Mathematical Literacy Grade 12

Teacher's Guide

This book was compiled and processed by E.J. Truter in 2013.

Publisher: ABC Mathematics

Contact number: 086 618 3709 (Fax!)

CONTENTS

Achievement Chart

Topic	Learner			Teacher		
	Date	√ or X	Comment	Date	√ or X	Comment
1	**BS: NUMBERS AND CALCULATION WITH NUMBERS**					
1.1	**Number Formats and Conventions**					
	Exercise 1: Large Numbers					
	Exercise 2: Fractions					
	Exercise 3: Positive and Negative Numbers					
	Exercise 4: Square numbers & roots					
	Exercise 5: Mathematical language and estimation					
1.2	**Operations Using Numbers and Calculator Skills**					
	Exercise 6: BODMAS					
1.3	**Rounding**					
	Exercise 7: Several Exercises on Rounding					
1.4	**Ratios**					
	Exercise 8: Ratios					
1.5	**Rate**					
	Exercise 9: Rate					
1.6	**Proportion**					
	Exercise 10: Proportion					
1.7	**Percentages**					
	Exercise 11: Percentage					
2	**PATTERNS, RELATIONSHIPS AND REPRESENTATIONS**					
2.1	**Patterns and Relationships**					
	Exercise 12: Patterns and Relationships					
2.2	**Representation of Direct Proportion**					
	Exercise 13: Direct Proportion (Graph)					
2.3	**Representation of indirect/ inverse proportions**					
	Exercise 14: Indirect/ Inverse Proportions (Graph)					
2.4	**Working with Two or More Relationships and/or Representation**					
	Exercise 15: Multiple Relationships					
3	**FINANCE**					
3.1	**Financial Documents**					
	Exercise 16: Balloon Payment					
3.2	**Tariff Systems**					
	Exercise 17: Gautrain Tariff System					

Achievement Chart

Topic		Learner			Teacher	
		Date	√ or X	Comment	Date	√ or X	Comment
3.3	**Income, Expenditure, Profit/Loss**					
	Exercise 18: Profit/Loss and Margin					
	Exercise 19: Income and Expenditure Statement					
	Exercise 20: Budget from a Horizontal Bar Graph					
3.4	**Cost Price and Selling Prices**					
	Exercise 21: Cost and Selling Prices					
3.5	**Break-even Analysis**					
	Exercise 22: Break even Analysis - Calculations and Graphs					
3.6	**Interest**					
	Exercise 23: Simple Interest (Graph)					
	Exercise 24: Compound Interest (Graph)					
3.7	**Banking, Loans and Investments**					
	Exercise 25: Loans: Vehicle Finance, Home Loans & Hire/Purchase					
	Exercise 26: Investment- Stokvel & Retirement Annuities					
3.8	**Inflation**					
	Exercise 27					
3.9	**Taxation**					
	Exercise 28 Tax					
3.10	**Exchange Rates**					
	Exercise 29 Exchange Rates					
4	**MEASUREMENT**					
4.1	**Measuring length (Conversions of km, m, cm and mm)**					
	Exercise 30: Conversions (km, m, cm & mm)					
4.2	**Time**					
	Exercise 31: Answer Questions on Time					
4.3	**Temperature**					
	Exercise 32: Answer Questions on Temperature					
4.4	**Measuring Weight**					
	Exercise 33: Answer Questions on Weight					
4.5	**Measuring Volume/Capacity**					
	Exercise 34: Conversions on Capacity and Volume.					
4.6	**Calculating Circumference, Perimeter, Area and Volume**					
	Exercise 35: Perimeter					
	Exercise 36: Area					
	Exercise 37: Pythagoras					

	Topic	Learner			Teacher		
		Date	√ or X	Comment	Date	√ or X	Comment
	Exercise 38: Assorted Exercises on Circumference, Perimeter, Area						
	Exercise 39: The World's Largest Pizza						
	Exercise 40: Surface Area						
	Exercise 41: Volume						
5	MAPS, PLANS AND OTHER REPRESENTATIONS OF THE PHYSICAL WORLD						
5.1	Scale: Steps to make it easier to work with scales:						
5.2	Maps						
	Exercise 42: Scale						
5.3	Plan						
	Exercise 43: Plans						
	Exercise 44: Site Plan						
	Exercise 45: House Plan						
6	DATA HANDLING						
6.1	Pose Questions						
6.2	Collecting Data						
	Exercise 46: Questions on the Data Handling Process						
6.3	Organising Data: Exercise 47						
6.4	Measure Data						
	Exercise 48: Divide into Quartiles and determine IQR						
6.5	Represent Data						
	Exercise 49: Complete the following questions on graphs:						
	Exercise 50: Box and whisker diagrams						
	Exercise 51: Growth Monitoring Chart						
	Exercise 52: Body Mass index for age percentiles: Girls 2 to 20						
	Exercise 53: Head circumference Percentiles						
7	PROBABILITY						
7.1	Expressions of Probability						
	Exercise 54: Expressions of probability						
7.2	Prediction						
	Exercise 55: Prediction						
7.3	Representations for Determining Possible Outcomes						

Assessment Tasks	Marks	Assessment Tasks	Marks
Assignment 1		Assignment 5	
Assignment 2		Assignment 6	
Assignment 3		Assignment 7	
Assignment 4		Assignment 8	

v

1 BS: NUMBERS AND CALCULATION WITH NUMBERS

1.1 Number Formats and Conventions

A million has 6 zeros: 1 000 000

A billion has 9 zeros: 1 000 000 000

A trillion has 12 zeros: 1 000 000 000 000

Sometimes one can become confused between the use of a comma and the point. In South Africa the decimal comma separates the whole number from the fraction.
e.g. 3 000 000,453

Note, however, that some calculators use a comma to separate the thousands and the point to separate the fractions, e.g. 3,000,000.453 while others use spaces e.g. 3 000 000.453; it can also be represented as 3'000'000,453

To indicate an amount of money, separate the Rand from the cents with a comma and use spaces to indicate thousands e.g. R123 345,45

Exercise 1: Large Numbers

(a) The Gariep Dam is the largest water reservoir in South Africa. This dam has a total storage capacity of approximately 5,3 trillion litres. It has a surface area of more than 370 square kilometres.

(i) The capacity of one Olympic standard swimming pool is 2,5 million litres. How many swimming pools will fill the Gariep Dam?
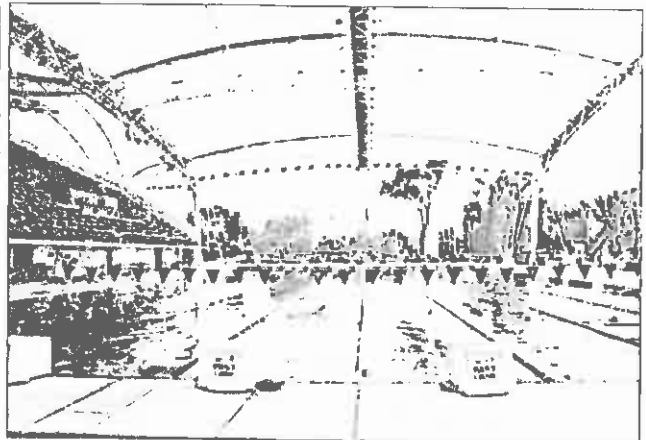
Ref: Wikipedia   Ref: Wikipedia

(ii) A factory uses about 287 458 kl of water to manufacture a product. How many Olympic standard swimming pools will this factory empty in the process?

(iii)   The wall of the Gariep Dam is 88 m high and contains approximately 1,73 million cubic metre concrete. One concrete truck takes 6 m^3. How many trucks of concrete did they order to build this wall?

(iv)   The surface area of South Africa is 1 221 037km^2. What percentage of South Africa's surface area is taken by the Gariep Dam with a 370 square kilometres surface?

(b)   South Africa's population is estimated at 48 million people. If the average household has more or less 6 members, how many households are in the country?

(c)   The surface area of South Africa is 1 221 037km^2 and its population is estimated at 48 million people. What is the average number of people per square kilometre?

Ref: Wikipedia

(d)   The sun is 148 million km from the earth and a space shuttle can reach a height of 207 thousand km above the earth. How many times more will it have to travel this distance in order to reach the sun?

(e)   The average distance between the earth and the moon is 384 392 km. How much further is the sun from the earth?

(f)   300 000 000 m/s is he speed of light. Write this speed in words.

(g)   In 1996, researchers found that 5,6 million adults in England had taken illegal drugs in the previous year. By 2009, this number had fallen substantially, to 4,4 million. What was the difference in the number of people between 1996 and 2009?
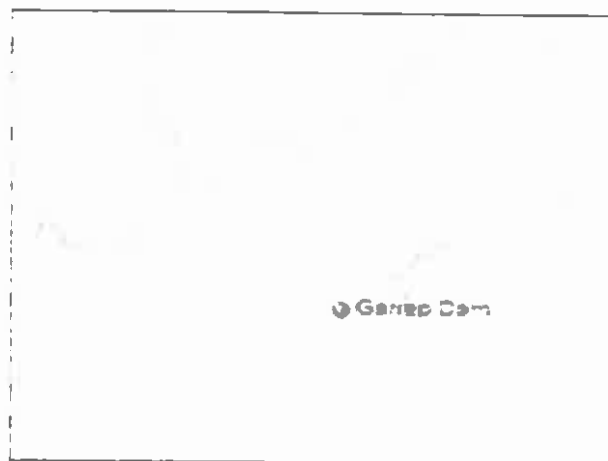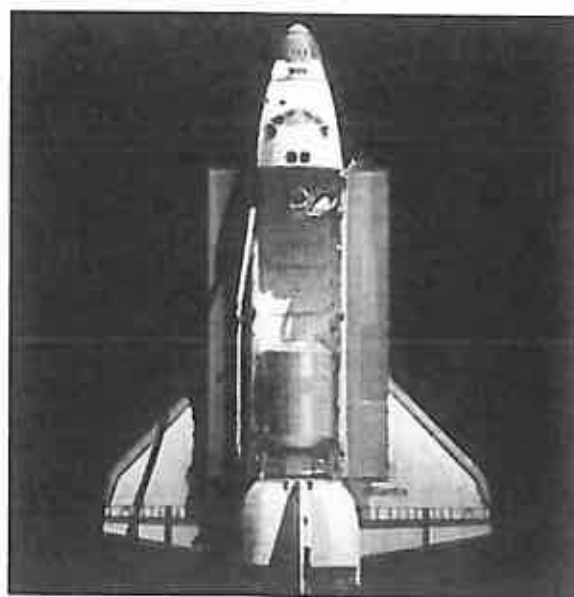
Exercise 1   Date:_____

a) i) 5,3 trillion = 5300 000 000 000 l

   2,5 million = 2 500 000 l

   ∴ 5 300⌀ 000 000 000 ÷ 2 500 000

   = 2 120   swimmingpools.

ii) 2,5 million l = 2 500 kl

   287 458 kl ÷ 2 500 kl

   = 114,9832

   ≈ 115 swimming pools

iii) 1,73 million m^3 = 1 730 000 m^3

   1 730 000 ÷ 6 = 288 333,32

                      ≈ 288 334 trucks (Round up)

iv) $\frac{370}{1\ 221\ 037}$ × 100 = 0,03 %

b) 48 000 000 ÷ 6 = 8 million households

c) 48 000 000 ÷ 1 221 037 km^2

   = 39,31 persons / km^2

d) 148 000 000 km ÷ 207 000 km

   = 714,9758 ≈ 714,98 times

e) 148 000 000 − 384 392

   = 147 615 608 km   (say this in words)

f) Three hundred million metres per second

g) 5,6 mil − 4,4 mil = 1,2 mil

   = 1 200 000

Exercise 2: Fractions.

(a) Complete the following table:

Common Fraction		Decimal Fraction
$\dfrac{13}{100}$	$\longrightarrow$	0,13
$\dfrac{4}{1000}$	$\longleftarrow$	0,004
$\dfrac{1}{1000}$	$\longrightarrow$	0,001
$1\dfrac{12}{1000}$	$\longleftarrow$	1,012
$\dfrac{32}{20000}$	$\longrightarrow$	0,0016
$100\dfrac{1}{1000}$	$\longleftarrow$	100,001
$2\dfrac{6}{10}$	$\longrightarrow$	2,6
$1\dfrac{3}{100}$	$\longleftarrow$	1,03
$\dfrac{50}{100}$	$\longrightarrow$	0,5

Exercise 3: Positive and Negative Numbers

Make use of a number line to do the following without your calculator:
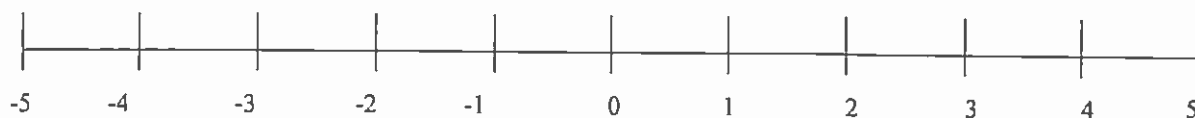
(a) The current temperature is $7°C$. It drops with $8°C$. What is the temperature now?

(b) The water level of the Gariep Dam is normal in the beginning of the summer. The previous year was very dry and the water level was three cm below normal. During the rainy season the water level rises to 5 cm above normal. What is the difference between these two levels?

(c) The time difference between South Africa and the United States of America is 7 hours. It is 2 o'clock in the morning in South Africa. What is the time in the United States of America? They are behind us. (Make use of the number line)

(d) The current temperature is $-7°C$. It drops with $2°C$. What is the temperature now?

Exercise 3: (Draw number lines) Date:_____

a)

$$7°C - 8°C = -1°C$$

b)

$$5 - (-3) = 5 + 3 = 8$$

c)

7 o'clock at night.

d)
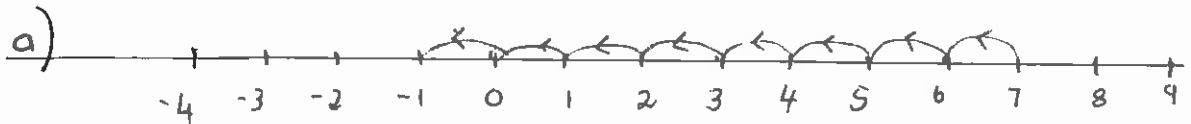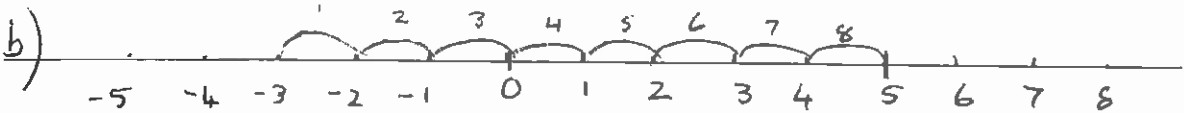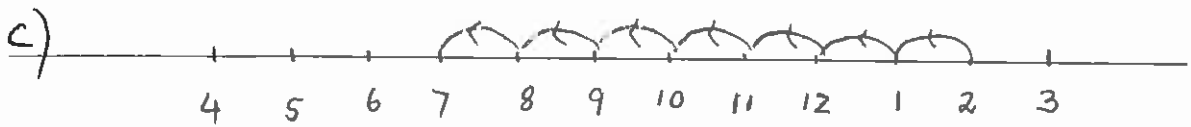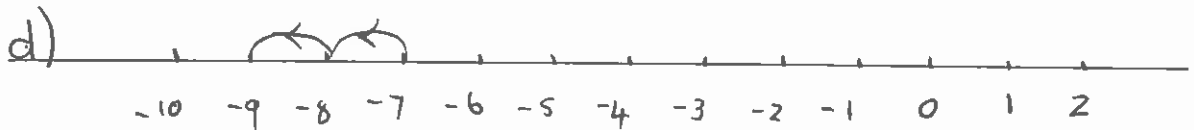
$$-7 - 2 = -9°C.$$

Square numbers & roots

You are able to calculate the length of the square if the area is known.
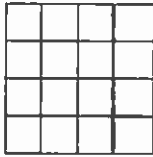
You count 16 squares

The length of the side is 4 units.

Therefore: $\sqrt{16} = 4$

Examples of square numbers: (know these by heart)

1^2	2^2	3^2	4^2	5^2	6^2	7^2	8^2	9^2	10^2	11^2	12^2	13^2
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
1	4	9	16	25	36	49	64	81	100	121	144	169

Therefore: $\sqrt{1} = 1$ *and* $\sqrt{4} = 2$ *etc*

Exercise 4: Square Numbers & Roots

Complete the table below: (Make use of your calculator)

(a)	$\sqrt{9} =$ 3	(f)	$\sqrt{25} \div \sqrt{36} = 5 \div 6 = \dfrac{5}{6} = 0{,}83$
(b)	$\sqrt{9 + 16} = \sqrt{25} = 5$	(g)	$\sqrt{2}^2 = 2$
(c)	$\sqrt{2\left(\frac{1}{2}\right)} = \sqrt{1} \approx 1$	(h)	$\sqrt{144} = 12$
(d)	$\sqrt{2\frac{1}{2}} = \sqrt{\frac{5}{2}} = 1{,}581 \approx 1{,}58$	(i)	$\sqrt{32 - 4} = 5{,}291 \approx 5{,}29$
(e)	$\sqrt{\frac{16}{4}} = \sqrt{4} = 2$	(j)	$\sqrt{9} + \sqrt{16} = 3 + 4 = 7$

(k) The area of a patio is in a square shape. It measures 25m². What is the length of its sides? $\sqrt{25m^2} = 5m$

(l) The area of a square table is 1m². What is the perimeter of the table?

$\sqrt{1m^2} = 1m$ Perimeter: $1 \times 4 = 4cm$

(m) The area of a square room measures 9m². What is the length of one wall?

$\sqrt{9m^2} = 3m$

Exercise 5: Mathematical Language and Estimation.

(a) Complete the table:

Sentence	Number sentence
The **difference** between six and twelve.	$6 - 12 = -6$
Four **times** ten	$4 \times 10 = 40$
Two **more than** three	$3 + 2 = 5$
Thirty thousand **divided by** ten.	$30\,000 \div 10 = 3000$
The total of 10, 200 and 23 is.	233
Add up seventy and one hundred and ten.	$70 + 110 = 180$
The product of twenty five and hundred	$25 \times 100 = 2500$
Reduce R87 by R12,50.	$R87 - R12,50 = R74,50$
Subtract sixty from twelve.	$12 - 60 = -48$
Half of 24m²	$\frac{1}{2} \times 24m^2 = 12m^2$
Reduce six by ten	$6 - 10 = -4$

(b)

CRAZY DAYS SALE!!!!!	
Hats	R25,95
Socks	R13,45
T-Shirts	R49,35
Jeans	R75,59

Study the advertisement above and estimate the following answers:

Will 4 hats cost more or less than R100,00?	More
Estimate the price of 2 pairs of socks	$\approx R27$
Will 3 hats cost more or less than 1 jean?	3 Hats $\approx$ R78 $\therefore$ More
Will 4 pairs of socks cost more or less than 2 hats?	$4 \times 13 = 52$ ← Round down ∴ more $26 \times 2 = 52$ ← Round up

1.2 Operations Using Numbers and Calculator Skills

Order of operations (BODMAS)

B	Brackets - Square numbers and roots
O	Of (Means Multiply)
DM	Multiplication and Division (From left to right)
AS	Add and Subtract (From left to right)

EXAMPLE:

$2 \times 3 + 4 \div 2 + (9 - 1) - \frac{1}{2} \text{ of } 8$ *First the brackets*

$= 2 \times 3 + 4 \div 2 + 8 - \frac{1}{2} \times 8$ *of (this is multiplication)*

$= 2 \times 3 + 4 \div 2 + 8 - 4$ *then multiply and divide from left to right*

$= 6 + 2 + 8 - 4$ *then add and subtract from left to right*

$= \underline{12}$

Exercise 6: BODMAS

Determine the following: (You may use your calculator):

(a)	$2(2 - 3)^2 - 6 \div 2$	(i)	$6 \times 8 \div 2 + 3$
(b)	$5^2 - \sqrt{42 - 6}$	(j)	$983{,}5 - 100 - 10$
(c)	$R450 - R32{,}50 \times 10$	(k)	$325 - 36{,}3 \div 0{,}3 + 100$
(d)	$58 \div 2 + 2 \times 4 - \frac{2}{3} \text{ of } 30$	(l)	$3 \times 7 - 11 \div 2 \times 6 + 1$
(e)	$10\,000 \times 100 - 10 \times 10 + 10$	(m)	$1 \times 1 - 1 + 1 \div 1 + 1^2$
(f)	$10\,000(1{,}01)^2 - 1 \times 1$	(n)	$3{,}6(2{,}01 + 102{,}5)$
(g)	$20 - \frac{3}{5} \text{ of } 205$	(o)	$\frac{2}{5}\left(1\frac{4}{9}\right) - 1$
(h)	$\frac{\sqrt{160 - 16}}{12} - 32 \div 8$	(p)	$(10)^2 + \frac{1}{2}$

Exercise 6: (Show your steps)   Date: _____

a) $2(2-3)^2 - 6 \div 2$

$= 2(1) - 6 \div 2$

$= 2 - 3 = \underline{-1}_{\rightarrow}$

b) $5^2 - \sqrt{42-6}$

$= 25 - \sqrt{36}$

$= 25 - 6 = \underline{19}_{\rightarrow}$

c) $R450 - R325 = R125$

d) $58 \div 2 + 2 \times 4 - \frac{2}{3} \times 30$

$= 29 \quad + 8 \quad - 20$

$= 37 - 20 = 17.$
$\rightarrow$

e) $10\,000 \times 100 - 10 \times 10 + 10$

$= 1\,000\,000 - 100 + 10$

$= 999\,900 + 10$

$= 999\,910_{\rightarrow}$

f) $10\,000(1,0201) - 1 \times 1$

$= 10\,201 - 1 = \underline{10200}_{\rightarrow}$

g) $20 - \frac{3}{5} \times 205$

$20 - 123 = \underline{-103}_{\rightarrow}$

h) $\sqrt{160 \cdot 16} - 4$

$= \dfrac{\sqrt{144}^{12}}{12} - 4$

$= 1 - 4 = \underline{-3}_{\rightarrow}$

i) $6 \times 8 \div 2 + 3$

$= 48 \div 2 + 3$

$= 24 + 3 = \underline{27}_{\rightarrow}.$

j) $9835 - 100 - 10$

$8835 - 10 = 8735_{\rightarrow}$

k) $325 - 36,5 \div 0,3 + 100$

$= 325 - 121,6 + 100$

$= 203,4 + 100 = 303,4_{\rightarrow}$

l) $3 \times 7 - 11 \div 2 \times 6 + 1$

$= 21 - 5,5 \times 6 + 1$

$= 21 - 33 + 1$

$= -12 + 1 = \underline{-11}_{\rightarrow}.$

m) $1 \times 1 - 1 + 1 \div 1 + 1^2$

$= 1 - 1 + 1 + 1$

$= 0 + 1 + 1$

$= \underline{2}_{\rightarrow}$

n) $3,6(2,01 + 102,5)$

$= 3,6(104,51)$

$= 376,236 \approx 376,24$

o) $\frac{2}{5}(1\frac{4}{9}) - 1 = -0,42$

p) $\underline{100,5}_{\rightarrow}$

1.3 Rounding

Exercise 7: Several Exercises on Rounding

Round off to two decimal places: (complete the table)

E.g. $354,7899 \approx 354,79$ but $354,7824 \approx 354,78$

(a)	123,2225 $\approx$ 123,22	(g)	12,504 $\approx$ 12,50
(b)	325,4567 $\approx$ 325,46	(h)	11,406 $\approx$ 11,41
(c)	341,455 $\approx$ 341,46	(i)	0,008 $\approx$ 0,01
(d)	19,999 $\approx$ 20	(j)	0,00009 $\approx$ 0
(e)	34,354999 $\approx$ 34,35	(k)	0,005 $\approx$ 0,01
(f)	67,899 $\approx$ 67,9	(l)	1239,95443 $\approx$ 1239,95

Round off to the nearest 10: (complete the table)

(a)	15 $\approx$ 20	(f)	457,345 $\approx$ 460
(b)	343,35 $\approx$ 340	(g)	568,224 $\approx$ 570
(c)	169,991 $\approx$ 170	(h)	299,201 $\approx$ 300
(d)	22,09 $\approx$ 20	(i)	342,456 $\approx$ 340
(e)	936,789 $\approx$ 940	(j)	11299,67 $\approx$ 11 300

Round off to the nearest 5: (complete the table)
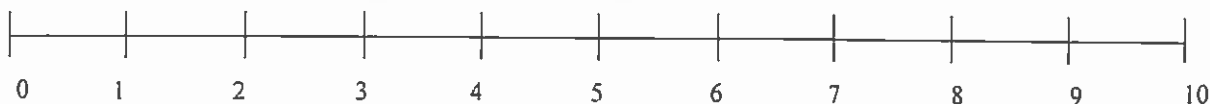
(a)	20 $\approx$ 20	(e)	431 $\approx$ 430
(b)	77 $\approx$ 75	(f)	438,45 $\approx$ 439
(c)	334 $\approx$ 335	(g)	432,89 $\approx$ 430
(d)	23 $\approx$ 25	(h)	79 $\approx$ 80

Round off to the nearest cent or Rand: (complete the table)

Round off to the nearest cent		Round off to the nearest Rand	
(a)	R134,905 ≈ *R 134,91*	(a)	R23,99 ≈ *R 24*
(b)	R23,544≈ *R 23,54*	(b)	R24,21324 ≈ *R 24*
(c)	R13,222222 ≈ *R 13,22*	(c)	R999,999 ≈ *R 1000*
(d)	R45,2899 ≈ *R 45,29*	(d)	R345,578 ≈ *R 346*
(e)	R999,999 ≈ *R 1 000*	(e)	R13,46 ≈ *R 13*

Implications of Rounding Up or Down

Rounding up or down can have significant implications in real life.
(a) If you work in a bank which holds accounts of 1 million people and you make a rounding mistake of one cent on each account in favour of the clients, how much money will the bank lose?

1 000 000 c = R 10 000,00

(b) Complete the table: (Make sure you know when you must **round up** or **down**. This is determined by the context.)

The government printer can only print in units of one million. How many ballot papers will you need to print if you expect 2,3 million voters for the election?	*3 mil*
You prepare food for a big event and you double your recipe. You now need 2,24kg rice. How much rice will you buy to the nearest kg?	*3 kg*
You need 4,3ℓ paint for your room. They sell the paint in one litre containers. How many containers do you need to buy?.	*5 ℓ*
144 boxes need to be packed onto the shelves. Each shelve can hold 13 boxes. Calculate how many shelves will be needed.	*11*
A recipe states that a single portion of a particular dish requires 250g of flour. Using this recipe, how many people can be fed with 5,55kg of flour? *5550 / 250*	*≈ 22*
A CD costs R145,99. Calculate the cost of 13 CD's	*R 1900*
How many bricks do you need to buy if you calculated that you need 234,3 bricks?	*235*
Susan buys fabric to sew a dress. She needs 2,3m². They sell the fabric in 1m². How much must she buy?	*3 m²*
Peter calculated that he needed 12,4ℓ petrol to do his trip. They only sell petrol in 5ℓ cans. How many cans must he buy?	*3 cans*
One piece of gum costs 22c. How many pieces of gum can you buy for R4,25?	*19*

1.4 Ratios

A ratio is the quotient obtained when comparing quantities of **the same kind and the same units** through division, e.g. There are 27 boys and 21 girls in a class. Therefore the ratio boys to girls is $\frac{27}{21}$ and is simplified (divide each part of the ratio with the same number) to $\frac{9}{7}$. We write the ratio of boys to girls as 27:21 = 9:7. (or girls : boys = 7 : 9) Note that in this ratio notation **no units** are written down.

The ratio π is often used in Math and is the circumference of a circle and its diameter.

$$\pi = \frac{Circumference\ of\ a\ circle}{Its\ diameter} = \frac{22}{7} = 3,1415926\ldots \approx 3,142$$

Exercise 8: Ratios

Answer the following questions: (Answer in full sentences and show all your calculations)

(a) Sipho and Thandi own a business together and divide their profits in the ratio 4 : 3.
    (i) Who receives the greater share of the profit?
    (ii) What fraction of the profit will each one get?
    (iii) If they make a profit of R3 416 in one month, how much will each one receive?

(b) Mrs Ahmad prepares oat porridge for her children. For each bowl of oats porridge, she always uses 3 cups of water for every 2 cups of oats.
    (i) Find the ratio of the number of cups of water to the number of cups of oats used.
    (ii) If she wants to prepare 5 bowls of oats porridge, how many cups of water and how many cups of oats does she need?
    (iii) If she uses 18 cups of oats, how many cups of water does she need?

(c) John, Andre and Peter are business partners, and share in the profit proportional to their original capital contributions. John contributed R85 000, Andre R120 000 and Peter R105 000. After a profit of R156 500 was declared, they gave 7% of the profit to a welfare organization and then divided the balance of the profit. Calculate the amount each partner received

(d) The instructions on a packet of crack filler state that one part of water must be added to two parts of crack filler and then mixed into a paste.
    (i) How much crack filler must you add to 150 $m\ell$ of water?
    (ii) How much water must be used with 550 $m\ell$ crack filler?

(e) A professional hair stylist wants to colour her hair. The manufacturer's instructions of how to mix the tint, recommend the ratio of peroxide to hair colour as 1:2. She measures 10 $m\ell$ of hair colour. How many $m\ell$ of peroxide must she mix it with?

Exercise 8:   Date:_____

a) i) Sipho

   ii) Sipho : $\frac{4}{7}$ and Thandi : $\frac{3}{7}$

   iii) Sipho: $\frac{4}{7} \times R\,3\,416$ and   Thandi: $\frac{3}{7} \times R\,3\,416$

                    $= R\,1\,952$ $= R\,1\,464$

b) i) Water : Oats   3 : 2

   Water   Oats

   ii) $3 \times 5 = 15$ cups $2 \times 5 = 10$ cups

   iii) Water : Oats   (3:2)   ($\underset{\downarrow}{27}$: 18) $\frac{3}{2} = \frac{?}{18}$; $2x = 3 \times 18$

                                                                    $x = 27$

c) $7\% \times 156\,500 = R10\,955.$

         $R156\,500 - R10\,955 = R\,145\,545$

   John : André : Peter   85 000 : 120 000 : 105 000

                              $(\div 5)$ 17 :   24   :   21

   $17 + 24 + 21 = 62$

   $\frac{17}{62} \times 145\,545 =$ $\frac{24}{62} \times 145\,545 =$ $\frac{21}{62} \times 145\,545$

   $= R\,39\,907,50$ $= R\,56\,340,00$ $= R\,49\,297,16$

d) i) Water : crackfiller   ii) 275 : 550 ml (crack filler)
        150 ml : 300 ml
         1   :   2

e) Peroxide : Hair colour   5 ml : 10 ml.
        6   :   1

f) Cars : Trucks $\frac{1}{7} \times 18\,567 = 2652,428.$

                                 ≈ 2652

g) $2\frac{1}{2} + 1\frac{1}{2} = 4$

   $\frac{2\frac{1}{2}}{4} \times 440 =$ $\frac{5}{2} \times \frac{1}{4} \times 440 =$

   $\frac{1\frac{1}{2}}{4} \times 440 =$ $\frac{3}{2} \times \frac{1}{4} \times 440 = 165$

(f) A traffic officer finds that 18 567 vehicles pass over the freeway during one week. The ratio of cars to trucks is given as 6:1. Find the number of trucks which used the freeway during that week.

(g) Elna and Susan are paid R440 for a task on which they worked $2\frac{1}{2}$ hours and $1\frac{1}{2}$ hours respectively. How much will each receive?
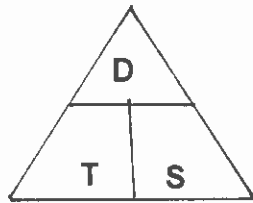
1.5 Rate

Exercise 9: Rate

Rate is when comparing two different quantities or different kinds or units through division. Rate is always expressed as "...**per**...." The symbol used is ".../..." Examples of rates include: Speed, distance and time relationships (e.g. km/h), product pricing (e.g. R/kg) etc.

Answer the following questions: (Show all your calculations)

SPEED, DISTANCE AND TIME

Know this triangle by heart!

$$Time = \frac{distance}{speed} \qquad Speed = \frac{distance}{time} \qquad Distance = time \times speed$$

(a) Mr Klumper asked his driver to undertake a trip of 650km. He drives at an average speed of 120km/h. How long will it take him to do the trip? Write your answer down in hours and minutes.

(b) Which car drives the fastest? Motorcar A drives 570 km in 4,75 hours; motorcar B drives 275 km in $2\frac{1}{2}$ hours and motorcar C drives 640 km in 5 hours 20 minutes.

(c) A car drives at a constant speed and the distance covered is presented in the following table:
(Complete the table)

Hours:	1	2	3	6	7		10			
Km:		160	240			680		880	1640	2400

(d) Determine the distance in meter if a vehicle travels at an average speed of 27,95 m/s for 1,36 seconds.

(e) You walk 21km in 4 hours time. What is your average speed?

(f) An aeroplane flies 512km in 40 minutes. What was its speed?

Exercise 9: Rate. Date:_____

a) Time = $\frac{Distance}{Speed}$ = $\frac{650 km}{120 km/h}$ = $5,41\dot{6}$ hours

   $0,416$ hours = $0,417 \times 60$ minutes = 25 minutes.

   $\therefore$ 5 hours 25 minutes.

b) A: $S = \frac{D}{T} = \frac{570 km}{4,75 hours} = 120 km/h.$

   B: $S = \frac{D}{T} = \frac{275 km}{2,5 hours} = 110 km/h.$ NB!

   C: $S = \frac{D}{T} = \frac{640 km}{5,3 hours} = 120,75 km/h$ $\left\{ \frac{20}{60} minutes = 0,3 \right\}$

   Motorcar C is the fastest.

c)

Hours	1	2	3	6	7	$8\frac{1}{2}$	10	11	$20\frac{1}{2}$	30	
Km:	80	160	240	480	560	680	800	880	1640	2400	

d) Distance = Time × speed

   = $1,36 sec \times 27,95 m/s$

   = $38,012 m/s$

e) Speed = $\frac{Distance}{Time}$

   = $\frac{21 km}{4 hours}$

   = $5,25 km/h.$ = $5\frac{1}{4} km/h.$

f) Speed = $\frac{Distance}{Time}$ NB!

   = $\frac{512 km}{40 min}$ $\left\{ 40 minutes = \frac{40}{60} h \right.$

   = $\frac{512 Km}{0,67 h}$ $\left. = 0,6\dot{6}h \right\}$

   = $764,1791$

   $\approx 764,18 km/h$

(g) It takes Mr. Gouws 30 minutes to cover a distance of 132km.

   (i) Determine his average speed in km/h.
   (ii) Did he drive according to the speed limit on the South African roads?
   (iii) What should his speed have been to keep within the speed limit?
   (iv) If he kept the speed limit, how long would it take him then?

(h) The Gautrain departs at 07:42 from a station and reaches the next station at 8:04. How far are the stations apart if the train moves at 130km/h?

(i) Ernst runs 400 metres in 58 seconds.

   (i) What is his average speed in m/s?
   (ii) What is his average speed in km/h?

(j) Felix Baumgartner set the record for the highest manned balloon flight and fastest speed of free fall at 1357,64 km/h, making him the first human to break the sound barrier (343,2m/s) outside of a vehicle. The mission took place on 14 October 2012 when Baumgartner landed in eastern New Mexico after jumping from a world record height of 38969,3 m above the earth

   (i) Calculate his free fall speed in m/s
   (ii) How much faster was this than the sound barrier?
   (iii) What was his height in kilometres above the earth?
   (iv) How long ago did this event take place? (Round your answer to the nearest month)

Best Buy

300ml ÷ 10 = 30ml

R17,95 ÷ 10 = R1.79

300ml

600ml ÷ 20 = 30ml

R34,99 ÷ 20 = R1.70 ✓

600ml

PRODUCT PRICING

(k) Work out the rate per 100mℓ in both cases and determine which one is the cheaper to buy.

(l) Sandra bought 7 metres of material for R84. What is the price of the material per metre? What is the rate in this case?

(m) A wholesaler buys a container with 60 light bulbs for R261. How much did he pay per bulb?

(n) 500g margarine costs R7,35 and 350g of the same kind costs R5,50. Which size is the cheaper to buy?

Exercise 9 (continued)   **Date:** _____

g i) $Speed = \dfrac{D}{T} = \dfrac{132}{0,5} = 264\,km/h.$

ii) No

iii) $120\,km/h.$ iv) $T = \dfrac{D}{S} = \dfrac{132}{120} = 1,1\ hours$ $1h\ 6min$

NB
$0,1 \times 60\ min$
$6\ minutes.$

h) $\begin{array}{r} 8:\overset{6}{\not6}4 \\ -\ 7:42 \\ \hline :22\ min\ apart. \end{array}$ $D = T \times S = \dfrac{22}{60} \times 130 = 47,67\,km$

i) i) $S = \dfrac{D}{T} = \dfrac{400}{58} = 6,8965 \approx 6,9\ m/s$

ii) $S = \dfrac{D}{T} = \dfrac{0,4km}{\frac{58}{3600}} = 25\,km/h.$

NB.
$58\ sec = \dfrac{58}{60 \times 60}\ hours$
$= 0,0161$

j) i) $\dfrac{1\,357,64\ km}{1\ hour} = \dfrac{1\,357\,640\,m}{3\,600\ sec} = 377,12\,m/s$

ii) $377,12 - 343,2 = 33,92\ m/s\ faster$

iii) $38\,969,3\,m = 38,9693\,km \approx 38,97\,km$

iv) Work it out from the current date.

k) $\div 3 \left(\begin{array}{lll} 300\,ml & @ & R\,17,95 \\ 100\,ml & @ & R\,5,98 \end{array} \right) \div 3 \div 6 \left(\begin{array}{lll} 600\,ml & @ & R\,34,99 \\ 100\,ml & @ & R\,5,83 \end{array} \right.$
$\underline{\quad Cheapest!\quad} \rightarrow$

l) $R\,84 \div 7\ metre$ Rate: $R\,12$ per metre.

m) $R\,261 \div 60$ Rate $R\,4,35$ per bulb.

n) $\div 10 \left(\begin{array}{lll} 500g & @ & R\,7,35 \\ 50g & @ & R\,0,735 \end{array} \right.$ $\div 7 \left(\begin{array}{lll} 350g & @ & R\,5,50 \\ 50g & @ & R\,0,7857 \end{array} \right.$

$\approx R\,0,74 \leftarrow cheaper$ $\approx R\,0,79$

Exercise 10:   Date:_____

a)   3,5 : 10,5   ∴ 1:3   20m : 60m.
                    Rate

b) 100 1,5 l bottles will fill up the tank.

        450 km/h : 3,25 hours.
c)   ?   : 2,5 hours

Distance: 450 × 3,25 = 1462,5 km.

Speed : $\frac{P}{T}$ = $\frac{1462,5}{2,5}$ = 585 km/h.

d)   1,5cm : 10km   scale: $\frac{1,5\, cm}{1,5}$: $\frac{10\,00000cm}{1,5}$

    7,5cm : 50km   1 : 666 666,67 →

    10 cm : 66,67 km ← 10cm × 666666 = 6666660cm

e)   16cm : 60 g

      1 cm : 3,75 g

      8cm   : 3,75 × 8

      8cm   : 30 g

     32cm   : 120 g

f) **Indirect / Inverse proportion.**

Check-out points	2	6	8	12	
	×	×	×	×	
Minutes	24	8	6	4	
Product	48	48	48	48	

1.7 Percentages

A percentage expresses a part of 100. E.g. 45% means $\dfrac{45}{100}$

How to convert percentage to ordinary fractions	E.g. 45% means $\dfrac{65}{100} = \dfrac{13}{20}$
How to convert percentage to decimal fractions	E.g. $33,3\% = \dfrac{33,3}{100} = 0,333$
How to convert ordinary fractions to percentage:	E.g. $\dfrac{1}{4} \mapsto \dfrac{1}{4} \times 100 = \dfrac{100}{4} = 25\%$ Use a calculator: $(1 \div 4 \times 100 =)$ Don't use the %-sign on the calculator!
How to convert decimal fractions to percentage	E.g. $0,257 \mapsto 0,257 \times 100 = 25,7\%$

Exercise 11: Percentages

Answer the following questions:

(a) A man bequeaths 50% of his estate to his wife, 20 % of the balance to each of his 2 children and the rest to welfare. What amount goes to welfare if the estate is

worth R3 000 000?

(b) A salesman receives a commission of 5% on his sales, as well as a weekly salary of R1 500. In one week he had sales of R13 000. How much commission did he

earn? Express his commission as a percentage of his weekly salary.

(c) 18% of a farmer's wheat crop is 1 260 tons. What is the weight of the total crop?

(d) A lottery win of R36 000 was split up between three people so that Mary received 25% of the win, Bill got 13% and Sam got the remainder. Find the percentage of the win that Sam received and the amount that Mary received.

(e) How much will I save on buying these items in the 15%-off sale:

15% off everything SALE	
Tennis racquet - normally	R420,54
Pair of shorts - normally	R69,67
Picture frame - normally	R43,90
Alarm clock - normally	R38,96
Stereo radio - normally	R109,78