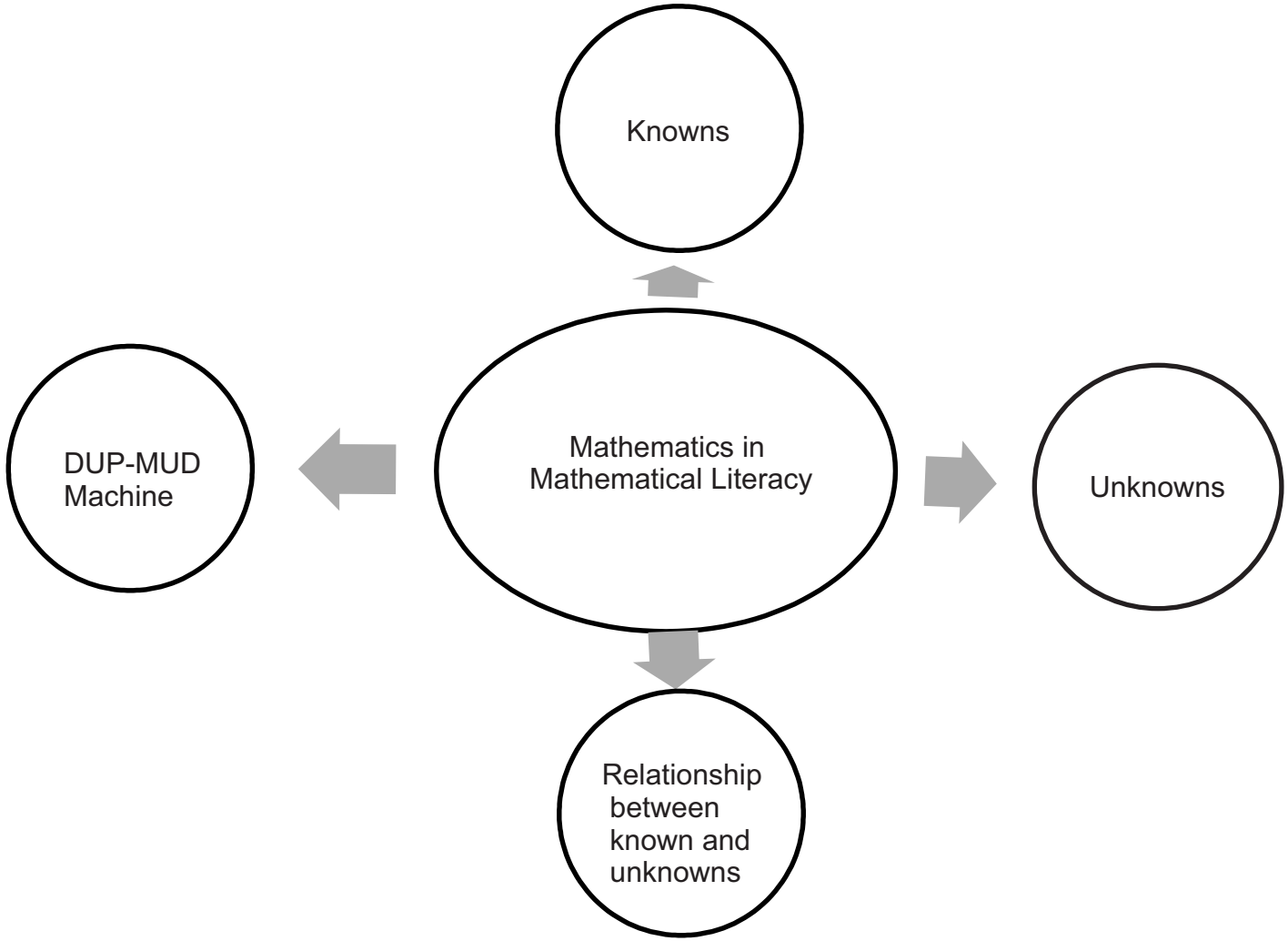
2018 June examination P1

3.5 Time management for examination preparation:

If you have 100 hours to prepare for the examination, the following can be used as a guide regarding how to use your hours:

Application topics	Number of hours
Finance	35
Measurement	20
Maps, plans and other	15
Data handling	25
Probability	5

1.Overview


Knowns
DUP-MUD Machine
Mathematics in Mathematical Literacy
Unknowns
Relationship between known and unknowns

5. Mathematics in Mathematical Literacy

In the following section a ratio method will be applied to calculate some items from past DBE question papers.

It is called a ratio method (**DUP-MUD method**) because it involves ratio. This method can be applied in a variety of calculations; for example, in the calculations for:

- VAT;
- Exchange rates;
- Rates of change;
- Ratios;
- Scales;
- Maps and plans;
- Metric and imperial conversions.

How does it work?

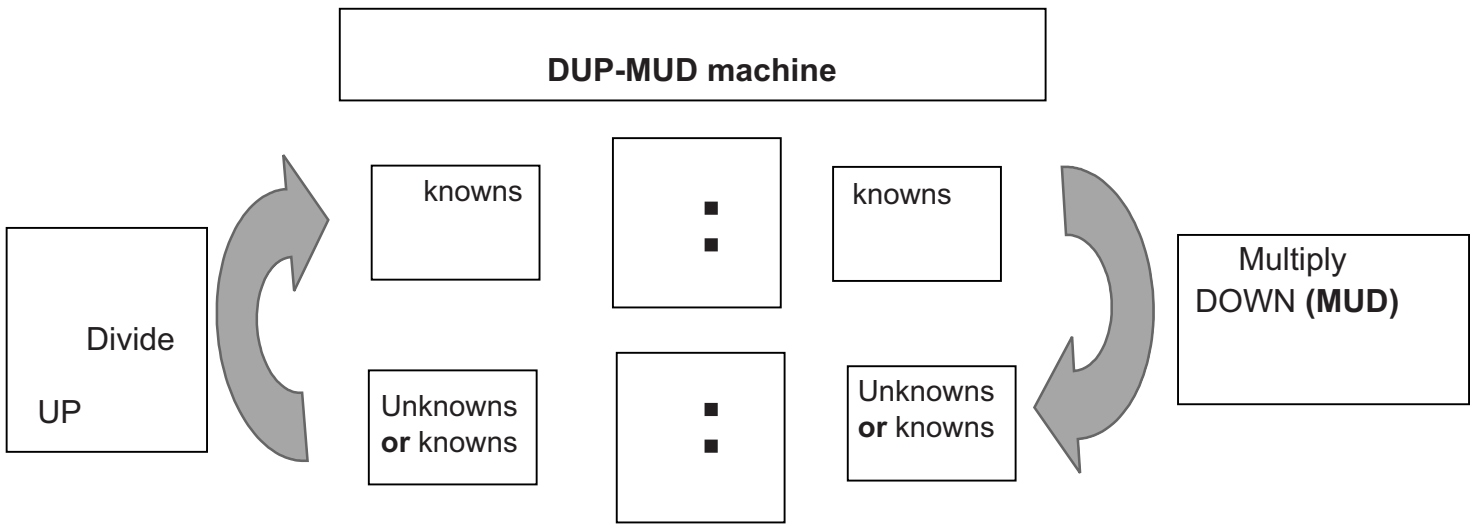
- Identify the Knowns in the context and question, and write this as a ratio, as follows:

  Knowns : Knowns

- Thereafter, identify the Unknowns in the context and question, and write this as a ratio, as follows:

  Unknowns : Unknowns

- Then take the two ratios and put the second below the first, as shown in the diagram below:



- Then **Divide UP** (DUP) and **Multiply DOWN** (MUD). If you like, 'DUP – MUD'.

This ratio method can from now on just be referred to as a DUP–MUD method. It is like a machine in which the process is to 'DUP – MUD'.

(# DUP – MUD Machine or # DUP – MUD Method!)

Example 1 (Calculating VAT)

DBE JUNE 2018 P1 Q2

2.2

John is interested in running a small internet station in a coffee shop. He searches the internet and finds the advertisement below on a website www.wish.com.

ALL prices include 14% VAT.

Portable Pocket Hotspot (PPH)
Was: R988,00
Now: R210,00

Identification of different names of items

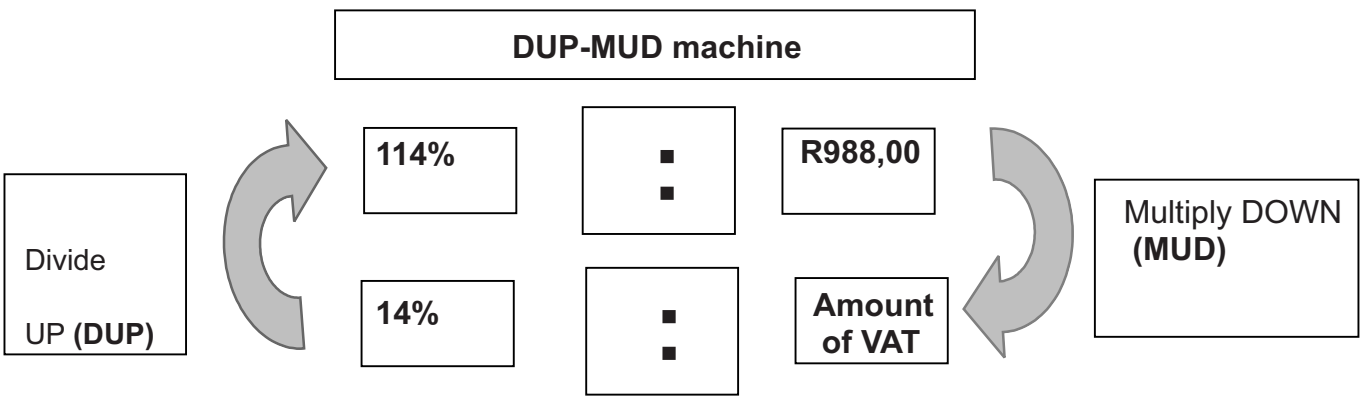
New Ultra-thin mouse (UTM)
Was: R223,00
Now: R13,00

[Source: www.wish.com]

Study the advertisement above and answer the questions that follow:

2.2.2Calculate the amount of VAT payable on the old price for the PHH (3)

Solution



Amount of VAT = 14% ÷ 114% × R988, 00 = R121,33

Example 2 (Calculating exchange rate)

DBE NOV 2017 P1 Q2

2.1 Rajesh changed a gift of £360,00 into South African rand at a bank.

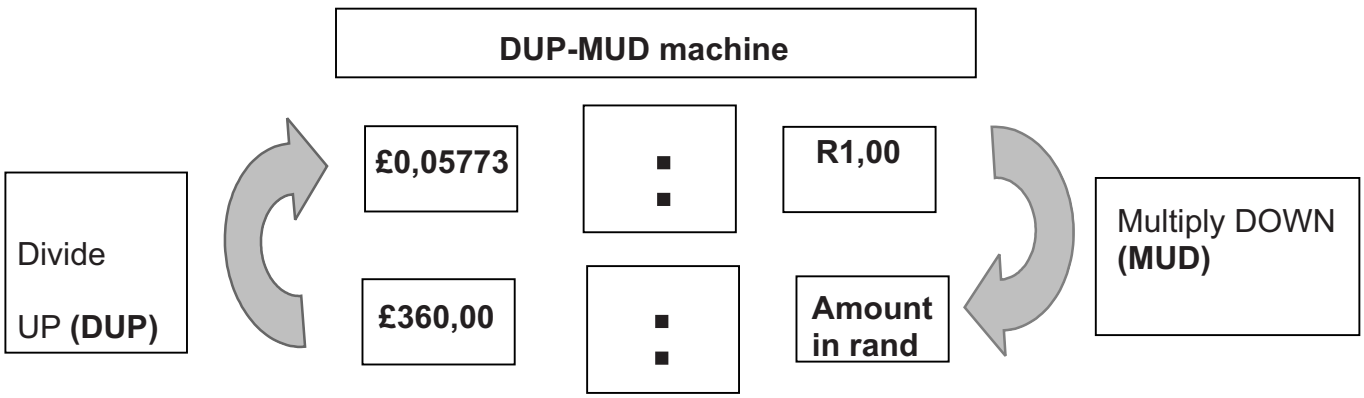
The exchange rate was **R1,00 = £0,05773**.

The bank charges 1,95% commission on the amount exchanged.

Rajesh then invested R5 000 of his gift in a fixed deposit account for $1\frac{1}{2}$ years at a compound interest rate of 6,3% per annum.

2.1.1Convert £360,00 to rand.

Solution



Amount of VAT = ÷ £360,00 × £0,5773 = R6 235,93

Example 3 (Calculating rate of change)

Use the DUP – MUD machine to solve the following problems.

1.1 Tyrone buys chocolates in bulk to make gift baskets containing different chocolate bars, which he will sell. He buys boxes that contain bars of Peppermint Crisp, Bar One, Kit Kat, and Cadbury 80 g chocolate slabs.

Picture of a gift basket with chocolate bars.

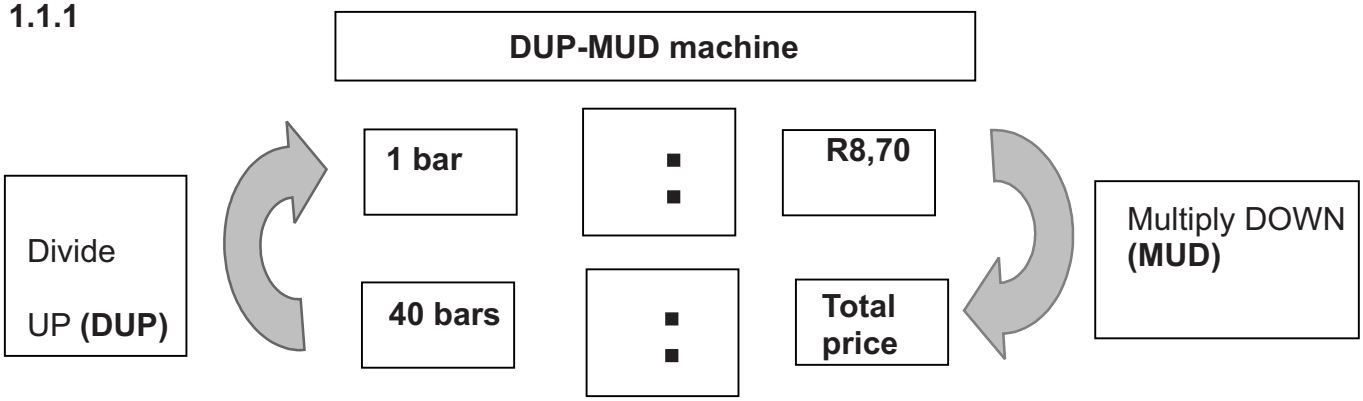
DBE JUNE 2017 P1 Q1

1.1.1 Determine the total price of a box of Peppermint Crisp bars if there are 40 bars in a box and the unit price of a bar is R8, 70.

1.1.2 A box of 40 Kit Kat bars costs R435, 04. To determine the selling price, Tyrone increases the cost price by 40%. Determine the amount that he adds to the cost price.

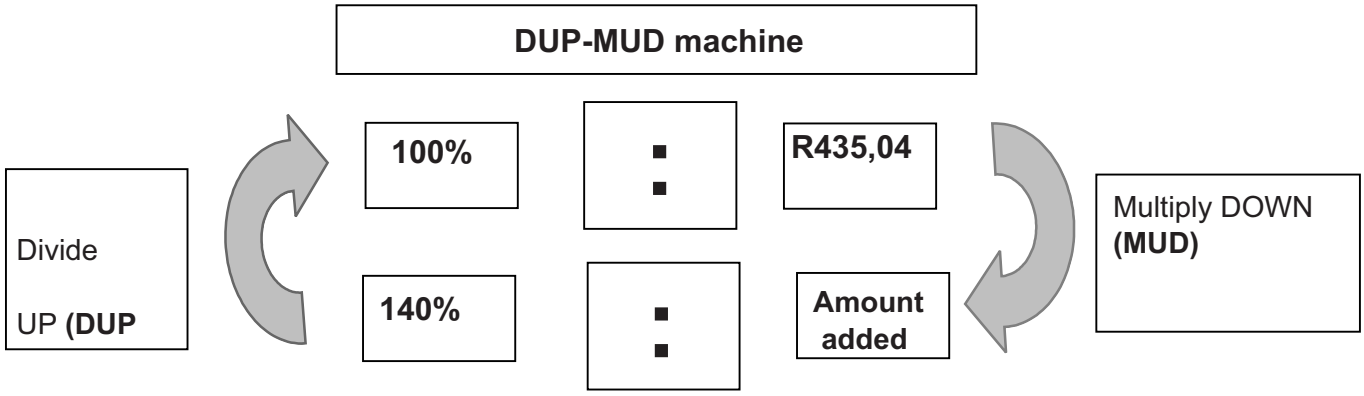
Solution

1.1.1



Total bars = 40 ÷ 1 × R8, 70 = R348

1.1.2



Amount added = 100% ÷ 140% × R435,04 = R609,06

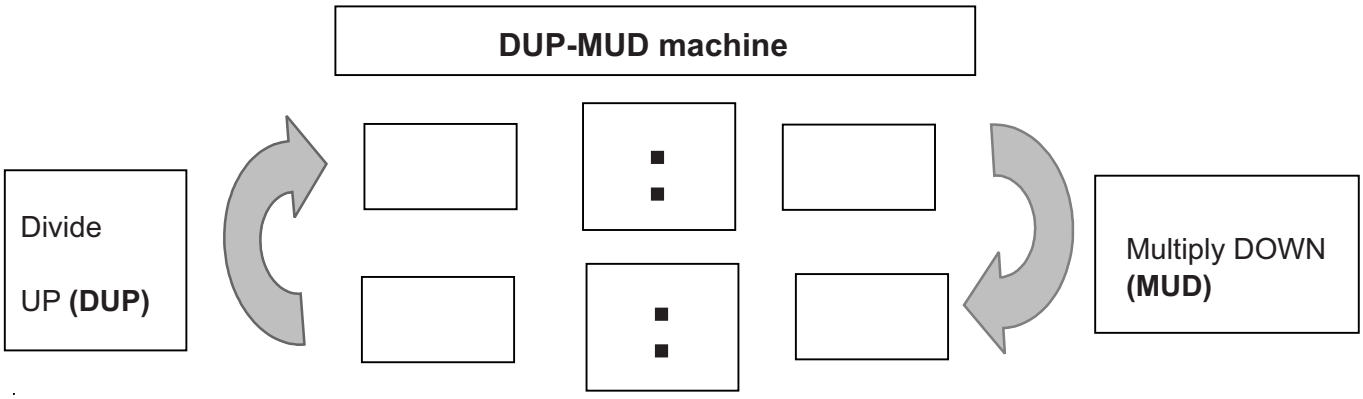
Activity 1

Use the DUP – MUD machine to solve the following problems:

A

2.1.4 Calculate the new price of the acute medication (R736,90) if the price increased by 6,3%.

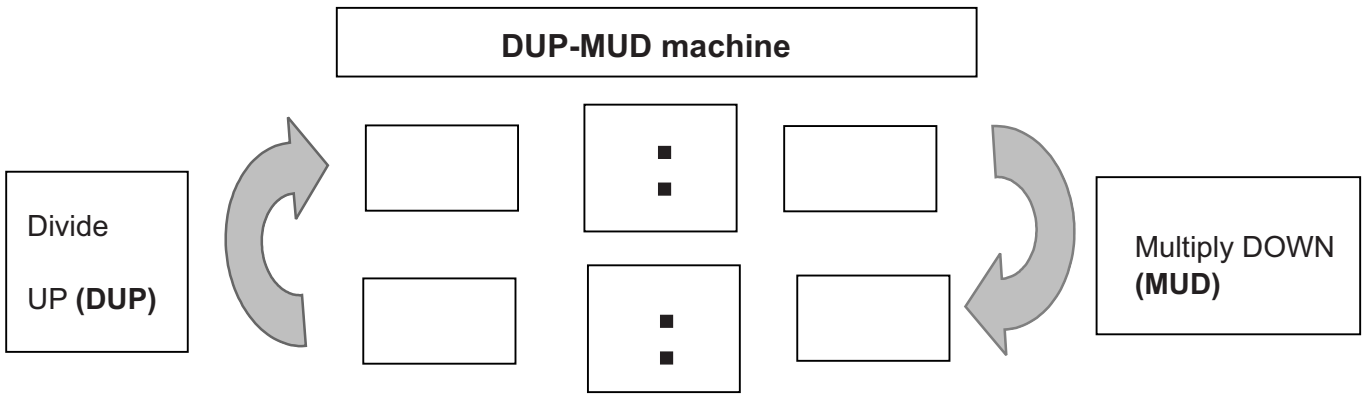
(3)



B

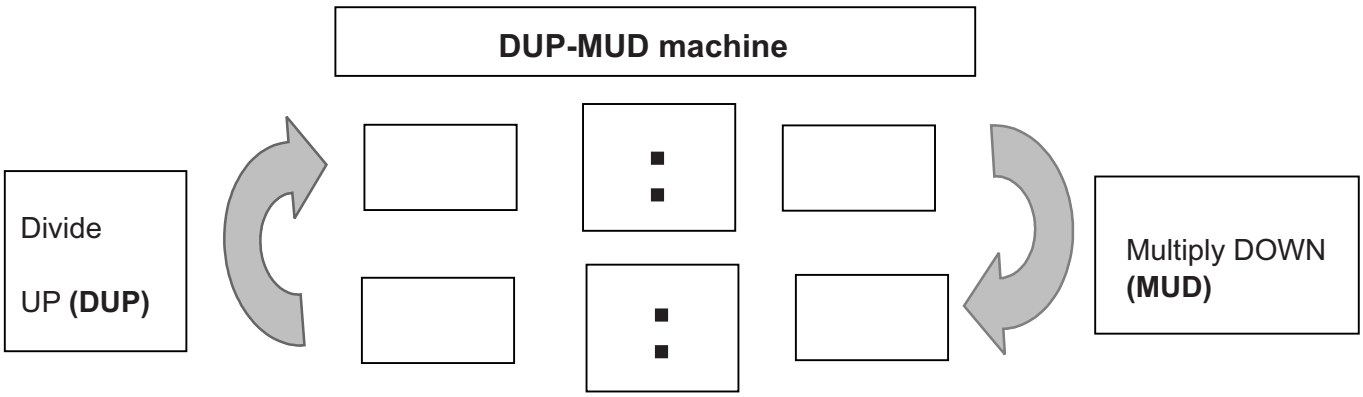
Currency	Units per ZAR	ZAR per unit
Botswana pula (BWP)	0,797782	1,253475

2.3.3 Convert R1 500 to BWP. (2)



C

4.2.4 The measured width of the coffee shop is 70 mm.
The scale is 1:200.
Calculate the actual width of the coffee shop. (3)



D

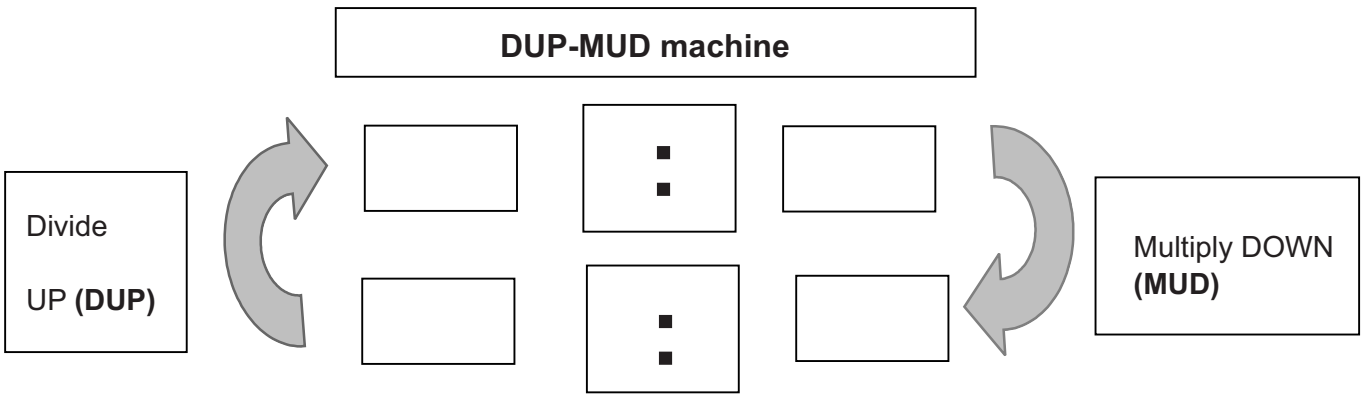
Naomi buys a 2 ℓ bottle of concentrated juice.

She adds water to make 14 ℓ of diluted juice at a total cost of R44,95.

She wants to serve the diluted juice in glasses. Each glass will contain 0,175 ℓ of diluted juice.

[Adapted from graphics24.co.za]

1.3.1 Calculate the cost per litre of the diluted juice. (2)



Example 4

4. Study the till slips below and answer the questions that follow.

LAST DAY FOR A FULL REFUND IS 12/07/2018
except for SALE items purchased
See reverse for refund policy

	Medium Rotisserie ChA		73.99
	24 LITRE RECYCLABLE A		0.62
	6009211140844		
	24 LITRE RECYCLABLE A		0.62
	6009211140844		
	750MLSTILL PUSH PULLA		10.99
	2L SPRITE	A	16.99
	PC Lentil BBQ 20 g	A	7.99
VIT	AVO SINGLE PUNNET	C	14.99
VIT	190G CRISP SALAD	C	25.99
****	TOTAL		152.18
VF	FNB		152.18

ACCOUNT NUMBER **********7016
AUTH: 344729 REF:

	CHANGE	0.00

WRewards:**********3956
---------- TAX INVOICE ----------

	TOTAL EXCL VAT	137.68
	A - 15% VAT	14.50
	VAT TOTAL	14.50

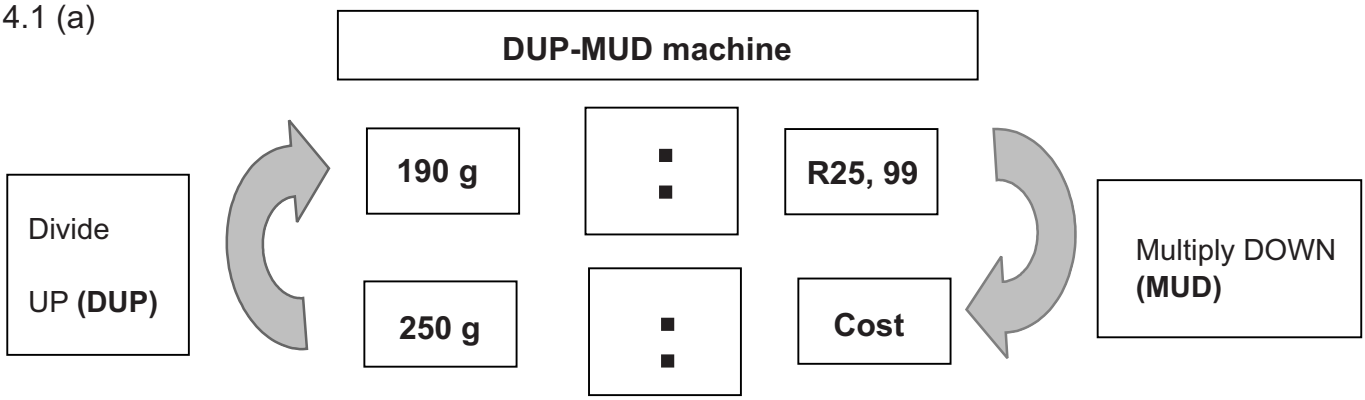
4.1 Calculate the cost of:

(a)250 g of crisp salad.
(b)1 000 ml of Push Pulla.

4.2 A 2-litre Sprite cost R16,99 (including 15% VAT). Calculate the cost of a 1-litre Sprite excluding VAT

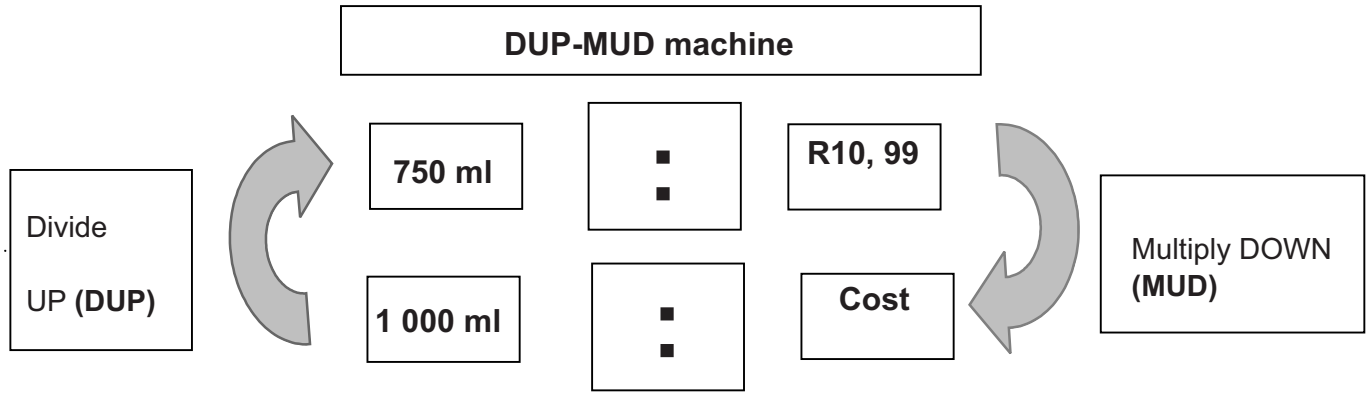
Solution

4.1 (a)



Cost 250 g of crisp salad = 250 g ÷ 190 g × R25,99 = R34,20.

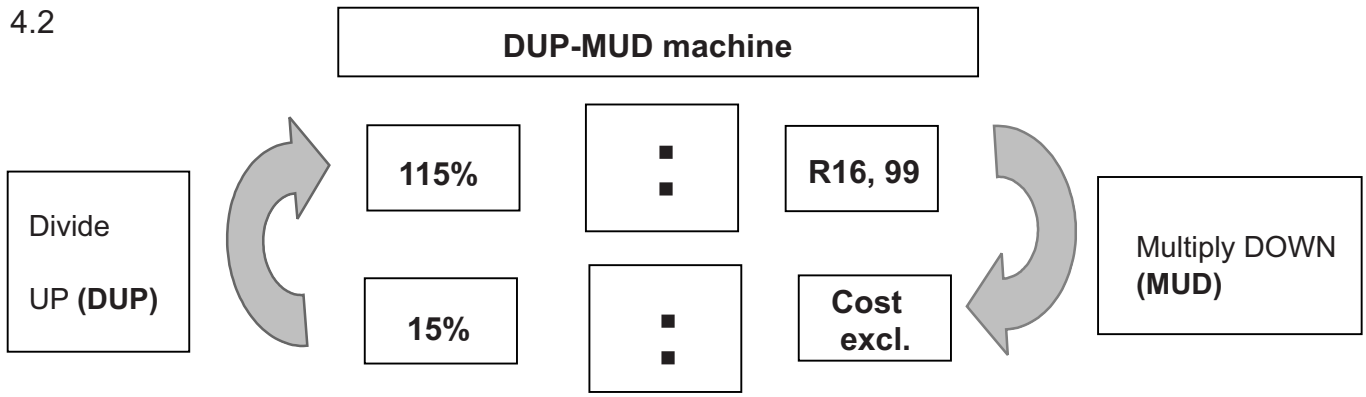
4.1 (b)



Cost of 1 000 ml of Push Pulla = 1 000 ml ÷ 750 ml × R10,99 = R14, 65.

A 2-litre bottle of Sprite cost R16,99 (including 15% VAT). Calculate the cost of the 2-litre bottle of Sprite excluding VAT.

4.2



Cost excluding VAT = 15% ÷ 115% × R16,99 = R2,22.

Activity 2

A

Show how the VAT of R23,21 was calculated.

TILL NO: 0008

LEVY RX.NO: 00573309/0 0518N

1000000000009 1 x 7.60 7.60 T1

PLASTIC BAG HANDY

6009654458223 1 x 0.42 0.42 T2

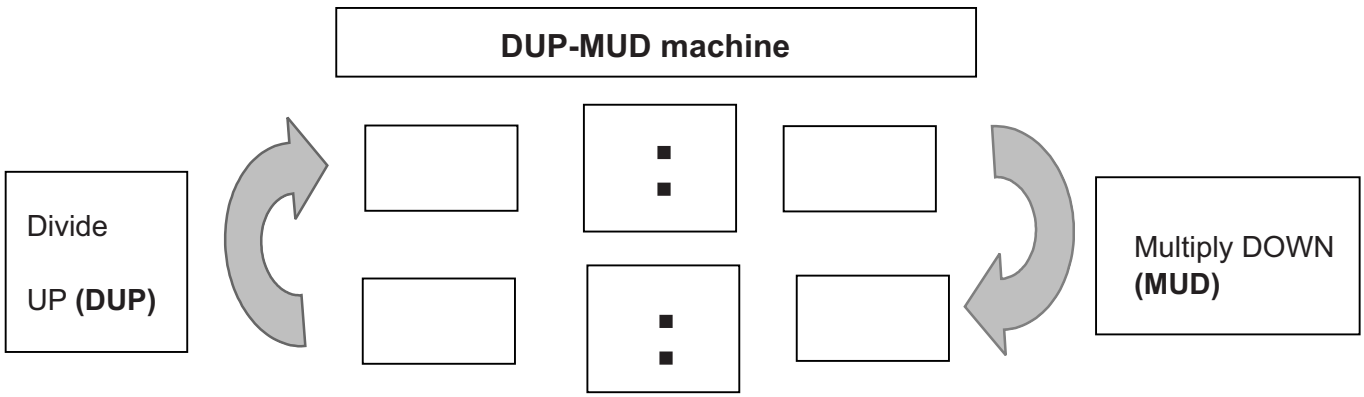
NUTRINUTS CASHEWS 750G ROASTED&SAL

6009534907247 1 x 169.95 169.95 T2

Total>>>: 177.97

(Rounding) 0.00

(Incl.VAT @15%): 23.21



B

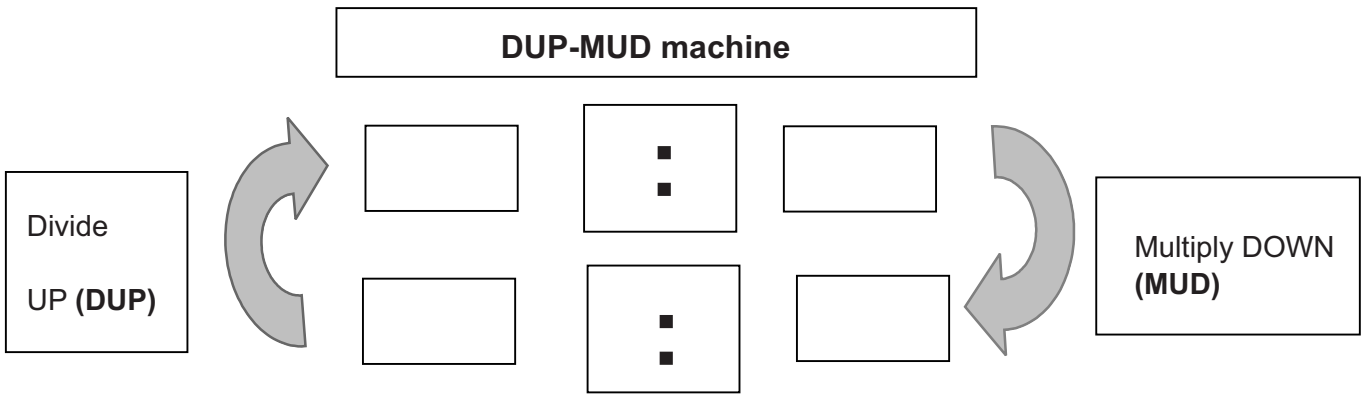
TABLE 3 below shows the bus fare (in rand), including 14% VAT, for a single trip.

TABLE 3: BUS FARE IN RAND FOR A SINGLE TRIP

	Port Elizabeth	Grahamstown	King William's Town	Queenstown	Aliwal North	Bloemfontein	Welkom
Port Elizabeth		305	320	395	410	435	515
Grahamstown	305		305	385	410	435	515
King William's Town	320	305		350	410	435	465
Queenstown	395	385	350		365	410	455
Aliwal North	410	410	410	365		410	435
Bloemfontein	435	435	435	410	410		335
Welkom	515	515	465	455	435	335	

[Source: www.greyhound.co.za]

2.1.4 Determine the cost, excluding 14% VAT, of a single bus fare of R365,00. (3)



C

The pictures below shows SMS messages sent to a cell phone after electricity was purchased on different days. Study the pictures and answer the questions that follow.

ABC Bank

Ref: V124354869

Amt: R49, 35

U: 32, 50 Kwh

Debt: R0,00

Charges: R0,65

Query? 0860 007 187

7July 2018

ABC Bank

Ref: V124352459

Amt: R400,00

U: 279,40 Kwh

Debt: R0,00

Charges: R0,00

Query? 0860 007 187

27July 2018

ABC Bank

Ref: V12274859

Amt: R200

U: 149,70 Kwh

Debt: R0,00

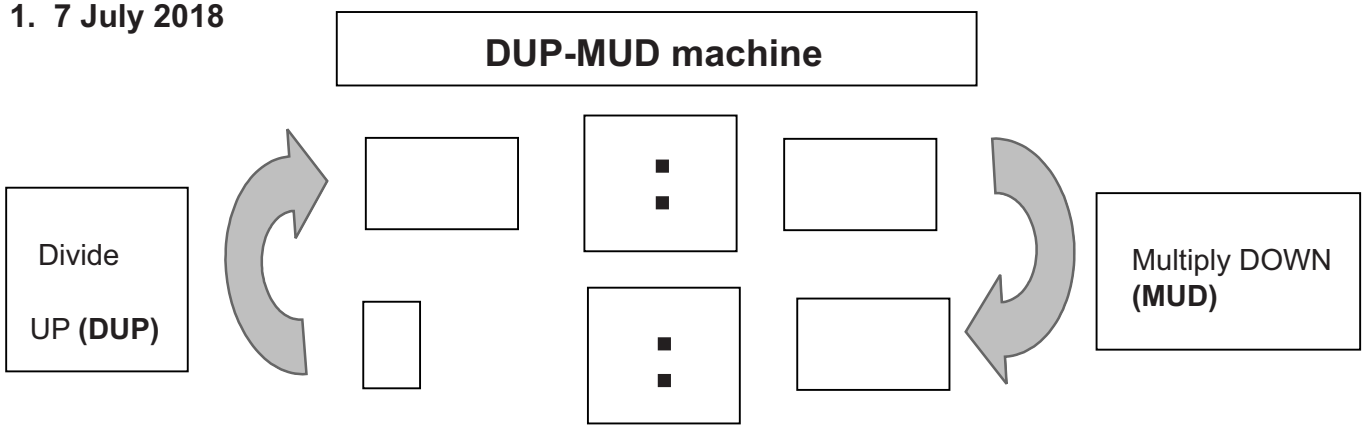
Charges: R0,00

Query? 0860 007 187

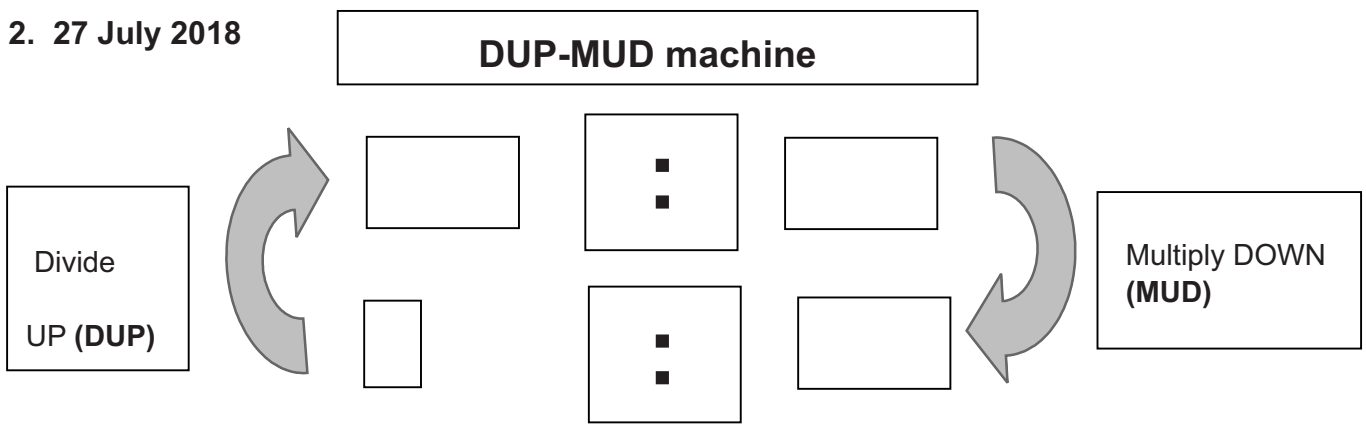
4 August 2018

Calculate the cost of 75 Kwh on:

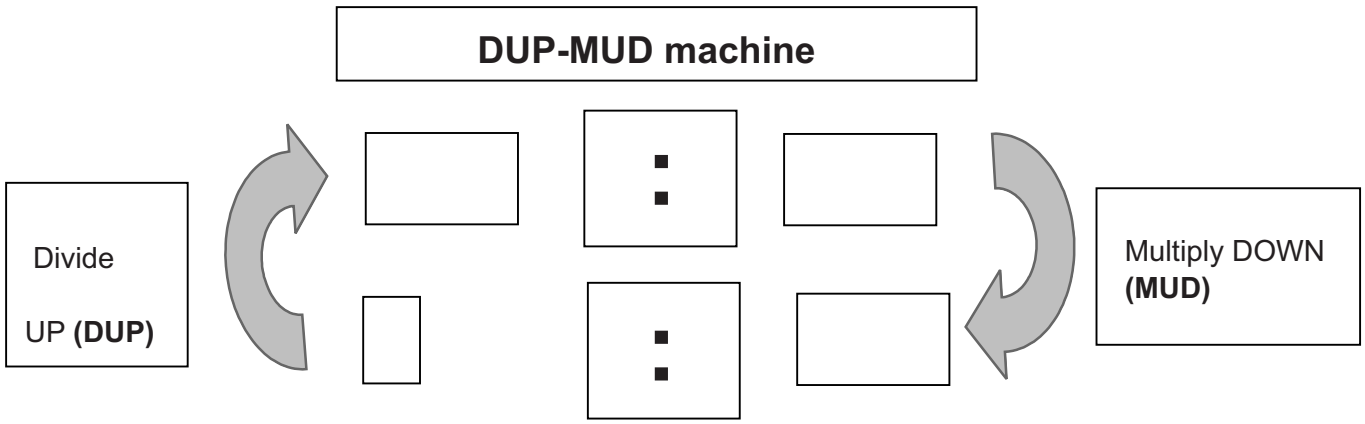
1. 7 July 2018



2. 27 July 2018



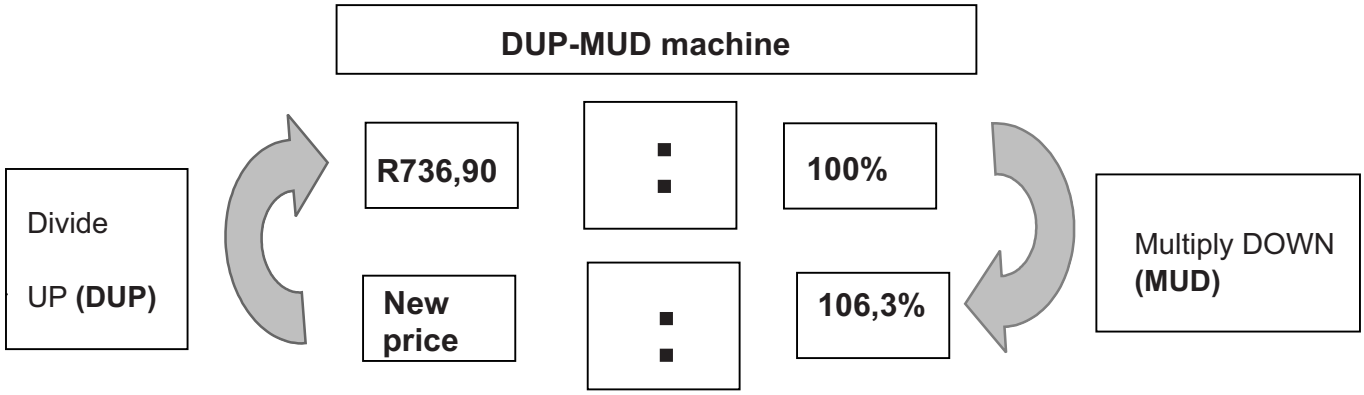
3. 4 August 2018



6. Check your answers

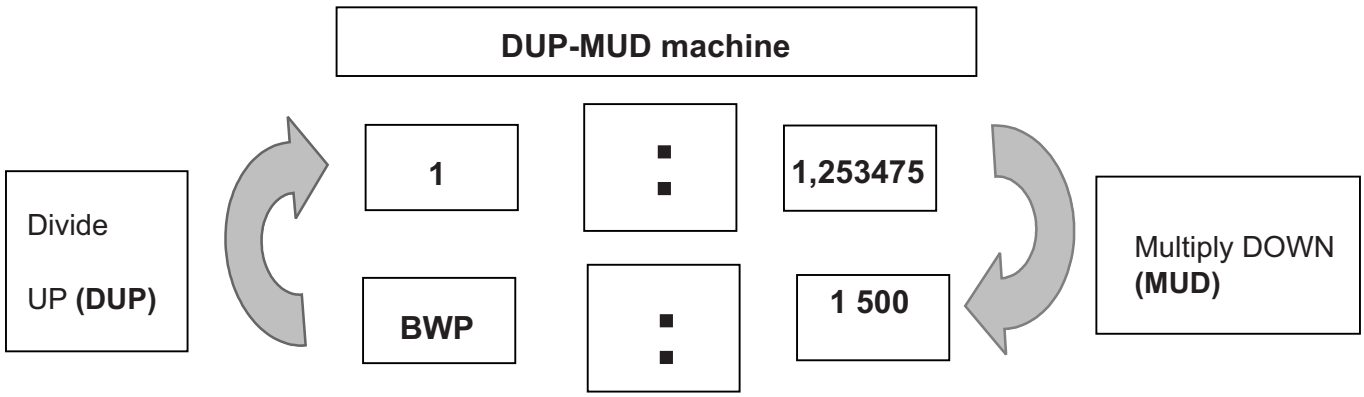
ACTIVITY 1

A



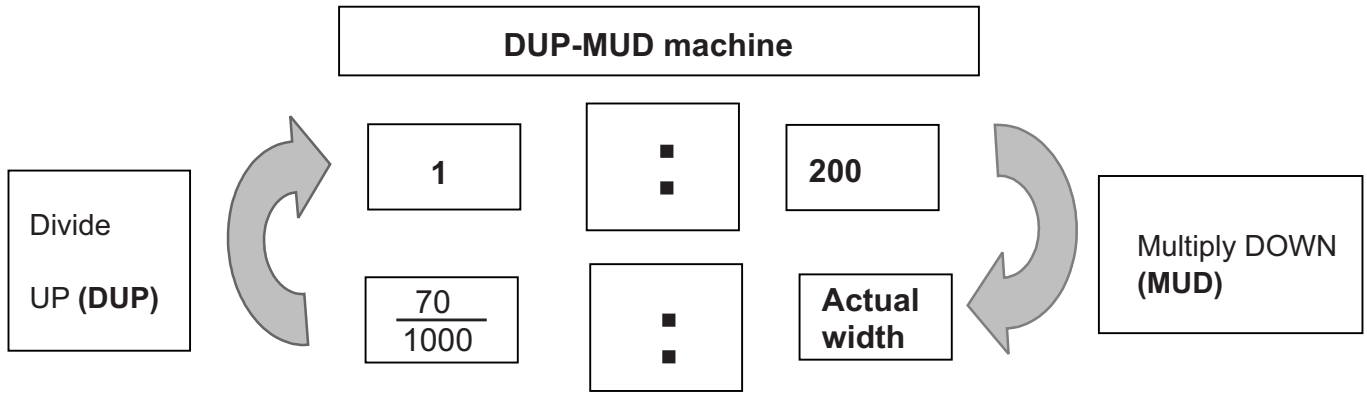
New price = 106,3% ÷ 100% × R736,90 = R783, 32.

B



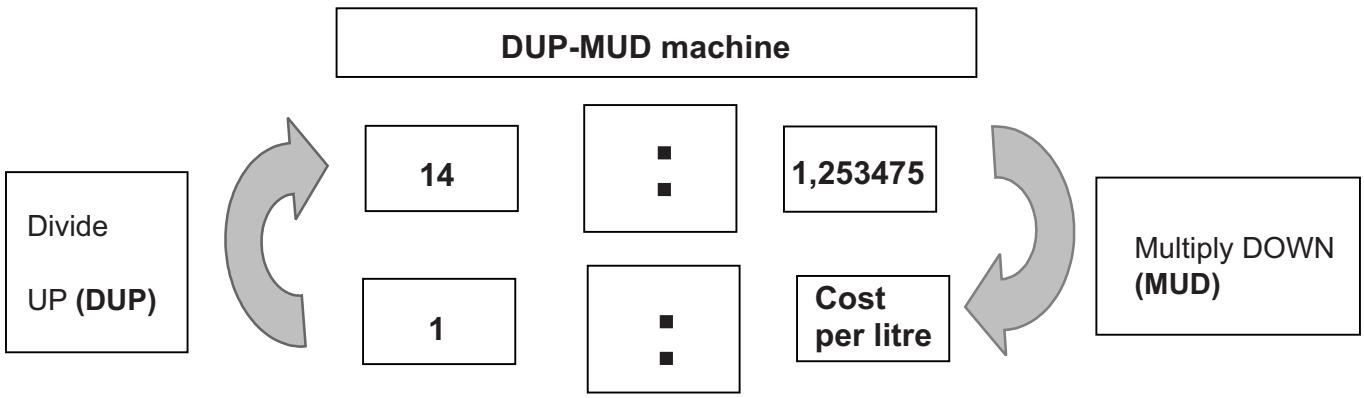
BWP = 1 500 ÷ 1,253475 × 1 = R1 196.

C



Actual width = $\frac{70}{1000}$ ÷ 1 × 200 = 14 m.

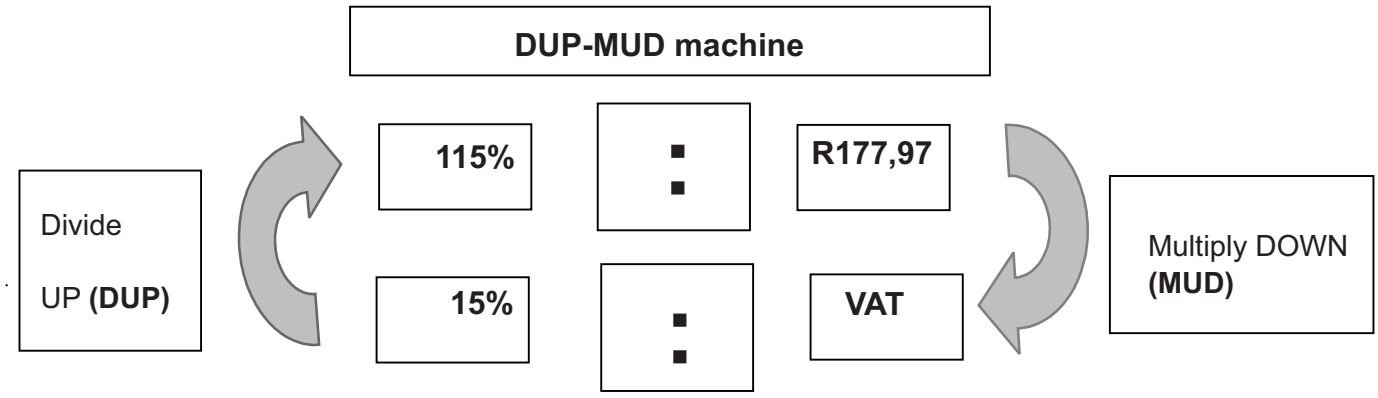
D



Cost per litre = 1 ÷ 14 × R44,95 = R3,21.

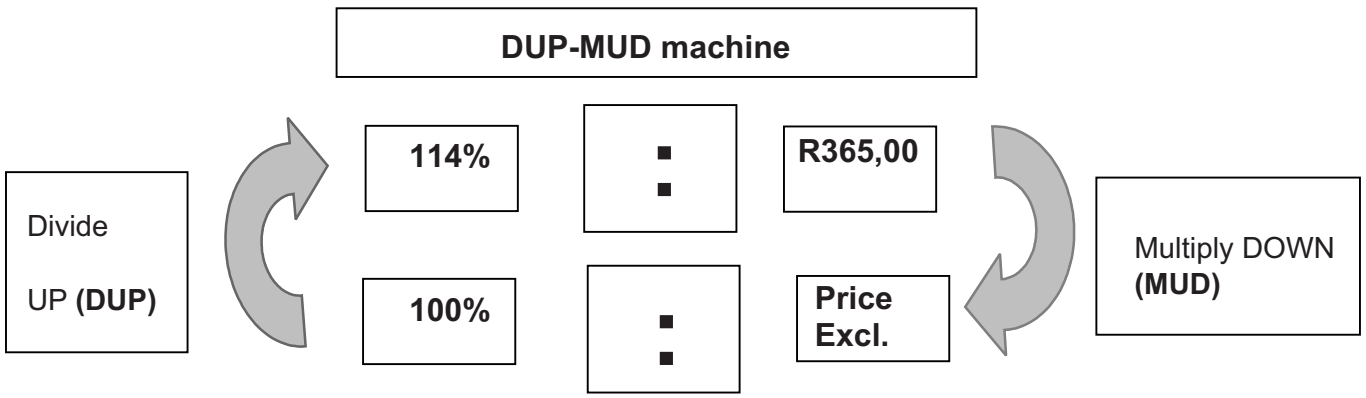
Activity 2

A



VAT = 15% ÷ 115% × R177,97 = R23,21.

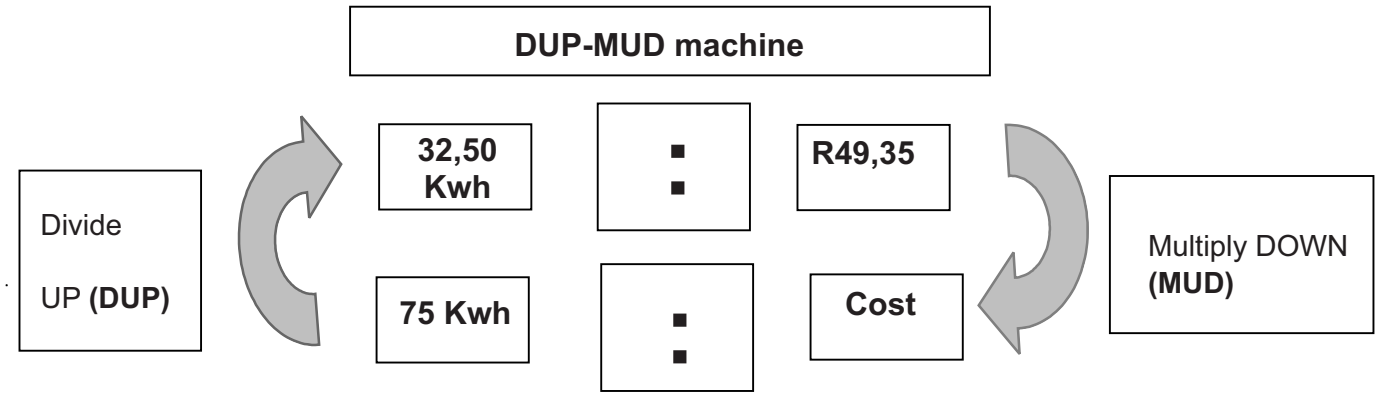
B



Price Excl. VAT = 100% ÷ 14% × R365,00 = R320,18.

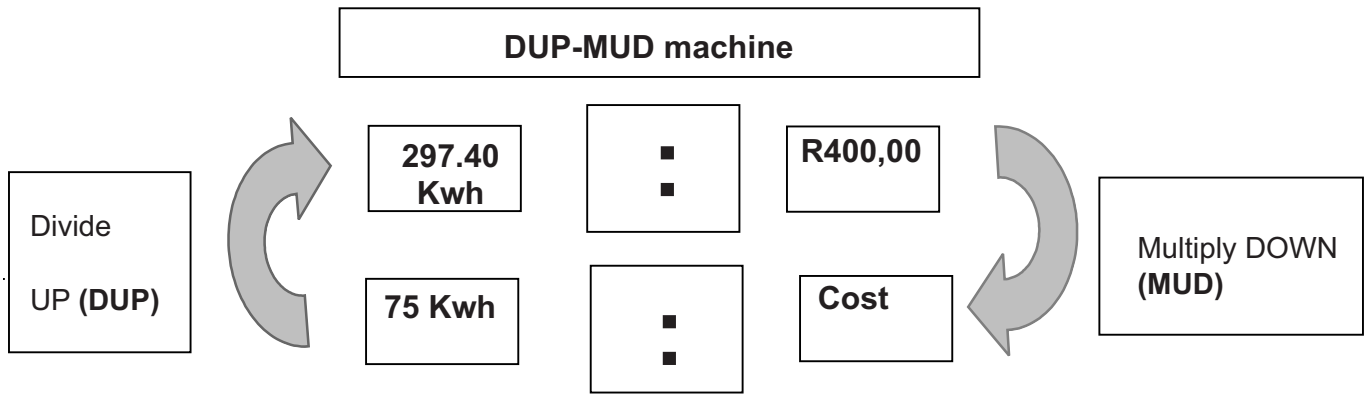
C

1. 7 July 2018



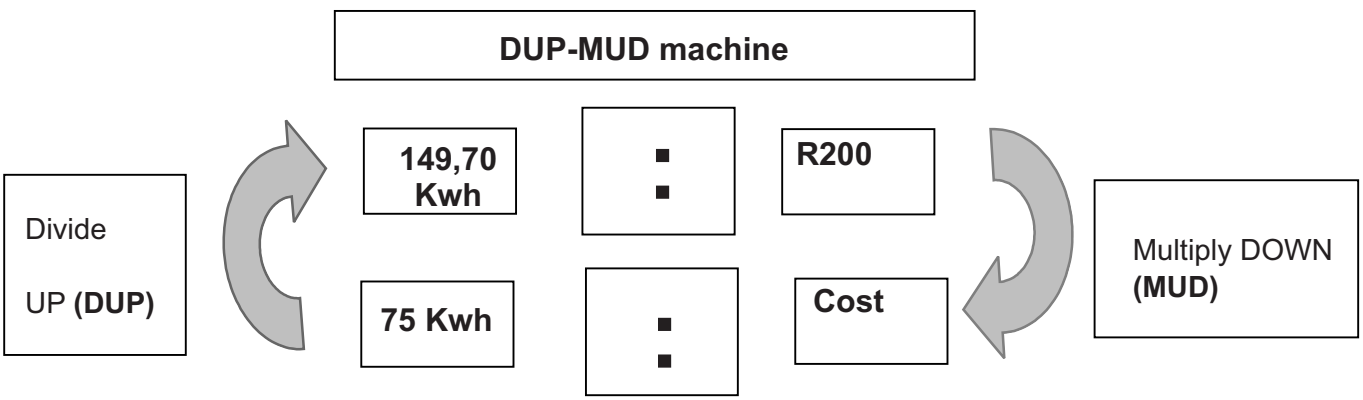
Cost = 75 Kwh ÷ 32,50 Kwh × R49,35 = R113,88.

2. 27 July 2018



Cost = 75 Kwh ÷ 279, 40 Kwh × R400,00 = R107,37.

3. 4 August 2018



Cost = 75 Kwh ÷ 149, 70 Kwh × R200 = R100,20.

7. Message to Grade 12 learners from the writers

"You have to do these problems and not watch how somebody else does them."

"Tune in to Mathematical Literacy to solve real-life problems."

"If anyone claims that Mathematical Literacy is easy maths, give them any question in Paper 2 to answer and watch them sweat."

"There is Mathematics in Mathematical Literacy."

"The key to solving Mathematical Literacy problems is to read and determine what you have and what you need to solve a contextual problem."

8. Thank you/ Acknowledgements

A candle does not lose any of its light by lighting another candle. It took a collective to put together this material. That is why two heads will always be better than one. A very big thank you to the provincial colleagues who made themselves available to develop this material. Their names are:

- Ms Thembeka Nethe (Free State Education Department)
- Mr Mandla Nkomo (Gauteng Education Department)
- Mr Sean Tune (Gauteng Education Department)
- Ms Zandile Mdiniso (KwaZulu-Natal Education Department)
- Mr Mbulelo Bali (Western Cape Education Department)

A very big thank you as well to their respective principals who allowed them to prepare material for the education sector even though they have their own duties have duties to perform in their provinces, as provincial officials.

Together we can!

MATHEMATICS LITERACY

BOOK 3 : MATHEMATICS IN MATHEMATICAL

GRADE 12

Department of Basic Education
222 Struben Street, Pretoria, 0001
Private Bag X895, Pretoria, 0001, South Africa
Tel: (012) 357 3000 Fax: (012) 323 0601

Hotline: 0800 202 933

website
www.education.gov.za

facebook
www.facebook.com/BasicEd

twitter
www.twitter.com/dbe_sa

ISBN NO. 978-1-4315-3297-1