



NBT

NATIONAL BENCHMARK TEST

NOTES & PRACTICE FOR QUANTITATIVE SECTION OF AQL

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Introduction

The National Benchmark Tests (NBTs) are a set of tests that measure an applicant's academic readiness for university. They complement and support, rather than replace or duplicate the National Senior Certificate.

A number of universities in South Africa use the NBTs to help interpret the National Senior Certificate (NSC) results. Universities use the NBT results in different ways:

- Some use them to help make decisions about an applicant's access to university. This means that the NBT results, in combination with the NSC results, are used to determine whether an applicant is ready for academic study.
- Some use them for placement within university. This means that the results are used to decide whether an applicant will need extra academic support after he/she has been admitted to university.
- Some use them to help develop curricula within their universities.

There are two NBT tests: the Academic and Quantitative Literacy (AQL), and the Mathematics Test (MAT).

The AQL test is three hours long and consists of seven timed sections of 25 to 30 minutes each. Some of these sections focus on Academic Literacy. Some of these sections focus on Quantitative literacy.

THIS BOOKLET WILL HELP YOU PREPARE FOR THE Quantitative Literacy parts of the AQL TEST ONLY.

Note that this is NOT an official publication from the NBT and the NBT test setters might choose to change the format and/or composition of the test over time. It is therefore advisable to check for up to date information on <http://nbt.ac.za>.

What can you expect from the NBT Quantitative Literacy (QL) Test?

(taken from The National Benchmark Tests: Preparing your learners for the academic and quantify literacy test by Natalie le Roux and Kabelo Sebolai. Available at <http://nbt.ac.za>.)

The NBT QL test assesses the candidate's ability to do the following:

- Understand basic numerical concepts and information used in text.
- Select and use a range of quantitative terms and phrases;
- Apply quantitative procedures in various situations;
- Formulate and apply simple formulae;
- Interpret tables, graphs, charts and texts and integrate information from different sources
- Do calculations involving multiple steps accurately
- Identify trends and patterns in various situations;
- Reason logically; and
- Interpret quantitative information presented verbally, symbolically and graphically.

There are 50 multiple-choice questions in the QL test. These questions are developed to assess the quantitative literacy of the learners based on the specifications summarized in the table on the next page. Candidates do not require a calculator to write the QL test and where necessary formulae are provided.

Subdomain	Description
Quantity, number and operations	- The ability to order quantities, calculate and estimate the answers to computations required by a context, using numbers (whole numbers, fractions, decimals, percentages, ratios, scientific notation) and simple operations (+, -, $\times$, $\div$, positive exponentiation) on them. - The ability to express the same decimal number in alternative ways (such as by converting a fraction to a percentage, a common fraction to a decimal and so on) - The ability to interpret the words and phrases used to describe ratios (relative differences) between quantities within a context, to convert such phrases to numerical representations, to perform calculations with them and to interpret the result in the original context. The ability to work similarly with ratios between quantities represented in tables and charts, and in scale diagrams.
Shape, dimension and space	- The ability to understand the conventions for measurement and description (representation) of 2- and 3-dimensional objects, angles and direction, - The ability to perform simple calculations involving areas, perimeters and volumes of simple shapes such as rectangles and cuboids.
Relationships, pattern, permutation	- The ability to recognize, interpret and represent relationships and patterns in a variety of ways (graphs, tables, words and symbols) - The ability to manipulate simple algebraic expressions using simple arithmetic operations.
Change and rates	- The ability to distinguish between changes (or differences in magnitudes) expressed in absolute terms and those expressed in relative terms (for example as percentage change) - The ability to quantify and reason about changes or differences. - The ability to calculate average rates of changes and to recognize that the steepness of a graph represents the rate of change of the dependent variable with respect to the independent variable. - The ability to interpret curvature of graphs in terms of changes in rate.
Data representation and analysis	- The ability to derive and use information from representations of contextualized data in tables (several rows and columns and with different data types combined), charts, (pie, bar, compound bar, stacked bar, 'broken' line, scatter plots) graphs and diagrams (such as tree diagrams) and to interpret the meaning of this information. - The ability to represent data in simple tables and charts, such as bar or line charts.

How to use this booklet

This booklet consists of notes that serve as a reminder of some of the mathematics topics that might be included in the QL part of the NBT. And as you are not allowed to use a calculator, you'll probably also find it useful if you brush up on your mental maths (practice your timestables, adding and subtracting numbers in your head, approximating answers to calculations etc.)

This is followed by a set of testlets. You should time yourself while doing each of these testlets (25 – 30 minutes per testlet). **Do not use a calculator** while doing the testlets. Answers to the testlets are provided.

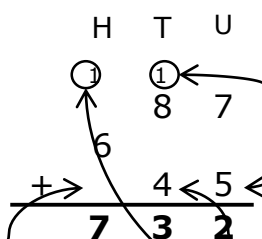
Operations on whole numbers

A method for adding



Worked example:

Calculate $687 + 45$. Put the numbers under each other in columns for hundreds, tens and units.



$$7 + 5 = 12$$

Put 2 in the units column and carry 1 ten into the tens column.

$1 \text{ ten} + 8 \text{ tens} + 4 \text{ tens} = 13 \text{ tens}$
Put 3 in the tens column and carry 1 hundred into the hundreds column.

$6 \text{ hundreds} + 1 \text{ hundred} = 7 \text{ hundreds}$

Subtraction

Subtraction as *take away*

Example: $23 - 5 = 18$

Take 5 away from 23. Start at 23 and take 5 steps back to get 18.

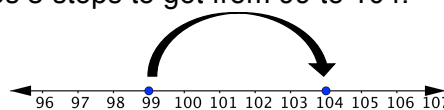


$$23 - 5 = 18$$

Subtraction as *difference between*

Example: $104 - 99$

We find the difference between 99 and 104. It takes 5 steps to get from 99 to 104.



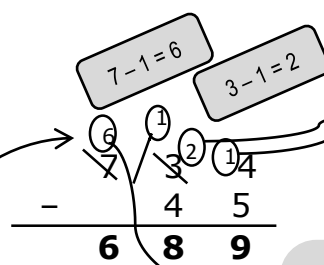
$$104 - 99 = 6$$

A method for subtracting



Worked example: Calculate $734 - 45$

Put the numbers under each other in the hundreds, tens and units columns.



1

→ $4 - 5$ is less than 0
→ Take 1 ten from the tens column and add it to the units to get 14.
→ $14 - 5 = 9$

2

→ $2 \text{ tens} - 4 \text{ tens}$ is less than 0
→ Take 1 hundred from the hundreds column and add it to the tens to get 12 tens.
→ $12 \text{ tens} - 4 \text{ tens} = 8 \text{ tens}$

3

$6 \text{ hundreds} - \text{no hundreds} = 6 \text{ hundreds}$

A method for multiplying



Worked example: Calculate 13×54

$13 \times 54 = 13(50 + 4)$ so we can calculate 13×50 and 13×4 and then add them.

Put the numbers under each other in the tens and units columns.

2

To calculate 13×50

- put 0 in the units column and then just multiply by 5
- $5 \times 3 = 15$ so put 5 in the tens column and carry 1
- $5 \times 1 = 5$ and $+1 = 6$

$$\begin{array}{r} 13 \\ \times 54 \\ \hline 52 \\ 650 \\ \hline 702 \end{array}$$

3

Add $52 + 650$

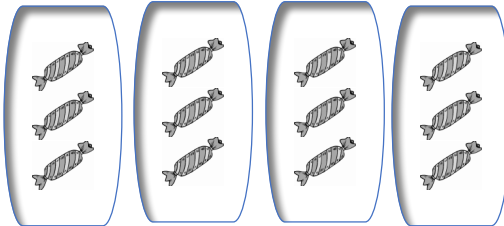
1

To calculate 13×4

- $3 \times 4 = 12$
- So put 2 in the units column and carry 1 to the tens column
- $1 \times 4 = 4$ and $+1 = 5$

Division We can think of division in two ways.

A. Division as making groups:

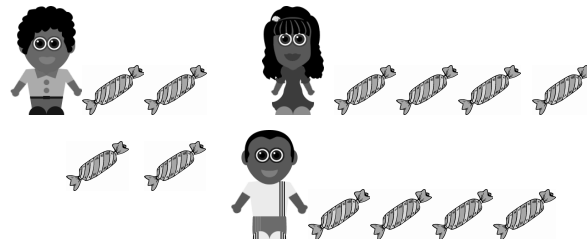


12 sweets. Put them into packets with 3 in each packet. How many packets?

$$12 \div 3$$

B. Division as equal sharing:

Share 12 sweets equally between 3 friends.
How many sweets will each friend get?



$$12 \div 3$$

A method for dividing



Worked example: Calculate $192 \div 3$. We want to know how many 3s there are in 192.

1

There are no 3s in 1 but there are six 3s in 19 with 1 ten remainder.

$$\begin{array}{r} 64 \\ 3 \overline{) 192} \\ \underline{18} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

2

Add the remainder of 1 ten to the units column to get 12.

3

There are four 3's in 12 with no remainder.

Approximation

It is useful to estimate the answer to a calculation before doing the calculation.



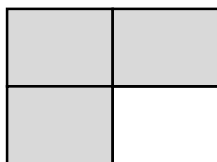
Worked examples:

1. Estimate the answer to 48×103 .
Round off 48 to 50 and 103 to 100.
 $50 \times 100 = 5\,000$. So 48×103 will be close to 5 000.
2. Approximate the answer to $25\,116 \div 483$.
 $25\,116 \div 483 \approx 25\,000 \div 500 = 50$. So we expect a calculated answer close to 50.

Fractions

How fractions work

numerator
(top number) $\rightarrow 3$
denominator $\rightarrow 4$
(bottom number)



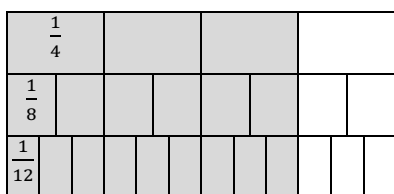
- $\rightarrow$ 3 pieces of the whole are shaded.
- $\rightarrow$ There are 4 pieces in the whole altogether.
- $\rightarrow$ So 3 out of 4 or $\frac{3}{4}$ of the whole is shaded.

Equivalent fractions

Equivalent fractions have the same value so they are equal.

Examples:

a) $\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$



- b) We can make equivalent fractions by multiplying or dividing the numerator and denominator by the same number.

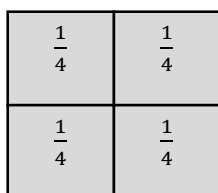
$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

$$\frac{8}{10} = \frac{8 \div 2}{10 \div 2} = \frac{4}{5}$$

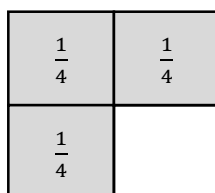
Improper fractions and mixed fractions

An **improper fraction** has a numerator that is larger than its denominator e.g. $\frac{7}{4}$.
 $\frac{7}{4}$ is seven quarters.
There are seven $\frac{1}{4}$ pieces.

A **mixed number** is made up of a whole number and a fraction e.g. $1\frac{3}{4}$.
 $1\frac{3}{4}$ is one and three quarters.
There is 1 whole and three $\frac{1}{4}$ pieces.



one whole



$$\text{So } \frac{7}{4} = 1\frac{3}{4}$$



Worked examples:

1. Write $\frac{7}{4}$ as a mixed number.

$$\frac{7}{4} = 1\frac{3}{4}$$

$7 \div 4$ is 1 whole (4 goes into 7 one time) with 3 quarters left over.

2. Write $3\frac{1}{5}$ as an improper fraction

$$3\frac{1}{5} = \left(3 \times \frac{5}{5}\right) + \frac{1}{5} = \frac{16}{5}$$

Adding and subtracting fractions

If fractions have the same denominator, it is easy to add or subtract them.

Example: $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$

Adding or subtracting fractions with different denominators:



Worked example 1: Calculate $\frac{2}{9} + \frac{5}{12}$

Multiples of 9: 9; 18; 27; 36; 45; 54; ...

Multiples of 12: 12; 24; 36; 48; ...

So lowest common multiple of 9 and 12 is 36.

$$\frac{2}{9} \times \frac{4}{4} = \frac{8}{36}$$

$$\frac{5}{12} \times \frac{3}{3} = \frac{15}{36}$$

$$\frac{2}{9} + \frac{5}{12} = \frac{8}{36} + \frac{15}{36} = \frac{23}{36}$$

There is no number that divides into 23 and 36

So $\frac{23}{36}$ is the answer in simplest form.

1

Find the lowest common denominator.

2

Rewrite each fraction using the lowest common denominator.

3

Add or subtract the fractions.

4

Simplify the answer if necessary.

Multiplying fractions

To multiply fractions you multiply the numerators together and multiply the denominators together.



Worked example 1: Calculate $\frac{3}{5} \times \frac{10}{11}$

$$\frac{3}{5} \times \frac{10}{11} = \frac{3 \times 10}{5 \times 11} = \frac{30}{55}$$

Use common factors to simplify the answer: $\frac{30}{55} = \frac{30 \div 5}{55 \div 5} = \frac{6}{11}$

Short way:

$$\frac{3}{5} \times \frac{10}{11} = \frac{3 \times \cancel{10}^2}{\cancel{5}_1 \times 11} = \frac{6}{11}$$

It is easier to divide top and bottom by common factors (cancel) before you multiply.



Worked example 2: Calculate $\frac{2}{3}$ of 12

$\frac{2}{3}$ of 12 means $\frac{2}{3} \times 12$

$$\frac{2}{3} \times 12 = \frac{2}{3} \times \frac{12}{1}$$

$$= \frac{2 \times \cancel{12}^4}{\cancel{3}_1 \times 1} = \frac{8}{1} = 8$$

Any whole number can be written as a fraction with denominator of 1 e.g. $12 = \frac{12}{1}$

Dividing fractions

Dividing is the same as multiplying by the inverse. So to divide a fraction, turn the fraction *you are dividing by* upside down and multiply.



Worked example: Determine $\frac{3}{4} \div \frac{5}{7}$

$$\frac{3}{4} \div \frac{5}{7} = \frac{3}{4} \times \frac{7}{5} = \frac{21}{20}$$

Turn $\frac{5}{7}$ upside down and multiply.

Decimal fractions

Understanding decimals

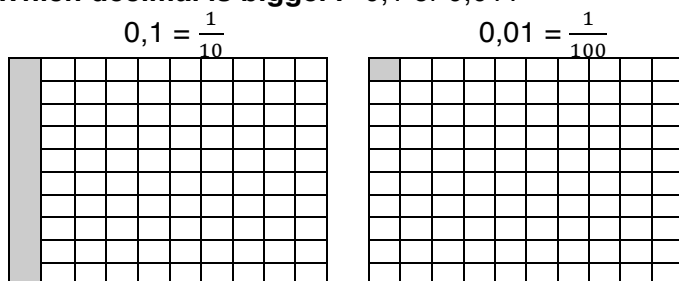
You need to understand place value when you deal with decimal values.

What does 536,247 mean? The digits after the comma represent fractions less than one unit written as tenths, hundredths and thousandths.

hundreds	tens	units	,	tenths	hundredths	thousandths
100s	10s	1s	,	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1\,000}$
5	3	6	,	2	4	7

So 536,247 means $5 \times 100 + 3 \times 10 + 6 \times 1 + 2 \times \frac{1}{10} + 4 \times \frac{1}{100} + 7 \times \frac{1}{1\,000}$

Which decimal is bigger? 0,1 or 0,01?



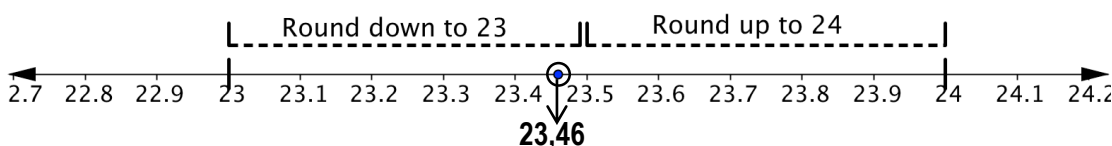
From the diagrams we see that $0,1 > 0,01$
Similarly $0,01 > 0,001$
And $0,001 > 0,0001$

So when we compare decimals, we must look at their place value.

35,2 is bigger than 35,098 (2 tenths is bigger than no tenths) $35,\underline{2} > 35,\underline{0}98$

Rounding decimals

Example 1: Round off 23,46 to the nearest whole number.



Look at the digit to the right of units (whole numbers) in the tenths place of 23,46.

It is 4 which is less than 5 (the half-way point), so we round down to 23.

Example 2: Round 23,46 to the nearest tenth.

Look at the digit to the right of the tenths i.e. in the hundredth place of 23,46.

It is 6, which is bigger than 5 (the halfway point), so we round up to 23,5.

Example 3: Round 23,5 to the nearest whole number.

Although 23,5 is exactly half way between 23 and 24 by convention when we have a “5” we round **up** so the answer will be 24. Similarly 23,75 rounded to the nearest tenth will be 23,8.

Converting decimals

a) We can rewrite a decimal as a fraction using our knowledge of place value:

$$0,62 = \frac{6}{10} + \frac{2}{100} = \frac{60}{100} + \frac{2}{100} = \frac{62}{100}. \text{ The fraction } \frac{62}{100} \text{ can be simplified to } \frac{31}{50}.$$

b) A fraction can be written as a decimal by writing it with a denominator of 10; 100

$$\text{or } 1\,000. \text{ So } \frac{1}{4} = \frac{25}{100} = 0,25.$$

If it is difficult to rewrite a fraction with a denominator of 10; 100 or 1 000, then you can convert it using division.



Worked example:

$$\frac{1}{8} = 1 \div 8 = \begin{array}{r} 0,125 \\ 8 \overline{)1,000} \end{array} = 0,125$$

Adding and subtracting decimals

Add or subtract decimals in the same way as we did for whole numbers. Line up the numbers carefully according to place value.



Example 1:

$$26,473 + 18,25 = 44,723$$

$$\begin{array}{r} \overset{1}{2} \ 6 \ , \ \overset{1}{4} \ 7 \ 3 \\ + \ 1 \ 8 \ , \ 2 \ 5 \ 0 \\ \hline 4 \ 4 \ , \ 7 \ 2 \ 3 \end{array}$$

We 'carry' as we did for whole numbers

Example 2:

$$15,03 - 2,751 = 12,279$$

$$\begin{array}{r} \overset{1}{1} \ \overset{4}{5} \ , \ \overset{9}{0} \ \overset{12}{3} \ \overset{10}{0} \\ - \ \quad \ 2 \ , \ 7 \ 5 \ 1 \\ \hline 1 \ 2 \ , \ 2 \ 7 \ 9 \end{array}$$

Align the place value columns by lining up the commas.

15,03 can be written as 15,030

We 'borrow' as we did for whole numbers

Multiplying and dividing decimals by 10, 100 or 1 000

Our number system is based on the number 10, so multiplying or dividing by 10, 100 or 1 000 just shifts the place value.

- Each time you multiply by a 10, the digits shift up one decimal place.
Moving the comma one place to the right will shift the digits up one decimal place.
- Each time you divide by a 10, the digits shift down by one decimal place.
Moving the comma one place to the left will shift the digits up one decimal place.

Examples:

$$2,03 \times 10 = 20,3$$

$$34,12 \div 10 = 3,412$$

For 10, move one place.

$$531,289 \times 100 = 53128,9$$

$$531,289 \div 100 = 5,31289$$

For 100, move 2 places.

Multiplying decimals

Multiply each decimal by a power of 10, to get rid of the comma. After calculating the answer, correct for this and divide by the same power of 10.



Example: $0,02 \times 7,4$

$$\begin{array}{r} 0,02 \times 7,4 \\ \downarrow \quad \downarrow \\ \times 100 \quad \times 10 \\ \hline 2 \times 74 \end{array}$$

Multiply 0,02 by 100 and 7,4 by 10 to get rid of the decimals.

Divide 148 by 100 and by 10 to make the final answer correct

$$2 \times 74 = 148 \rightarrow \boxed{\div 100} \rightarrow \boxed{\div 10} \rightarrow 0,148$$

We can summarise what we have done as follows

$$\text{Multiply } 2 \times 74 = 148$$

and so

$$0,02 \times 7,4 = 0,148$$

$\underbrace{\quad\quad}_{2 \text{ places}} \quad \underbrace{\quad}_{1 \text{ place}} \quad \underbrace{\quad\quad\quad}_{3 \text{ places}}$

Dividing decimals

- First write the division of decimals as a fraction.
- Then multiply top and bottom by a power of 10 – choose these to make the denominator a whole number.

Example:

$$6,51 \div 0,3$$

$$= \frac{6,51}{0,3} = \frac{6,51 \times 10}{0,3 \times 10} = \frac{65,1}{3} = 21,7$$

Multiply numerator and denominator by the same number to make denominator a whole number.

Percentages

$$x\% = \frac{x}{100}$$

Percent means 'out of 100'

Converting between fractions, decimals and percentages



Worked examples:

a) Convert 25% to a fraction in simplest form.

$$25\% = \frac{25}{100}$$

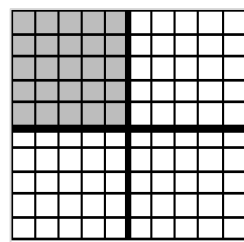
$$= \frac{1}{4}$$

1

Rewrite % as 'out of 100'.

2

Simplify fraction. Divide top and bottom by the common factor of 25.



b) Convert 0,3 to a percentage.

$$0,3 = \frac{3}{10}$$

1

Rewrite decimal as a fraction.

2

Make an equivalent fraction with a denominator of 100.

$$= \frac{3}{10} \times \frac{10}{10} = \frac{30}{100}$$

$$= 30\%$$

3

Rewrite it as a percentage.

Calculating a percentage of an amount

To calculate $x\%$ of an amount, use

$$\frac{x}{100} \times \text{the amount}$$



Worked example:

$$20\% \text{ of R75} = \frac{20}{100} \times \text{R75}$$

$$= \frac{20}{100} \times \frac{\text{R75}}{1}$$

$$= \frac{1 \cancel{20} \times 75}{5 \cancel{100} \times 1}$$

$$= \frac{\text{R75}}{5} = \text{R15}$$

Finding what percentage a part of a whole is

To find what percentage a part (x) is of a whole (y), we want the fraction

$$\frac{x}{y} \text{ of } 100\%$$



Worked example:

21 learners out of the 420 learners in a school sing in the choir.

What percentage of the learners sings in the choir?

$$\left(\frac{21}{420} \text{ of } 100 \right) \%$$

$$= \left(\frac{21}{420} \times \frac{100}{1} \right) \%$$

$$= \left(\frac{1 \cancel{21}}{20 \cancel{420}} \times \frac{100}{1} \right) \%$$

$$= \frac{100}{20} \% = 5\%$$

Calculating percentage increase or decrease

To find the percentage by which something has increased or decreased we calculate

$$= \left(\frac{\text{new amount} - \text{original amount}}{\text{original amount}} \times 100 \right) \%$$



Worked example:

The number of learners taking maths drops from 500 to 470.

What percentage of the learners drop maths?

$$\% \text{ decrease} = \left(\frac{\text{new amount} - \text{original amount}}{\text{original amount}} \times 100 \right) \%$$

$$= \left(\frac{470 - 500}{500} \times 100 \right) \% = -6\%$$

The negative shows that this is a decrease in percentage, not an increase.

Increase or decrease by a percentage

→ To increase an amount by $x\%$, you add $x\%$ of the amount to the amount.

$$\text{amount} + x\% \text{ of amount} = \text{amount} + \frac{x}{100} \times \text{amount} = \left(1 + \frac{x}{100} \right) \times \text{amount}$$

→ To decrease an amount by $x\%$, you subtract $x\%$ of the amount to the amount

$$\text{amount} - x\% \text{ of amount} = \text{amount} - \frac{x}{100} \times \text{amount} = \left(1 - \frac{x}{100} \right) \times \text{amount}$$



Worked examples:

1. The price of milk was R11, but is increased by 5%. What is the new price of milk?

$$\begin{aligned} \text{New price} &= \text{R11} + 5\% \text{ of R11} = \text{R11} + \frac{5}{100} \times \text{R11} \\ &= \left(1 + \frac{5}{100} \right) \times \text{R11} = (1,05) \times \text{R11} = \text{R11,55} \end{aligned}$$

If an amount is increased by 5%, you multiply by 1,05.
If the amount was increased by 43% you would multiply by 1,43.

2. You get a discount of 25% on a shirt that costs R400.

How much do you pay for the shirt?

$$\begin{aligned} \text{New price} &= \text{R400} - 25\% \text{ of R400} = \text{R400} - \frac{25}{100} \times \text{R400} \\ &= \left(1 - \frac{25}{100} \right) \times \text{R400} = (0,75) \times \text{R400} = \text{R300} \end{aligned}$$

Percentage back to whole

$$\text{If } x\% = \text{an amount} \quad \text{then } 1\% = \frac{\text{amount}}{x} \quad \text{so } 100\% = \frac{\text{amount}}{x} \times 100$$

$$\begin{array}{ccc} \div x & x\% = \text{an amount} & \div x \\ \times 100 & 1\% = \frac{\text{amount}}{x} & \times 100 \\ & 100\% = \frac{\text{amount}}{x} \times 100 & \end{array}$$



Worked example:

30% of my class is boys. There are 12 boys in my class. How big is my class?

$$30\% = 12 \text{ learners} \quad 1\% = \frac{12}{30} \quad \text{so } 100\% = \frac{12}{30} \times 100 = 40 \text{ learners}$$

There are 40 learners in my class.

Ratio and rate

Ratio A ratio compares two quantities *of the same kind* (e.g. people, cups, kilometres etc)

Example:

In a recipe I use 3 cups of milk for every 2 cups of flour. This tells us the ratio of milk to flour. We can write the ratio in different ways:

3 to 2

3 : 2

$\frac{3}{2}$

Equivalent ratios

Ratios can be written as fractions. Equivalent ratios are equal, but the numbers in the top and bottom of the fractions are different. To find equivalent ratios, we can multiply or divide each number in the ratio by the same amount.

Example:

The ratios $\frac{12}{16}$, $\frac{3}{4}$ and $\frac{15}{20}$ are equivalent.

$$\begin{array}{c} \div 4 \left(\begin{array}{cc} 12 & : & 16 \\ 3 & : & 4 \end{array} \right) \div 4 \\ \times 5 \left(\begin{array}{cc} 15 & : & 20 \end{array} \right) \times 5 \end{array}$$

Part-part ratios:



Worked example:

At a camp, there is a ratio of children to adults of 5 : 2.

If there are 30 children at the camp, how many adults are there?

$$\times 6 \left(\begin{array}{cc} 5 & : & 2 \\ 30 & : & ? \end{array} \right) \times 6$$

The number of adults is $2 \times 6 = 12$.

Part-whole ratios:



Worked example:

At a camp there is a 5 : 2 ratio of children to adults. If there are 140 people at the camp altogether, how many children and how many adults are there?

We know that for every 5 children there are 2 adults.

So there are 5 children in every group of $5 + 2 = 7$ people.

$$\begin{array}{c} \text{children : people} \\ \times 20 \left(\begin{array}{cc} 5 & : & 7 \\ ? & : & 140 \end{array} \right) \times 20 \end{array}$$

So the number of children = $5 \times 20 = 100$.

The number of adults = $140 - 100 = 40$.

Rate

A rate is similar to a ratio, but a rate compares two *different* kinds of quantities.

Example:

A car can travel 26 km on 2 litres of petrol. How far will it travel on 6 litres of petrol?

$$\times 3 \left(\begin{array}{cc} 26 \text{ km} & : & 2 \text{ litres} \\ ? & : & 6 \text{ litres} \end{array} \right) \times 3$$

The distance the car can travel will be $26 \times 3 = 78$ km

Using unit ratios and rates

Sometimes it is not easy to see what number to multiply by to get the equivalent ratio we want. It helps to find a unit ratio or rate (a ratio or rate with 1 in it) first and then get the ratio we want.



Worked example:

A factory produces 261 boxes in 3 hours. If the factory produces boxes at that rate, how long will it take them to make 870 boxes?

$$\begin{pmatrix} 261 \text{ boxes} : 3 \text{ hours} \\ 870 \text{ boxes} : ? \text{ hours} \end{pmatrix}$$

It is not easy to see what we've multiplied by so we will first make a ratio with 1.

The time taken to make 1 box

$$\div 261 \begin{pmatrix} 261 \text{ boxes} : 3 \text{ hours} \\ 1 \text{ box} : \frac{3}{261} \text{ hours} \end{pmatrix} \div 261$$

The time taken to make 870 boxes:

$$\times 870 \begin{pmatrix} 1 \text{ box} : \frac{3}{261} \text{ hours} \\ 870 \text{ boxes} : \frac{3}{261} \times 870 \text{ hours} \end{pmatrix} \times 870$$

So it will take $\frac{3}{261} \times 870 = 10$ hours

Direct and indirect proportion

Direct proportion – two quantities are *directly proportional* if they have a constant quotient (the answer when you divide).



Worked example:

Distance (km)	60	120	180	210	240
Time (hours)	1	2	3	3,5	4

$\frac{\text{distance}}{\text{time}}$ gives the *constant*
speed of 60 km/h.

$$\frac{60}{1} = \frac{120}{2} = \frac{180}{3} = \frac{210}{3,5} = \frac{240}{4} = 60 \text{ km/h} \rightarrow \frac{\text{distance}}{\text{time}} \text{ is constant.}$$

The distance travelled *increases* in *direct proportion* to the time. As the time increases, the distance also increases.

Indirect (inverse) proportion – two quantities are indirectly or inversely proportional if they have a constant product (the answer when you multiply).



Worked example:

It takes 24 days for 1 worker to paint a factory. The table shows the number of days it takes depending on how many workers are employed.

Number of days	24	12	8	4	2
Number of workers	1	2	3	6	12

$$24 \times 1 = 12 \times 2 = 8 \times 3 = 4 \times 6 = 2 \times 12 = 24 \rightarrow \text{no days} \times \text{no workers is constant}$$

The number of days to paint the factory *decreases* as the number of workers employed *increases*.

The number of days and number of workers are *indirectly proportional*.

Percentages, decimals and fractions to know

There are some fractions, decimals and percentages that occur frequently. It is worth being able to recognize these instantly.

Fraction	Decimal	Percentage	Ratio	Words (example)
$\frac{1}{2}$	0,5	50%	1 : 2	1 out of every 2 people are overweight 50% of the people are overweight
$\frac{1}{4}$	0,25	25%	1 : 4	1 in 4 people wear glasses $\frac{1}{4}$ of the people wear glasses
$\frac{3}{4}$	0,75	75%	3 : 4	3 out of every 4 cars are white 0,75 of the cars are white
$\frac{1}{3}$	0,333...	33,33...%	1 : 3	1 in 3 children are malnourished About 33% of children are malnourished
$\frac{2}{3}$	0,666...	66,66...%	2 : 3	2 out of 3 learners speak isiZulu $\frac{2}{3}$ of the learners speak isiZulu
$\frac{1}{5}$	0,2	20%	1 : 5	She has a 1 in 5 chance of being chosen The probability of her being chosen is 0,2
$\frac{1}{10}$	0,1	10%	1 : 10	He got 1 out of 10 for the test He got 10% for the test
$\frac{1}{20}$	0,05	5%	1 : 20	1 out of every 20 children play tennis $\frac{1}{20}$ of the children play tennis
$\frac{1}{8}$	0,125	12,5%	1 : 8	1 out of every 8 rooms are vacant. 12,5% of the rooms are vacant
$\frac{3}{8}$	0,375	37,5%	3 : 8	She has a 3 in 8 chance of winning The probability of her winning is 0,375
$\frac{5}{8}$	0,625	62,5%	5 : 8	She has a 5 in 8 chance of winning The probability of her winning is 62,5%

Exponents

Exponential notation

We use exponents to represent repeated multiplication of a number.

The exponent of a number shows how many times to multiply the base by itself.

$$7^4 = 7 \times 7 \times 7 \times 7$$

Useful squares, cubes, square roots and cube roots

These are used often, so you should know them. Then you won't need to calculate them each time you use them.

$1^2 = 1$	$\sqrt{1} = 1$	$7^2 = 49$	$\sqrt{49} = 7$	$1^3 = 1$	$\sqrt[3]{1} = 1$	
$2^2 = 4$	$\sqrt{4} = 2$	$8^2 = 64$	$\sqrt{64} = 8$	$2^3 = 8$	$\sqrt[3]{8} = 2$	
$3^2 = 9$	$\sqrt{9} = 3$	$9^2 = 81$	$\sqrt{81} = 9$	$3^3 = 27$	$\sqrt[3]{27} = 3$	
$4^2 = 16$	$\sqrt{16} = 4$	$10^2 = 100$	$\sqrt{100} = 10$	$4^3 = 64$	$\sqrt[3]{64} = 4$	
$5^2 = 25$	$\sqrt{25} = 5$	$11^2 = 121$	$\sqrt{121} = 11$	$5^3 = 125$	$\sqrt[3]{125} = 5$	
$6^2 = 36$	$\sqrt{36} = 6$	$12^2 = 144$	$\sqrt{144} = 12$	$6^3 = 216$	$\sqrt[3]{216} = 6$	

Scientific notation

Scientific notation uses a shorter way of writing very large or very small numbers. Numbers are converted to a decimal number, with a one-digit whole number (1 to 9), multiplied by a power of 10 with a positive or negative exponent.

Examples:

1. $4\ 000 = 4 \times 1\ 000 = 4 \times 10^3$

2. $4\ 060 = 4,06 \times 10^3$

3. $0,07$ is $7 \times 0,01 = 7 \times 10^{-2}$

4. $0,076 = 7,6 \times 10^{-2}$

5. $1\ 303\ 000\ 000 = 1,303 \times 10^9$

The whole number is 4. There are 3 places after the 4, so the exponent is 3.

Make 7 the whole number. 7 is 2 places after the decimal comma, so the exponent is negative 2.

9 places after the 1, so the exponent is 9

Laws of operations when working with exponents

When you calculate with numbers that have exponents, you need to use the following order of operations:

Brackets Exponents Division Addition
Multiplication Subtraction

Remember:

Use BEDMAS and if there is only division and multiplication then just work from left to right. If there is only addition and subtraction in the calculation, then just work from left to right.



Worked example:

$$3 + 6^2 \div 4 - (\sqrt[3]{27} + 1)$$

$$= 3 + 6^2 \div 4 - (3 + 1)$$

$$= 3 + 36 \div 4 - 4$$

$$= 3 + 9 - 4 = 8$$

- Deal with cube root in bracket first
- Calculate the Exponent and $3 + 1$ in bracket
- Divide and then Add and Subtract

Perimeter and Area

Perimeter:

The perimeter is total **distance around** any closed 2-D shape.

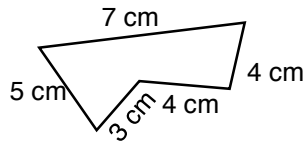
The perimeter is measured in metres (m), millimetres (mm), centimetres (cm) or kilometres (km).

Converting units

1 km = 1 000 m
1 m = 100 cm
1 cm = 10 mm



Example:

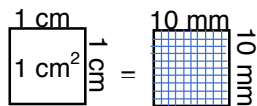


Perimeter of shape
= 5 + 7 + 4 + 4 + 3 = 23 cm

Area: Area is the size of the surface of a flat 2-D shape. So area is the number of **square units** that fit **onto** a shape.

Area is measured in square metres (m²), square millimetres (mm²), square centimetres (cm²) or square kilometres (km²).

Converting square units

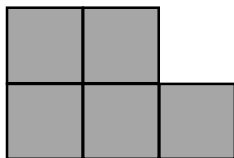


1 cm² = 10 mm × 10 mm = 100 mm²
1 m² = 100 cm × 100 cm
= 10 000 cm²
1 km² = 1 000 × 1 000 = 1 000 000 m²

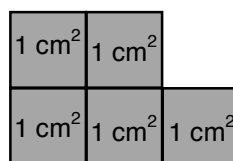


Worked example:

Find the area and perimeter of the shape. Each small square has sides of 1 cm.

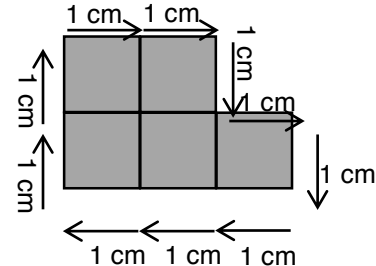


Area



Area of shape = 5 cm²

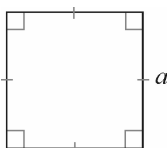
Perimeter



Perimeter of shape = 10 cm

Formulas to calculate perimeter and area of square and rectangle

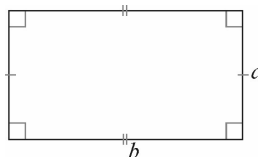
Square



Perimeter = 4 × length = 4a

Area = length × length = a²

Rectangle



Perimeter = 2a + 2b

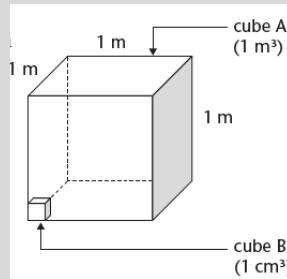
Area = length × breadth = ab

3D shapes and volume

- Volume measures the *amount of space* occupied by a 3D object.
- We use cubes (or cubic units) as the unit to measure volume.
A cube with edges of 1 cm has a volume of 1 cubic centimetre (cm^3)

Why is $1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$?

The big cube (A) has edge lengths of 1 m and the small cube (B) has edge lengths of 1 cm. We can fit 100 small cubes along the length of the big cube, and along the breadth and along the height.
So total 1 cm^3 cubes in 1 m^3
 $= 100 \times 100 \times 100 = 1\,000\,000$



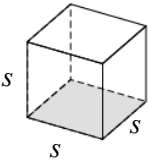
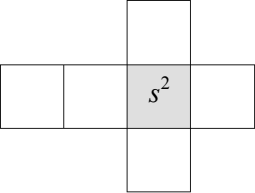
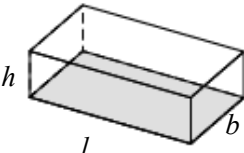
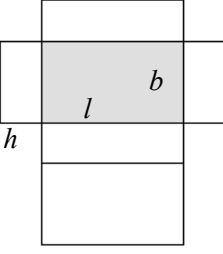
Units of measurement

$$1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3 \quad 1 \text{ cm}^3 = 0,000001 \text{ m}^3$$

$$1 \text{ cm}^3 = 1\,000 \text{ mm}^3 \quad 1 \text{ mm}^3 = 0,001 \text{ cm}^3$$

$$1 \text{ litre (l)} = 1\,000 \text{ cm}^3$$

$$1 \text{ kilolitre (kl)} = 1\,000 \text{ l} = 1\,000\,000 \text{ cm}^3$$

3D object: right prisms	Net	Surface area	Volume
A right prism is a geometric solid that has a polygon as its base and vertical sides perpendicular to the base. The base and top surface are the same shape and size.	The net of a solid is a picture of the solid when it is “unfolded” and laid flat.	The surface area of a solid is the sum of the areas of all its faces (or outer surfaces). So we can add up the area of all the shapes in the net of the solid	Volume measures the amount of space an object takes up. Volume of a right prism $= \text{area of base} \times \text{height}$
Cube has a square base s = length of sides 		Surface area $= 6 \times \text{area of square}$ $= 6s^2$	Volume $= \text{area of square} \times \text{height}$ $= s^2 \times s$ $= s^3$
Rectangular prism has a  rectangle as base l = length of rectangle b = breadth of rectangle h = height of prism		Surface area $= 2$  $+ 2$  $+ 2$  $= 2 \times l \times b + 2 \times b \times h + 2 \times l \times h$ $= 2lb + 2bh + 2lh$	Volume $= \text{area of rectangle} \times \text{height}$ $= l \times b \times h$ $= lbh$

Data

Measures of central tendency:

- ✓ **Mean:** The sum of all the data values divided by the number of data values.
- ✓ **Median:** The middle value of the data when it is ordered from smallest to largest. When there is an even number of values in the data set, the median lies halfway between the middle two values. Add these two values and divide by 2.
- ✓ **Mode:** The data value that occurs most often in the data set.

Measures of spread (dispersion):

Range: The range tells you whether a data set is spread out or not.

$$\text{Range} = \text{highest value} - \text{lowest value}$$



Worked example:

The marks for the class of 16 learners for a Mathematics test are ordered from smallest to largest:

3; 15; 16; 16; 18; 20; 21; 22; 27; 27; 27; 27; 31; 35; 40; 42; 43

Mean:
$$\frac{3+15+16+16+18+20+21+22+27+27+27+27+31+35+40+42+43}{16} = \frac{403}{16} = 25,2 \text{ (to one d.p.)}$$

Median: 3; 15; 16; 16; 18; 20; 21; **22; 27**; 27; 27; 31; 35; 40; 42; 43

There are two values in the middle: 22 and 27 so median = $\frac{22+27}{2} = 24,5$

Mode: 27

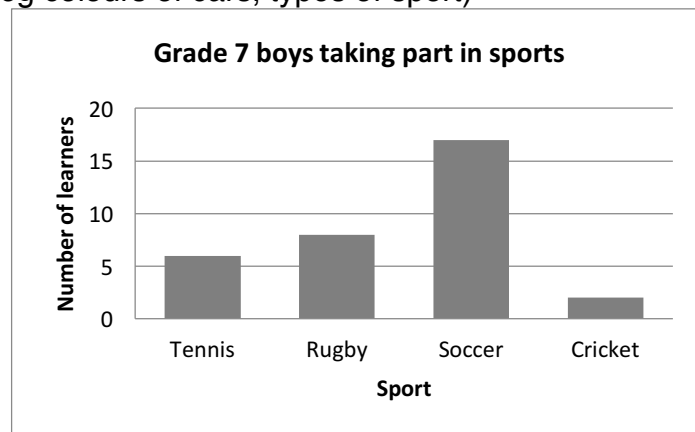
Range = highest value – lowest value
= 43 – 3 = 40

Graphs.

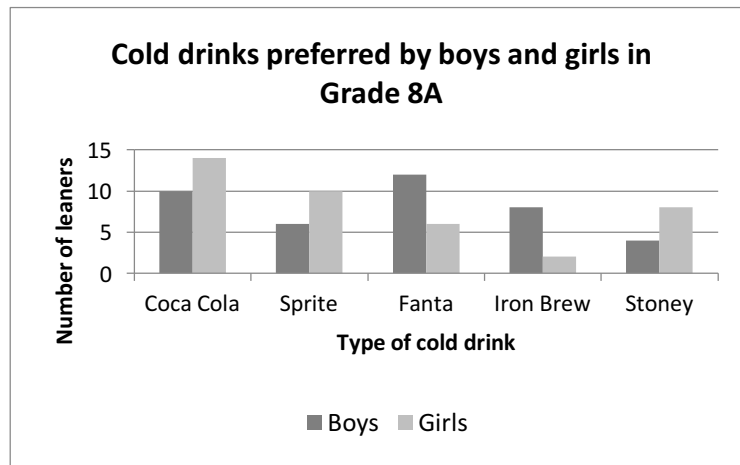
You will need to be able to interpret information provided in different types of graphs.

A. Bar graphs:

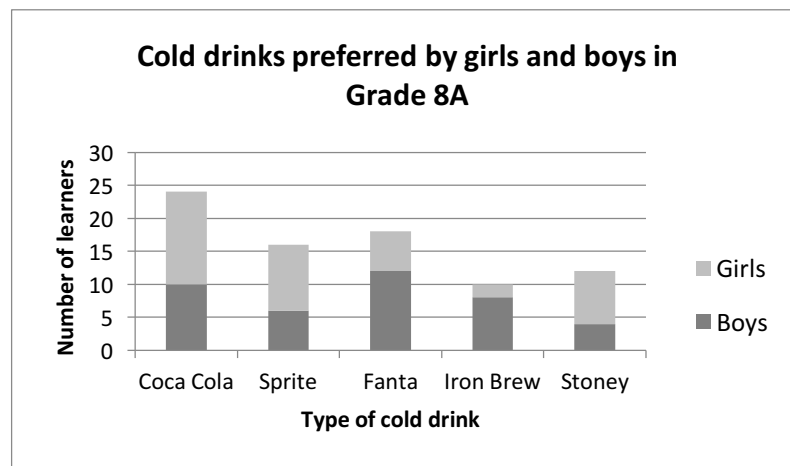
Bar graphs are used for discrete data (eg number of learners) or for data in categories (eg colours of cars, types of sport)



Double bar graph:

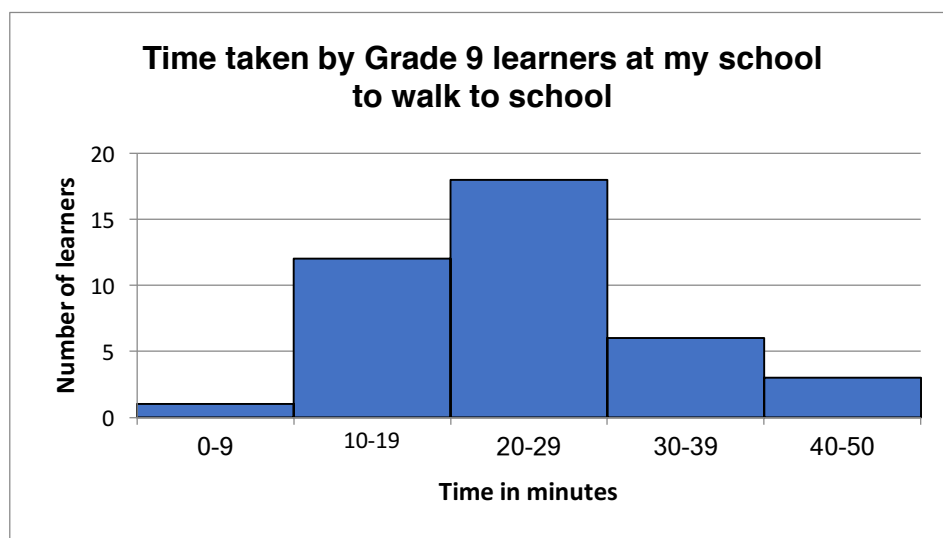


Stacked bar graph



B. Histograms:

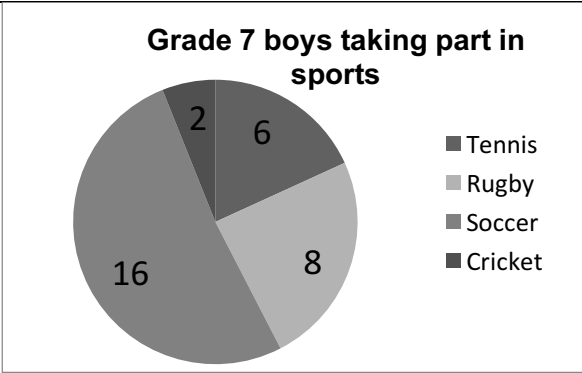
Histograms are used for continuous data which in groups or intervals. This data is not restricted to whole numbers e.g. temperature of heating water)



C. Pie charts:

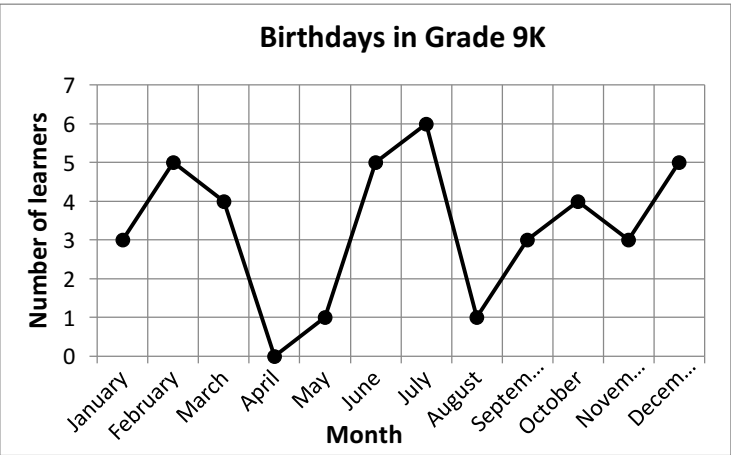
Pie charts can be used for data in categories. You can compare the size of each category with the total of all the data.

Sport	Frequency	
Tennis	6	$\frac{6}{32} = \frac{3}{16}$
Rugby	8	$\frac{8}{32} = \frac{4}{16}$
Soccer	16	$\frac{16}{32} = \frac{8}{16}$
Cricket	2	$\frac{2}{32} = \frac{1}{16}$
Total	32	



D. Broken line graphs:

A broken line graph is used for data in categories where the categories are related to each other or follow on from each other. For example, the categories might be consecutive times, days, months or years.

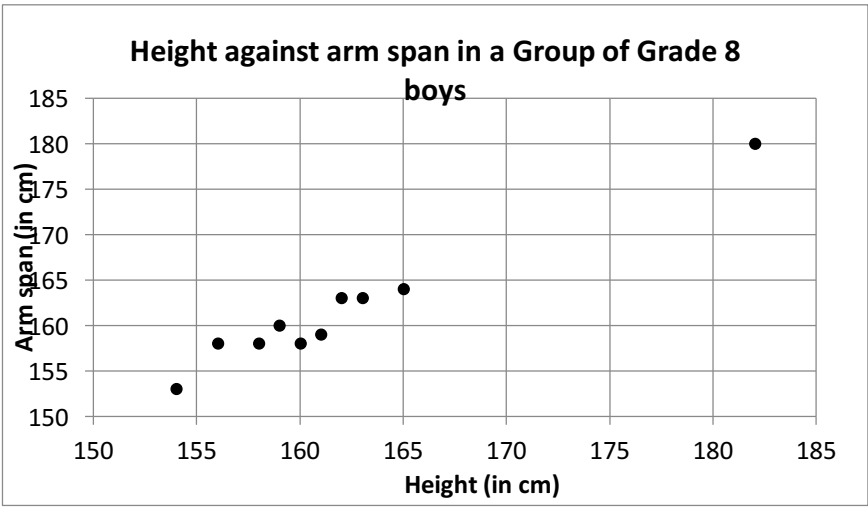


might be consecutive times, days, months or years.

Note: In these graphs the line does not indicate continuity between the categories. Its purpose is to highlight the trend of the data.

E. Scatter plots:

Scatter plots are used to graph data points that have two values associated with them. Data values have two independent measurements. e.g. Grade 8 boys who measure their arm span and their height.

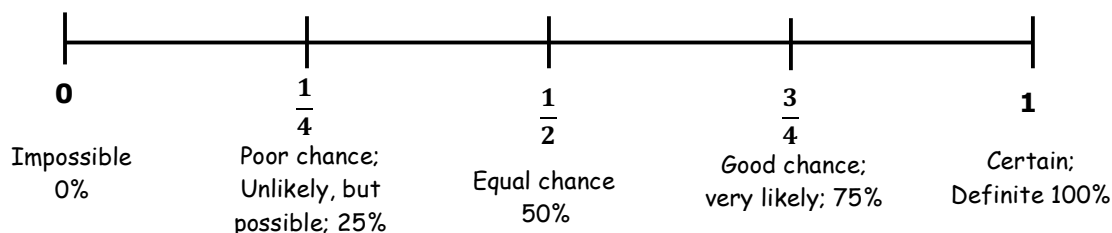


Probability

Probability is the study of how likely it is that an event will happen.

- ✓ Probability always lies between 0 and 1, measured as a fraction or as a decimal. It can also be shown as a percentage between 0% and 100%.

We can show probability on a scale:



- ✓ We can work out the **probability** using the formula: $\frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}}$
- ✓ We can show probability as a common fraction, a decimal fraction or a percentage eg A probability of 5 out of 8 can be written as $\frac{5}{8}$ or as 0,625 or as 62,5%



Examples:

If a dice is rolled, the probability of getting a 5 is 1 out of 6.

We can write this as $P(5) = \frac{1}{6}$ or as $P(5) = 0,167$ or as $P(5) = 16,7\%$.



Probability questions sometimes refer to dice, coins or cards. Make sure you know that:

- ✓ When throwing a dice, there are 6 possible outcomes (1; 2; 3; 4; 5; 6)
- ✓ A coin has 2 sides, heads and tails



Cards:

- ✓ There are 52 cards in a pack of cards.
- ✓ A pack of cards has 4 suits with 13 card values in each suit. So there are 4 cards of each value (i.e. there are 4 twos, threes, fours etc in a pack)
- ✓ The four suits are diamonds (red), spades (black), hearts (red) and clubs (black).
- ✓ The card values in each suit are 2; 3; 4; 5; 6; 7; 8; 9; 10; Jack; Queen; King; Ace.



Worked examples:

1. Bongani flips a coin 10 times and it lands on heads 4 times.

The relative frequency of heads for this experiment is $\frac{4}{10} = 0,4$ or 40%.

2. Bongani flips a coin 100 times and each time, he records H for heads or T for tails. His record shows that he flipped heads 55 times.

So the relative frequency of heads is $\frac{55}{100}$ or 0,55 or 55%.

This is closer to 50% which is what we expected.

3. As Bongani flips the coin more times, he will get a relative frequency closer and closer to 50%.

Probabilities for compound events:

Using probability, we can also work out the chances of two events happening.

Tables

You can show the number of possible outcomes for two events happening one after the other using tables.



Worked example:

A coin is tossed two times. What is the probability of getting two heads?

		Flip 2	
		H	T
Flip 1	H	HH	HT
	T	TH	TT

The probability of two heads is 1 out of 4, or $\frac{1}{4}$

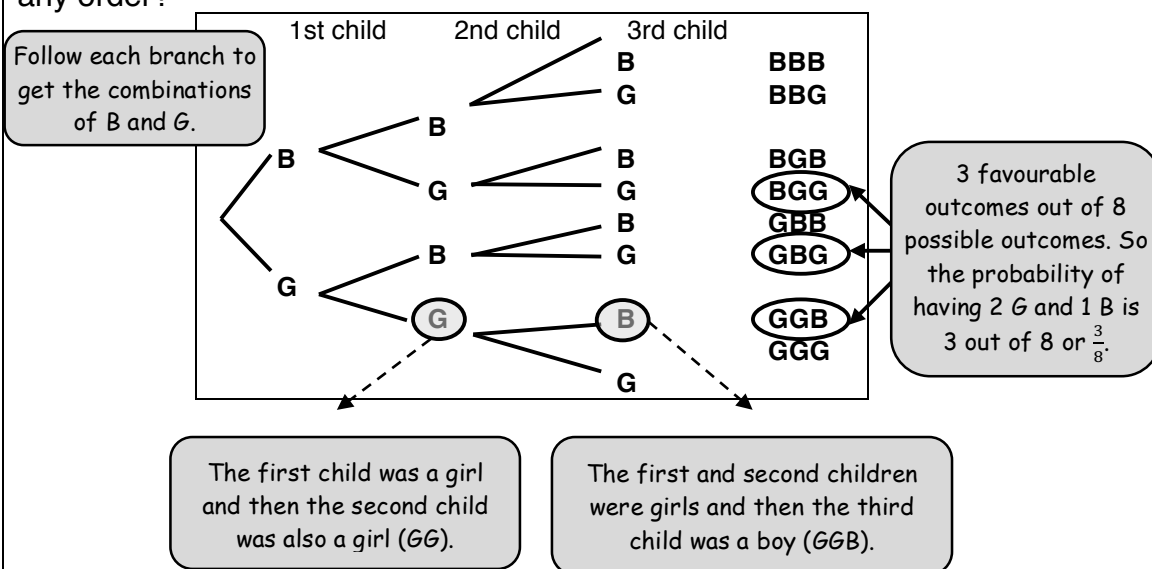
Tree diagrams

In a tree diagram, you can list all the possible outcomes for an experiment.



Example:

In a family of 3 children, what is the probability of having 2 girls (G) and 1 boy (B) in any order?



Testlet 1

1. Calculate $(5 - 3 + 2 \times 6) \div 0,1$

A) 140

B) 1,4

C) 0

D) 240

2. I am planning a trip to Gaborone in Botswana.

I have a scale map with scale 1: 2 000 000

I measure the distance from Johannesburg to Gaborone on the map. It is 14 cm

i) What is the actual distance between Johannesburg and Gaborone?

A) 280 km

B) 700 km

C) 2800 km

D) 28 000 000 km

ii) The exchange rate is R1 = 0,8 pula

If I exchange R300, how many pula will I get? (You do not need to consider bank charges/commissions)

A) 400 pula

B) 375 pula

C) 240 pula

D) 200 pula

iii) If I want to have 1000 pula, how many rands will I need to exchange. (You do not need to consider bank charges/commissions)

A) R1250

B) R1000

C) R800

D) R2000

3. The table below, taken from the Stats SA General Household Survey of 2016, shows the different kinds of educational institutions that people are attending in each province.

Table 4: Percentage of persons aged 5 years and older who are attending educational institutions by province and type of institution attended, 2016

Type of institution	Province (per cent)									
	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Pre-school	4,4	2,4	4,8	4,4	3,2	2,9	5,2	3,8	1,3	3,5
School	83,6	90,9	89,7	86,0	90,4	89,1	77,1	87,9	92,9	86,9
AET	0,4	0,8	0,3	1,4	0,4	0,6	0,8	0,5	0,5	0,6
Literacy classes	0,1	0,1	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,0
Higher education institutions	6,8	2,2	1,7	4,6	3,6	4,1	9,9	2,9	1,8	4,8
TVET	1,3	2,2	2,3	2,4	1,2	2,1	3,4	3,7	2,7	2,3
Other colleges	1,9	1,3	1,0	1,2	0,9	0,9	2,5	1,1	0,7	1,4
Home Schooling	1,1	0,1	0,0	0,0	0,1	0,0	0,2	0,0	0,0	0,2
Other	0,4	0,1	0,2	0,1	0,3	0,4	0,9	0,1	0,1	0,4
Subtotal (thousands)	1 541	2 315	320	806	3 430	1 026	3 327	1 310	2 034	16 108
Unspecified (thousands)	9	12	3	3	23	7	39	3	15	115
Total (thousands)	1 550	2 327	323	809	3 453	1 033	3 366	1 313	2 049	16 222

Unspecified was excluded from the denominator when calculating percentages

i) The province with the largest NUMBER of learner in TVET institutions is?

A) MP

B) LP

C) GP

D) KZN

ii) Approximately how many learners in WC were attending Home Schooling institutions?

A) 17 000

B) 170

C) 170 000

D) 17

iii) Approximately what percentage of persons in RSA aged 5 years and older attending educational institutions are in GP

A) 30%

B) 20%

C) 10%

D) 40%

4. A class of 30 learners wrote a maths test.

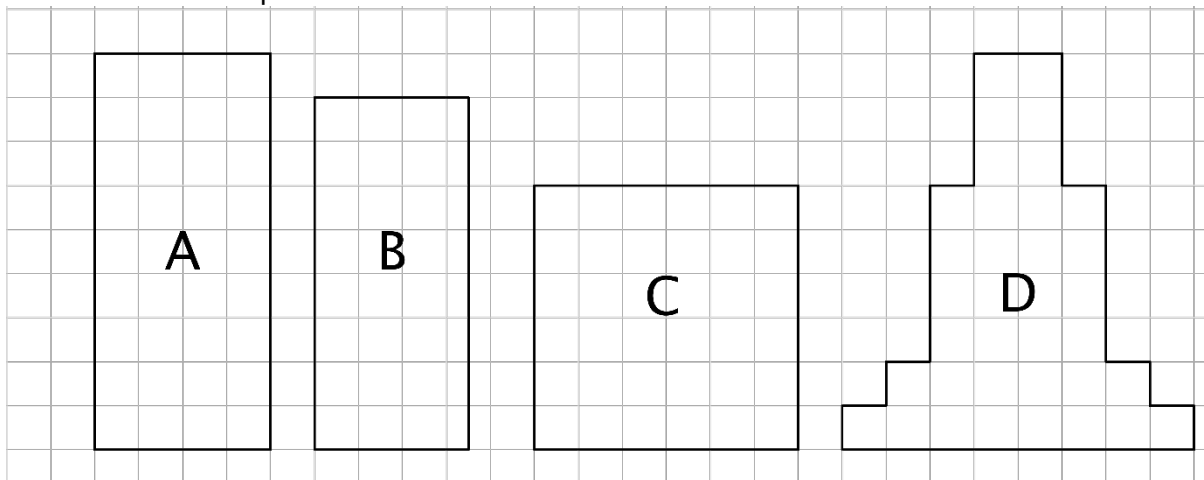
20 of the learners scored 50% or less for the test. The remaining 10 learners got 90% or above for the test.

- i) By eliminating the values it could not be, decide on a possible value for the median.
A possible value for the median is:
A) 45% B) 75% C) 65% D) 55%
- ii) If the sum of the marks of all 20 learners who scored under 50% for the test is 800. And the 10 learners who got 90% or above all got 97%, the mean mark for the class is:
A) 59% B) 62% C) 73% D) 50%

5. The price of a new car was increased by 10% in March and then by a further 10% in June. By what percentage has the price increased in total?

- A) 20% B) 21% C) 25% D) 22%

6. Consider the shapes shown below



- i) If the rectangle B has a breadth of 3,5 cm and a length of 8 cm , what is its area?
A) 12,5 cm² B) 23 cm² C) 28 cm² D) 30 cm²
- ii) Arrange the shapes in descending order of perimeter size:
A) D: A: C: B B) C; A: D: B C) A; C; D; B D) D; C; A; B

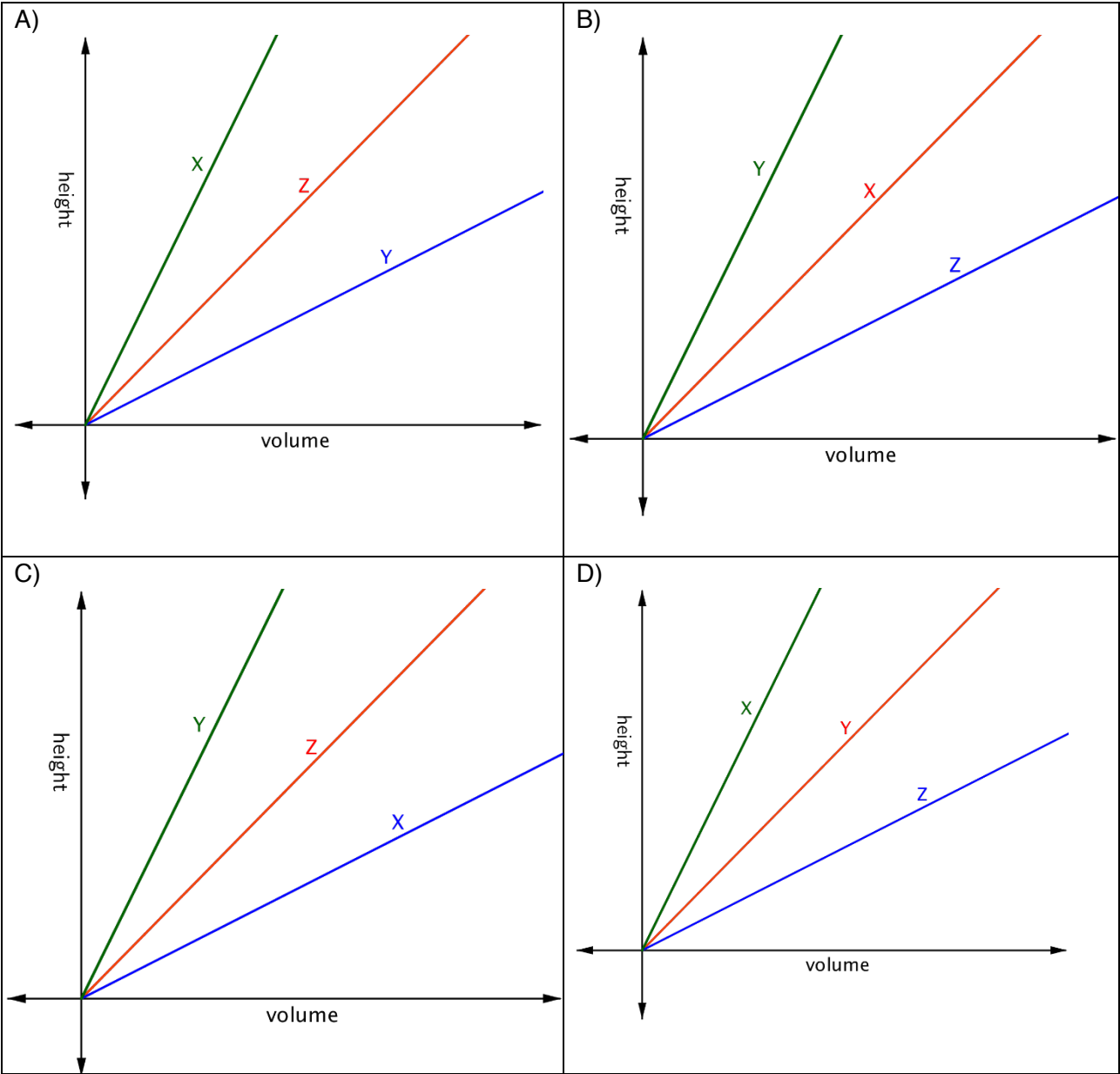
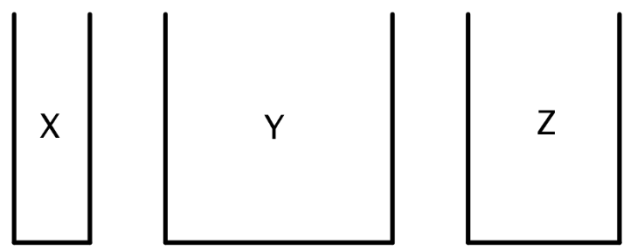
7. In my class of 40 learners, 20 learners play soccer, 5 learners play tennis and 12 learners play basketball. If a learner from my class is picked at random, what is the probability that the learner does NOT play basketball?

- A) 0,28 B) 0,7 C) 0,5 D) 0,12

8. According to the Stats SA household survey of 2016, the population in the Western Cape grew from 4 951 000 people in 2003 to 6 017 000 in 2013 and then to 6 362 000 in 2016.

- i) By what percentage (approximately) did the population of the Western Cape grow between 2003 and 2013?
A) 16% B) 20% C) 30% D) 10%
- ii) At what average rate (people/year) did the population of the Western Cape grow between 2013 and 2016?
A) 55 people/year B) 2 000 000 people/year
C) 200 000 people/year D) 115 000 people/year

9. Water is being dripped into each of the beakers (X; Y and Z) at the same steady rate. Select the graph that best shows the relationship between the volume of water and the height of the water in the 3 beakers.

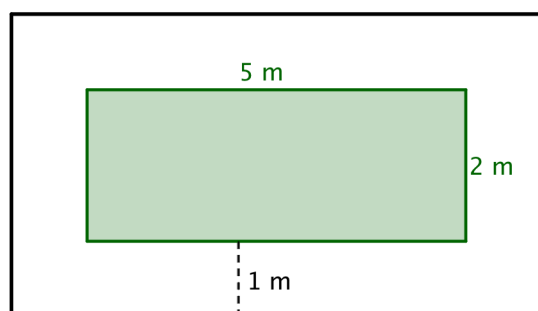


10. The General Household Survey of 2016 published by Stats SA showed that 0,2% of persons aged 5 years and older who were attending educational institutions in South Africa were home schooling. Write this as a fraction i.e. what fraction of persons aged 5 years and older who were attending educational institutions in South Africa were home schooling?

- A) $\frac{1}{20}$
- B) $\frac{1}{5}$
- C) $\frac{1}{500}$
- D) $\frac{1}{2000}$

Testlet 2

1. As shown in the diagram below, a path is paved around a rectangle of grass. The rectangle of grass is 2 m wide and 5 m long. The path is 1 m wide.



The paved area is:

- A) 10 m^2 B) 18 m^2 C) 8 m^2 D) 28 m^2

2. I need to arrange 3 children in a row. In how many different ways can I do this?

- A) 6 B) 5 C) 3 D) 4

3. There are 200 members in my tennis club. The table below shows the number of members by age and gender.

	Men	Women
Under 18 years	18	16
Aged 18 – 30 years	64	58
Older than 30 years	20	24

- i) If I select a member of the tennis club at random, what is the probability the member will be a man, older than 30 years?
A) 20 B) 0,02 C) 0,2 D) 0,1
- ii) If I select a member of the tennis club at random, what is the probability the member will be under 18 years old?
A) 0,18 B) 0,16 C) 0,17 D) 0,34

4. I need 400g of flour to make 30 biscuits.

I have a bag of 1kg of flour. How many biscuits can I make?

- A) 80 B) 60 C) 90 D) 75

5. If I run at a steady pace of 10 km/h how far will I run in 45 minutes?

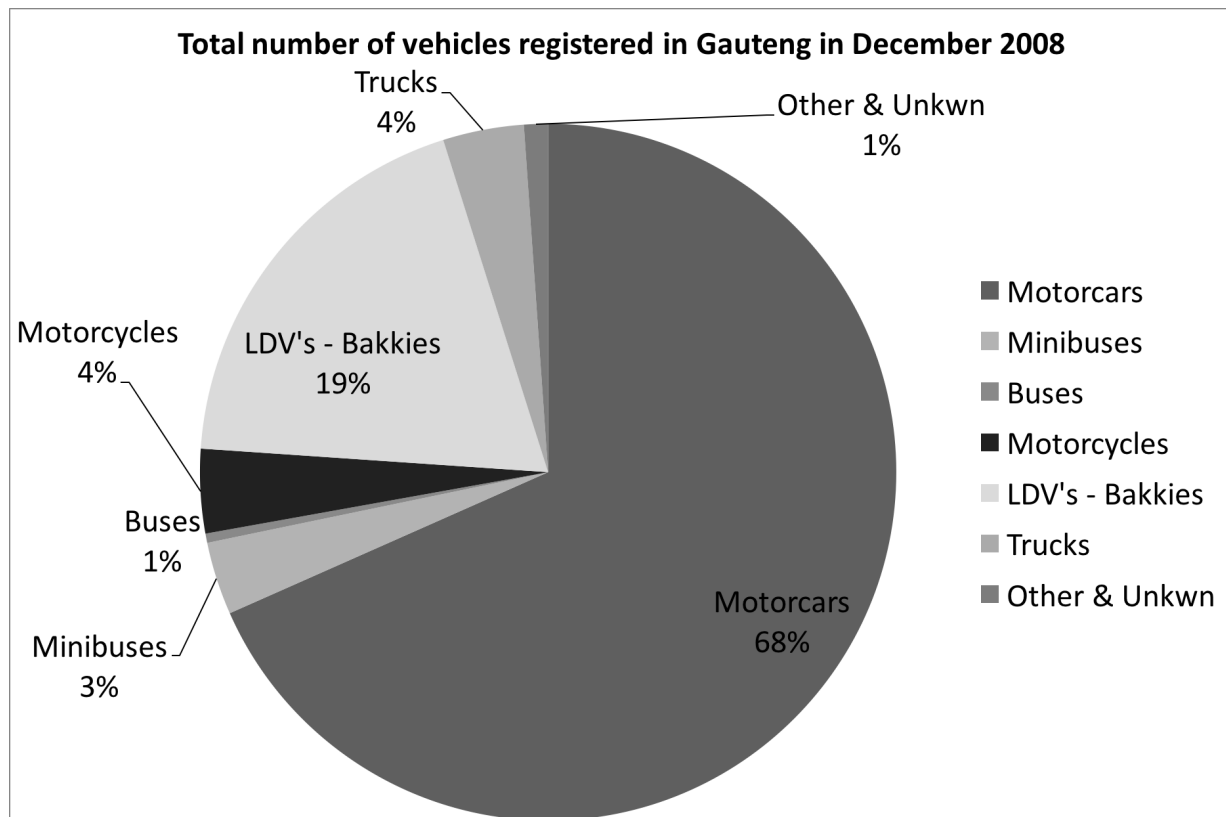
- A) 4,5 km B) 8 km C) 7,5 km D) 6 km

6. A plumber charges R450 for a job. She adds 14% VAT to this amount.

What will the total be?

- A) R495 B) R464 C) R524 D) R513

7. The pie chart below shows the percentage of vehicles of each type registered in Gauteng in December 2008.



i) Approximately what fraction of the vehicles register in Gauteng in December 2008 were motorcars?

A) $\frac{3}{4}$

B) $\frac{1}{8}$

C) $\frac{2}{3}$

D) $\frac{6}{7}$

ii) If there were 613 328 LDVs - Bakkies registered in Gauteng in December 2008, which of the following numbers would be a good approximation of the number of motorcycles registered in Gauteng in 2008?

A) 60 000

B) 200 000

C) 40 000

D) 125 000

iii) If 3 220 000 vehicles were registered in Gauteng in December 2008, how many of them were minibuses?

A) 105 300

B) 108 600

C) 91 200

D) 96 600

8. At a school there are 252 learners and 6 teachers.

i) The teacher : learner ratio at the school, written in simplest form, is?

A) 1 : 42

B) 1 : 6

C) 1 : 36

D) 3 : 50

ii) If the school increases the number of learners at the school by 50%, how many learners will be at the school?

A) 302

B) 126

C) 275

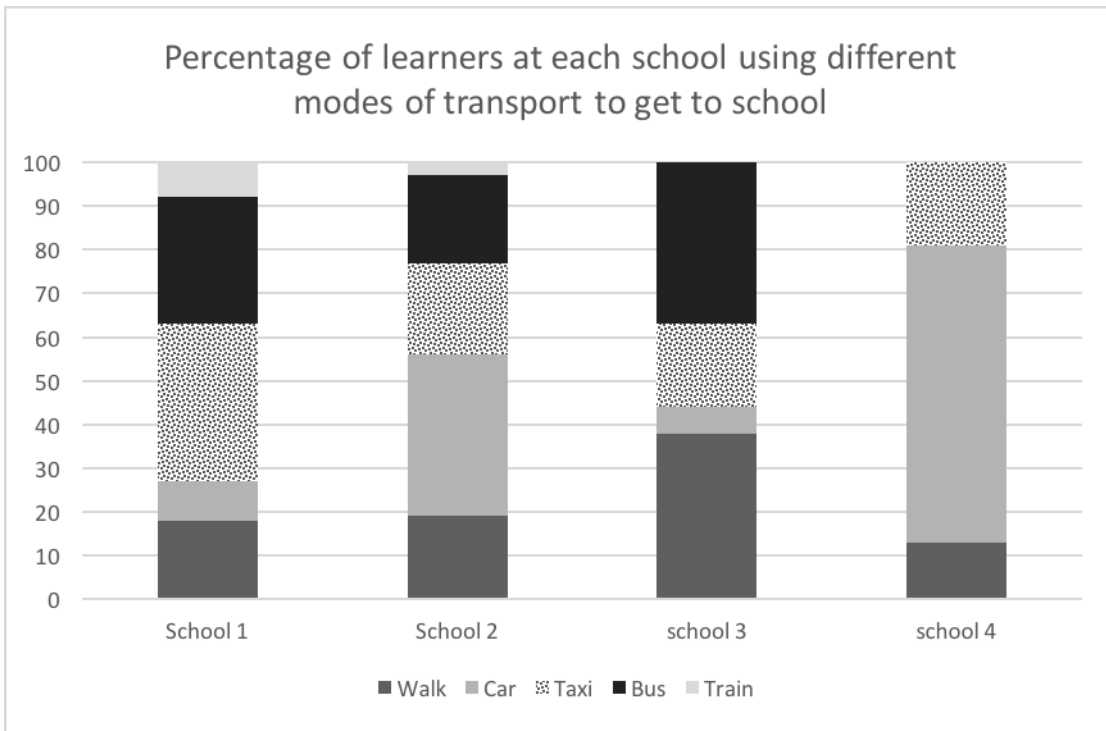
D) 378

9. Find the values of (a) and (b) in the table

x	0	2	3	6	(b)
$2x + 1$	1	5	(a)	13	21

- i) The value of (a) is:
A) 7 B) 9 C) 6 D) 4
- ii) The value of (b) is:
A) 10 B) 7 C) 8 D) 20

10. The chart below shows the different modes of transport that learners at four different schools use to get to school. The percentage of learners from the school using the different modes of transport is shown.

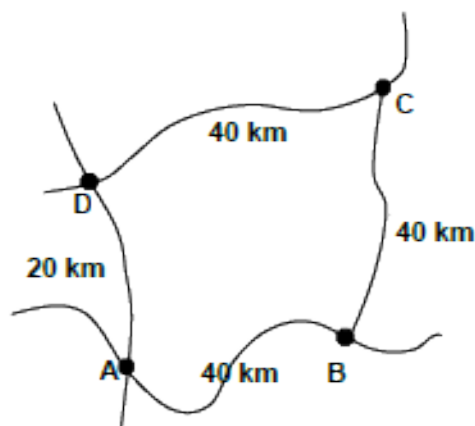


- i) Approximately what portion of learners at school 4 come to school by taxi?
A) $\frac{1}{8}$ B) $\frac{4}{5}$ C) $\frac{1}{5}$ D) $\frac{8}{9}$
- ii) Approximately what percentage of learners at school 1 come to school by bus?
A) 30% B) 63% C) 20% D) 93%
- iii) If there are 300 learners at school 3, approximately how many of them walk to school?
A) 140 B) 39 C) 110 D) 62

Testlet 3

1.

Driver	Route	Time taken minutes
W	D to C	35
X	A to D to C	40
Y	A to B	30
Z	A to B to C	60



Which driver travelled the fastest between various points?

- A) W B) X C) Y D) Z

(Adapted from the THE NATIONAL BENCHMARK TESTS: PREPARING YOUR LEARNERS FOR THE ACADEMIC AND QUANTITATIVE LITERACY (AQL) TEST)

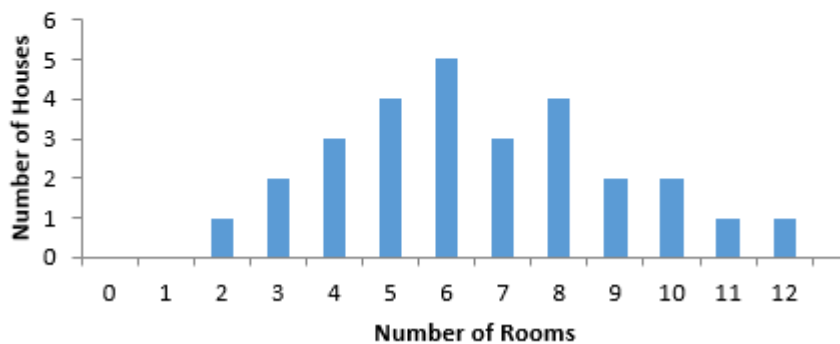
2. The table represents the number of football championships won by football teams for different leagues

	Football Championships				
Football Team	League A	League B	League C	League D	Total
Lions	2	4	0	3	9
Tigers	3	0	3	5	11
Sharks	0	2	5	6	13
Ostriches	6	3	2	3	14
Snails	9	8	0	6	23
Total	20	17	10	23	70

- i) What proportion of the League A championships did the Tigers win?
 A) $\frac{3}{20}$ B) $\frac{11}{70}$ C) $\frac{1}{10}$ D) $\frac{3}{70}$
- ii) Which team won the most championships in League C?
 A) Tigers B) Sharks C) Ostriches D) Lions
- iii) Of the Total Football Championships, what percentage did the team who came second overall win of all leagues played?
 A) 33% B) 14% C) 20% D) 28%

3. A car costs R50 000 this year and this price is set to increase by 7% next year and then 8% on that the following year. What will it cost in 2 years time?
 A) R 53 500 B) R57 500 C) R57 780 D) R58 700
4. A company uses special machines to produce sculptures. All the machines are equally productive. If 3 machines are used it takes 6 days to finish a sculpture. How many days will it take 9 machines to finish the sculpture?
 A) 18 days B) 3 days C) 4 days D) 2 days
5. Study the graph and answer the questions that follow:

**Graph showing the number of
houses in relation to the number of
rooms**

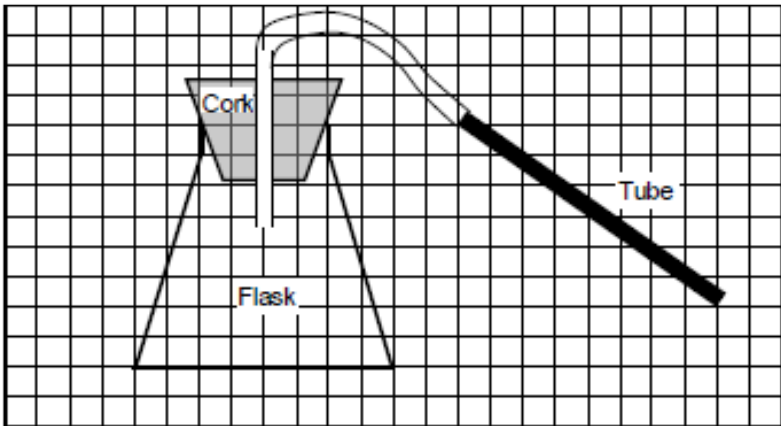


- i) The mode for this data set is:
 A) 5 B) 7 C) 12 D) 6
- ii) The total number of houses sampled is:
 A) 5 B) 28 C) 77 D) 11
- iii) The mean for this data set is between:
 A) 4 and 5 B) 5 and 6 C) 6 and 7 D) 7 and 8
6. Ryan wants to buy some apples and bananas. Apples cost R2 per apple and bananas cost R3.
 i) How many apples could he buy if he spends R60 on apples?
 A) 20 B) 12 C) 30 D) 33
- ii) If he buys 9 apples and spends a total of R60. How much money did he spend on bananas?
 A) R42 B) R14 C) R18 D) R51
- iii) If we let B stand for the number of bananas he buys and A stand for the number of apples he buys, which expression gives the total amount (in Rands) he spends on the apples and bananas.
 A) $3A + 2B$ B) $2A + 3B$ C) $A + B$ D) $A - B$
- iv) If we let B stand for the number of bananas he buys and A stand for the number of apples he buys, which expression gives the total number of pieces of fruit he bought.
 A) $3A + 2B$ B) $A + B$ C) $2A + 3B$ D) $A - B$

7. A school offers 5 sports: hockey, rugby, soccer, diving and karate. Each student is only allowed to play one sport and there are 60 students. Twenty learners play hockey, five play rugby, fifteen play soccer, twelve do diving and the rest practice karate. If a learner in the school is picked at random, what is the probability that this learner is a diver?

A) 0,12 B) 12% C) 0,2 D) 0,02

8. The diagram below shows the side view of an apparatus in a laboratory, consisting of a conical glass flask, a cork, and some tubing. The flask has a circular base. The diagram is drawn to scale on a grid in which each block represents 20 mm × 20 mm

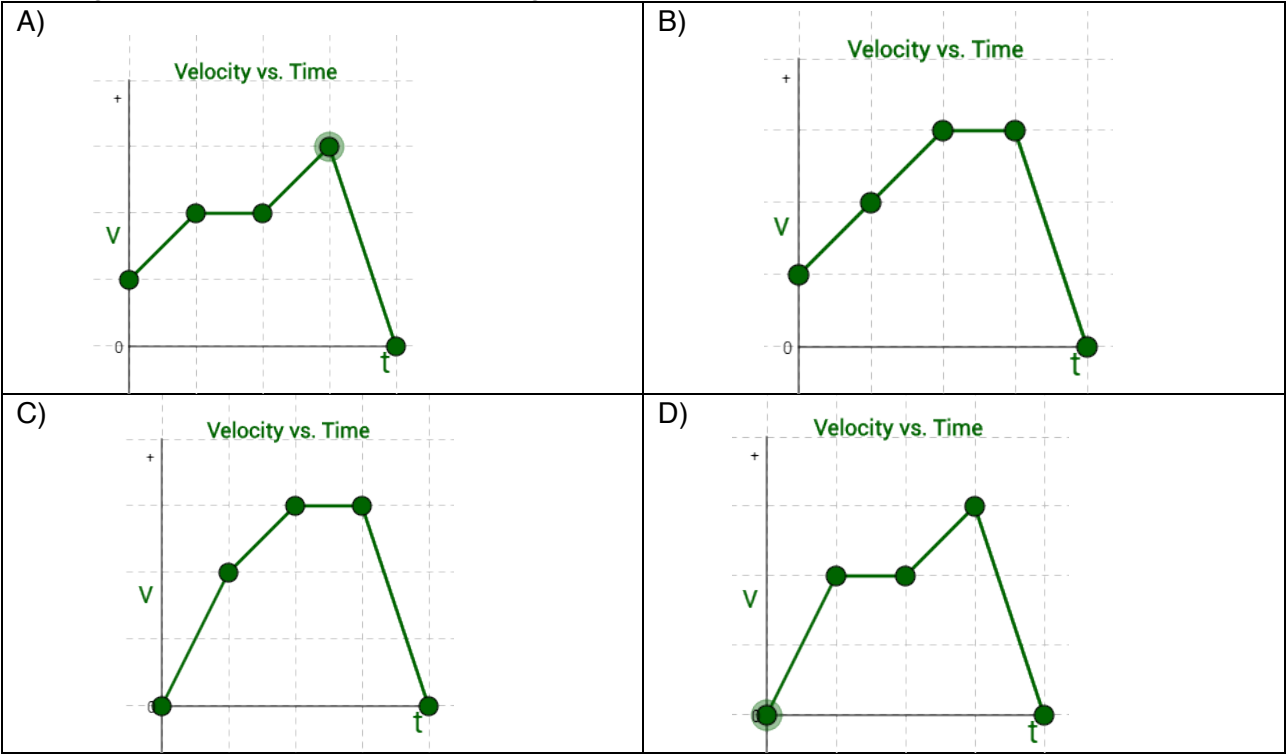


What is the radius of the bottom end of the flask?

A) 160 mm B) 40 mm C) 20 mm D) 80 mm

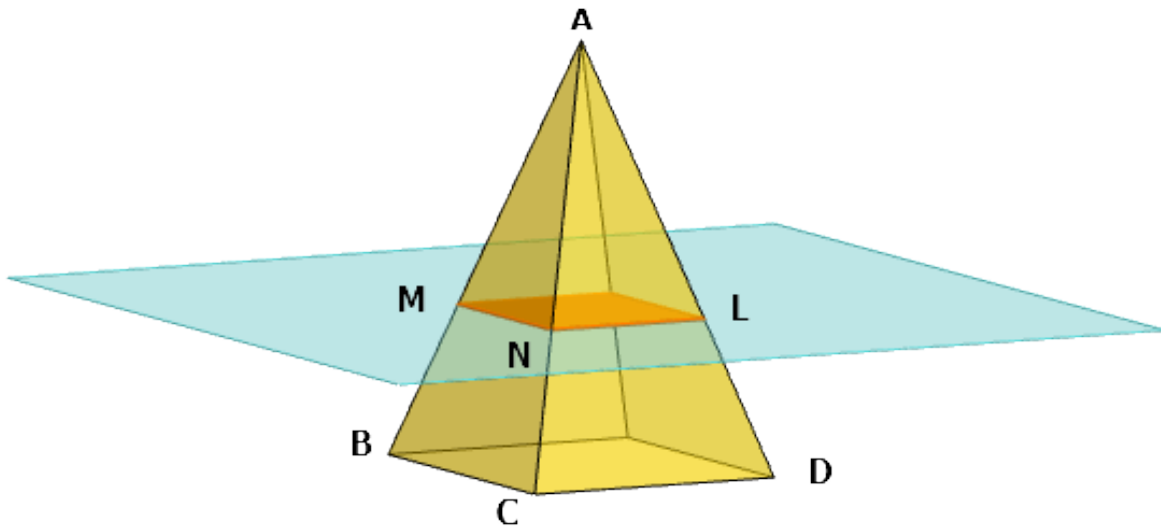
Adapted from the THE NATIONAL BENCHMARK TESTS: PREPARING YOUR LEARNERS FOR THE ACADEMIC AND QUANTITATIVE LITERACY (AQL) TEST

9. Nolo starts from rest and runs at an increasing velocity. Then she runs at a constant velocity before increasing her velocity again. Becoming tired she decreases her velocity. Which graph shape matches the following description?



Testlet 4

1. The diagram shows a rectangular pyramid **ABCD**. **BC** is 10cm ; **CD** is 15cm. Triangle **ABC** has an area of 125cm^2 and triangle **ACD** is 183cm^2



- i) What is the area of the base?
 A) 200 cm^2 B) 50 cm^2 C) 150 cm^2 D) 100 cm^2
- ii) What is the surface area of the entire rectangular pyramid?
 A) 458 cm^2 B) 766 cm^2 C) 616 cm^2 D) 308 cm^2
- iii) If the pyramid **ABCD** has a volume of 1200 ml and the pyramid **AMNL** is 40% of this. What is the volume of **AMNL**?
 A) 48 ml B) 4800 ml C) $4,8\text{ l}$ D) $0,48\text{ l}$

2. I have four friends: Shaun, Kyle, Monika and Ali. I ask them to stand in a horizontal line. In how many ways can I arrange them in this line?

- A) 10 B) 20 C) 24 D) 16

3. Saul wants to make a smoothie after gym. He knows that 15 kiwis will give him 2 litres of smoothie. He doesn't need that much though as he didn't gym too hard today. How many millilitres of smoothie will he get if he uses 6 kiwis instead?

- A) 800 ml B) 600 ml C) 700 ml D) 900 ml

4. The area of a square is 36m^2 , what is the perimeter of the square?

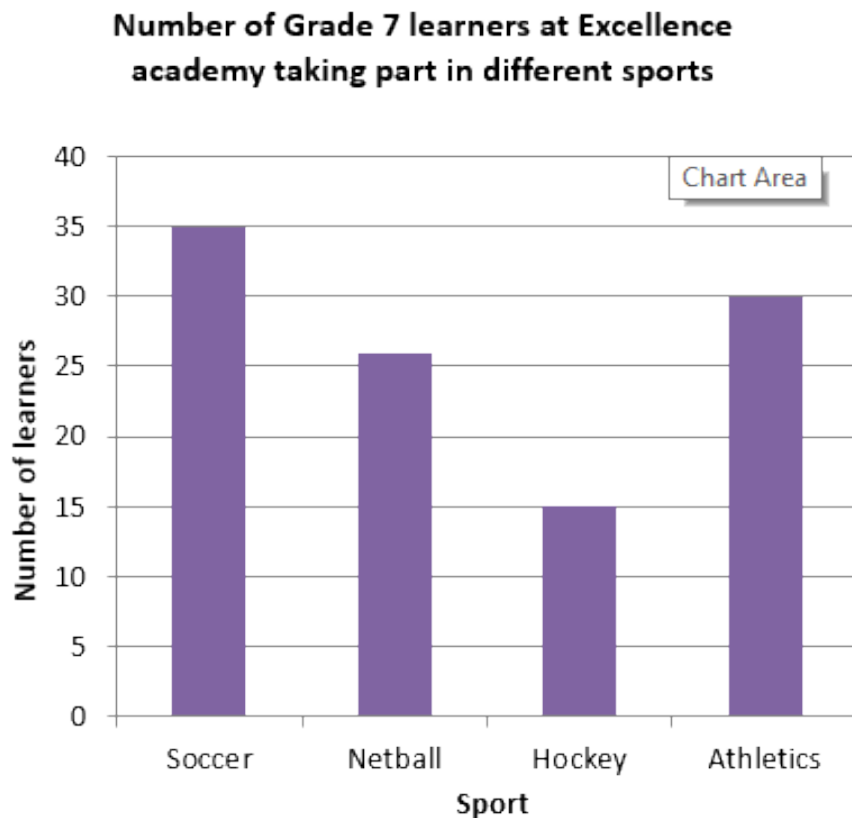
- A) 20 m B) 6 m C) 12 m D) 24 m

5. Suppose that the price of platinum is twice the price of gold.

If we use p to stand for the price of platinum and g for the price of gold then which statement is true?

- A) $g = p + 2$ B) $p = g + 2$ C) $p = 2g$ D) $g = 2p$

6. The bar graph below shows the Number of Grade 7 learners and the sports they play. Each learner only plays one sport.

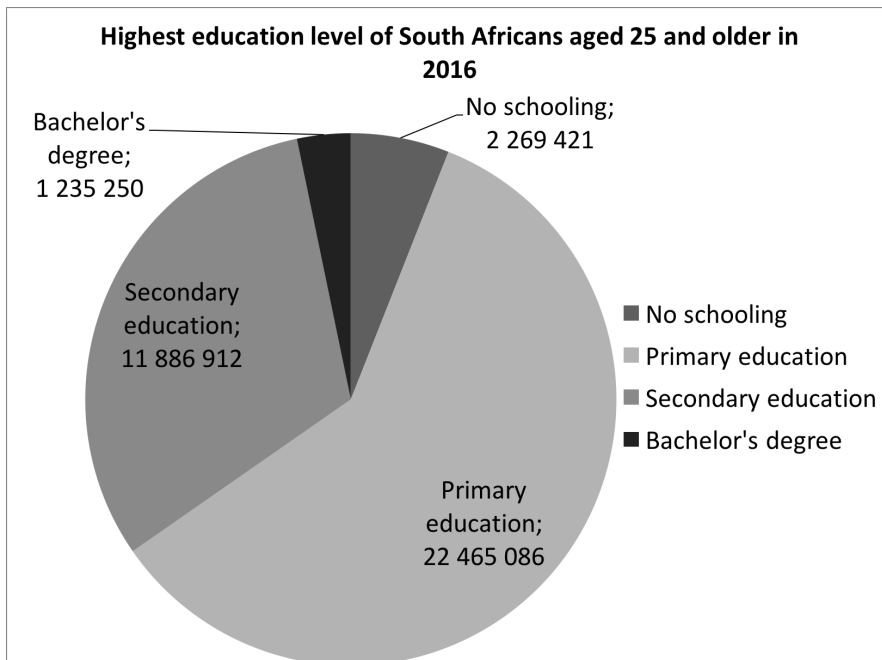


- i) What is the total number of learners?
 A) 105 B) 106 C) 35 D) 107
- ii) What is the modal group?
 A) Athletics B) Netball C) Hockey D) Soccer
- iii) If I choose one learner randomly which statement best describes the probability that the learner selected plays hockey?
 A) 0,15 B) more than 0,15 C) less than 0,15 D) 15%

7. Minki is planning a trip to Europe. First she will go to England and from there to France. She budgets R20 000 for this trip which she wants to convert all to Pounds. The exchange rate is £1 = R16

- i) How many Pounds does she get for her Rand?
 A) £320 000 B) £1 000 C) £300 000 D) £1 250
- ii) When she leaves England she decides to change £500 to Euros. The exchange rate is £1 = €1,25. How many Euros does she get for her Pounds?
 A) €475 B) €400 C) €550 D) €625
- iii) Returning home from Europe she converts €250 to Rand. Using the above exchange rates, how much Rand does she get for her Euros?
 A) R1600 B) R3200 C) R2500 D) R1000

8. The pie chart below shows the highest level of education South Africans ages 25 and older have, giving the exact number of people.



- i) Approximately what fraction of people have Secondary Education as their highest level of education?
- A) $\frac{2}{3}$ B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{3}$
- ii) Approximately what percentage of people have Primary Education as their highest level of education?
- A) 60% B) 50% C) 70% D) 75%

9. According to Stats SA, the South African Total Population in 2016 was at 55,6 million people. The population of the Eastern Cape in 2016 was 7 000 000 people.

- i) What percentage of the total population live in the Eastern Cape approximately?
- A) 7,5% B) 10% C) 12,5% D) 15%
- ii) If 25% of the Total Population live in Gauteng how many people live in Gauteng?
- A) 13 900 000 B) 1 390 000 C) 13, 9 D) 139 000 000
- iii) 55,6 million written in scientific notation is:
- A) $5,56 \times 10^6$ B) $5,56 \times 10^7$ C) $55,6 \times 10^7$ D) $55,6 \times 10^6$
- iv) In 2016 an expert predicted that the population of South Africa would grow from 55,6 million by 10% in the next 6 years. Approximately how many people is she predicting there will be?
- A) 65 million B) 60 million C) 61 million D) 56 million

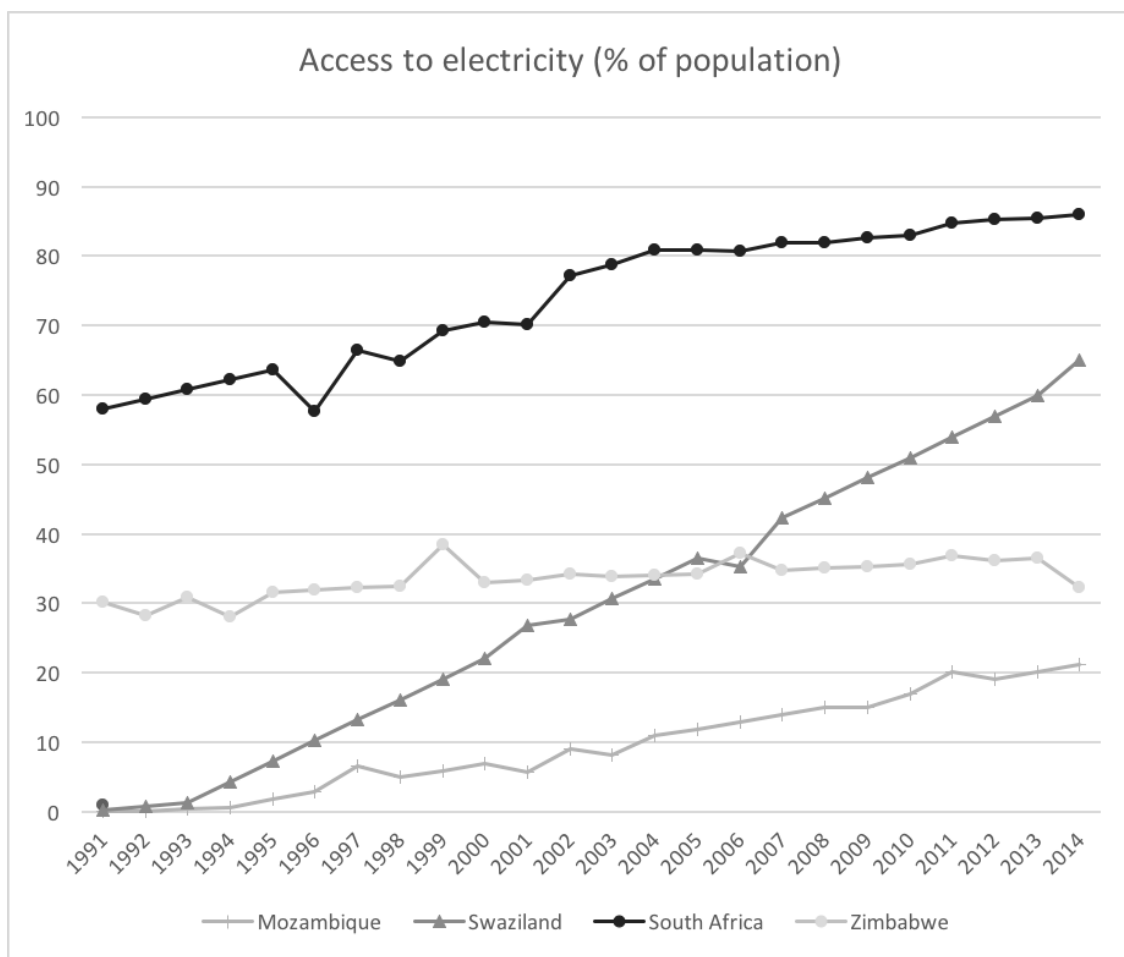
10 . If Car A is travelling at 60km/h and is covering a distance of 330km

- i) How many hours will it take to cover this distance?
 A) 5 hours B) 5,5 hours C) 6 hours D) 5,30 hours
- ii) Car B covers the same distance plus an additional 50km in 4,75 hours. How many minutes is this?
 A) 315 minutes B) 445 minutes C) 475 minutes D) 285 minutes
- iii) Which car travelled at a faster average speed?
 A) They travelled at the same speed B) Car B
 C) Car A D) It is impossible to tell

Testlet 5

1. The graph below shows the percentage of population of four Southern African countries that have access to electricity.

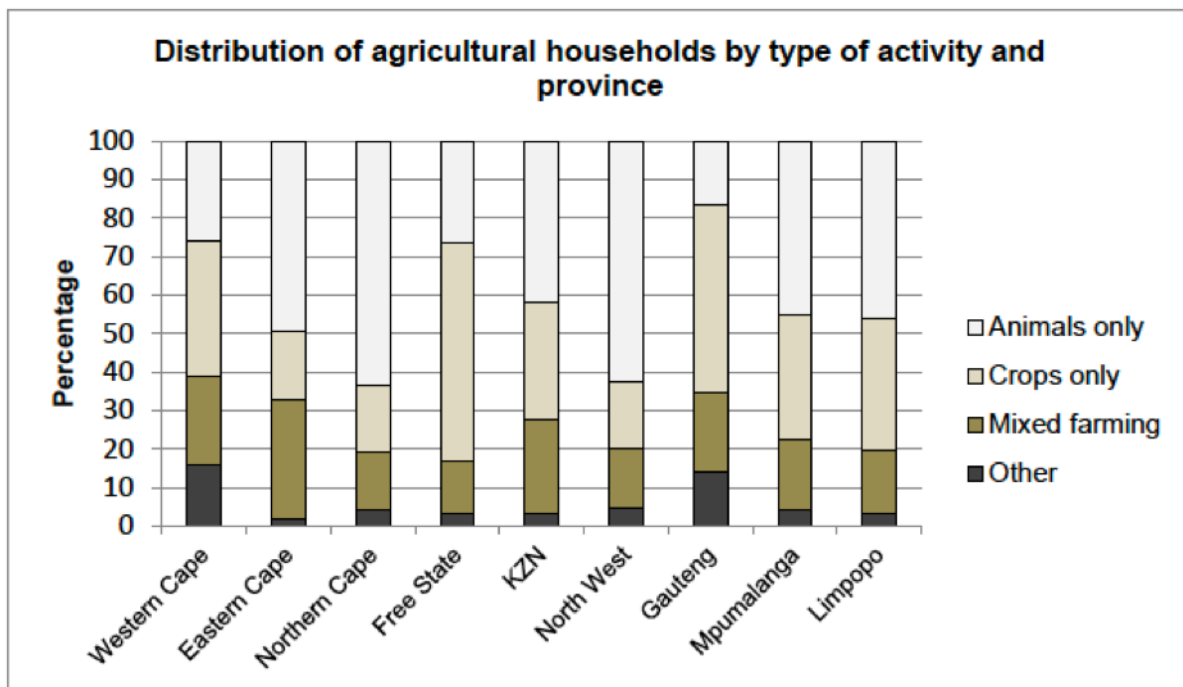
Use the graph below to answer the questions that follow.



- i) Approximately what percentage of the South African population had access to electricity in 2014?
 A) 86% B) 80% C) 78% D) 66%

- ii) In which country did the percentage of the population with access to electricity change the least between 1991 and 2014?
A) Swaziland B) South Africa C) Mozambique D) Zimbabwe
- iii) Which country showed the fastest growth in the percentage of the population with access to electricity between 1991 and 2014?
A) Mozambique B) South Africa C) Zimbabwe D) Swaziland
- iv) Which was the first year in which more than $\frac{1}{4}$ of the people in Swaziland had access to electricity?
A) 1999 B) 2001 C) 1992 D) 2007

2. Use the chart below to answer the questions that follow:



- i) Approximately what percentage of agricultural households were involved in "mixed farming" in the Western Cape?
A) 22% B) 39% C) 70% D) 17%
- ii) Approximately what percentage of agricultural household in Free State were not involved in "Crops only" agricultural activity?
A) 18% B) 73% C) 23% D) 45%
3. A college has decided they must have a lecturer to student ratio of 1 : 25
- i) If the college employs 5 lecturers, how many students should they enroll?
A) 300 B) 100 C) 125 D) 25
- ii) If the college enrolls 500 students, how many lecturers should they employ?
A) 20 B) 50 C) 25 D) 10

4. An architect draws up plans for a house using a scale of 1 : 50
- If you measure the width of the front door on the plan it is 2 cm wide. How wide will the front door of the house actually be?
A) 50 m B) 50 cm C) 1 m D) 100 m
 - If the length of the house is 10 m, what will the length of the drawing of house on the plan measure?
A) 2m B) 50 cm C) 10 cm D) 20 cm

5. The table below shows data from the World Bank about the composition of the population of some countries.

For each country the table shows

- the total population (in millions) in 2000 and 2016
- the percentage of the population that various age groups make up
- the age dependency ratio, old which is calculated by working out the ratio of people aged 65 and above to the working age population (defined as those aged 15 - 64) and turning it into a percentage.

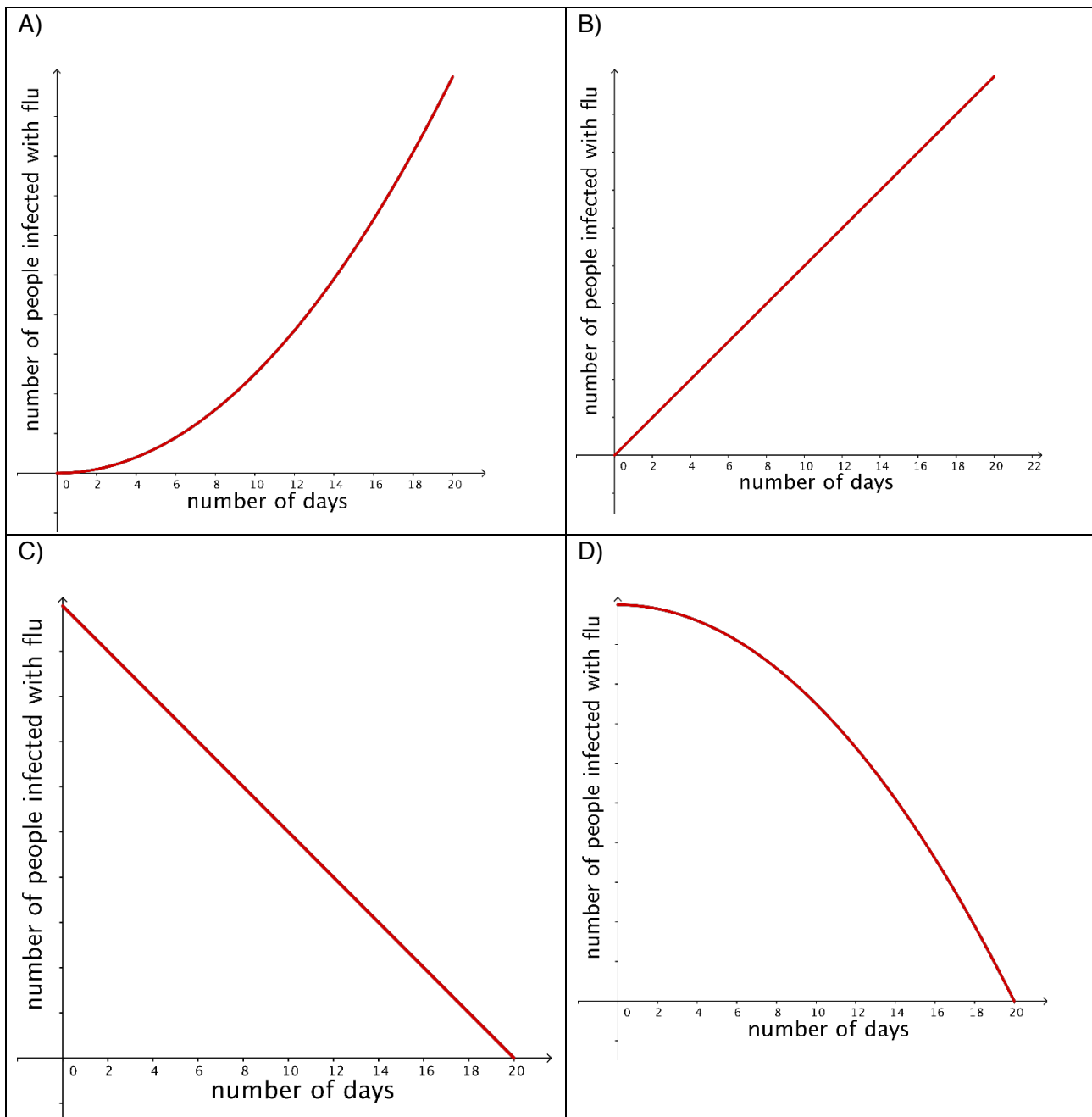
Refer to the table to answer the questions that follow.

	Population, total (in millions)		Population ages 0-14 (% of total)	Population ages 15-64 (% of total)	Population ages 65 and above (% of total)	Age dependency ratio, old (% of working-age population)
	2000	2016	2016	2016	2016	2016
Greece	10.8	10.7	15	64	22	34
India	1053.1	1324.2	28	66	6	9
Kenya	31.5	48.5	42	55	3	5
South Africa	44.9	55.9	29	66	5	8
Sierra Leone	4.6	7.4	42	55	3	5
United Kingdom	58.9	65.6	18	64	18	28

- Which country showed a decrease in population between 2000 and 2016?
A) India B) Kenya C) Sierre Leone D) Greece
- Approximately how many people in Greece were between 0 and 14 years old in 2016?
A) 5 million B) 15 C) 15 million D) 1,6 million
- Which of the countries shown in the table had the largest **NUMBER** of people aged 65 and above in 2016.
A) United Kingdom B) Greece C) South Africa D) India
- By what percentage (approximately) did the population of Sierra Leone grow between 2000 and 2016?
A) 40% B) 60% C) 28% D) 2,8%

- v) In Sweden in 2016, 20% of the population was aged 65 years old and above and 62% of the population was aged between 15 and 64 years. Approximately what would the age dependency ratio, old (as defined above) for Sweden be?
 A) 20 B) 62 C) 5 D) 32
- vi) The crude birth rate is defined as the number of babies born per 1000 people in a country. If the crude birth rate in South Africa in 2016 was 20, approximately how many babies would have been born?
 A) 20 000 000 B) 100 000 C) 550 000 D) 1 100 000

6. If the number of people infected with flu grows at an increasing rate over a period of 20 days, which of the following graphs could represent that situation.



Answers

Testlet 1 ANSWERS

1) **A.** BODMAS says we must do the work in the brackets first. In the brackets we need to do the multiplication first so we get: $(5 - 3 + 12) \div 0,1$. We then do the addition and subtraction in the brackets from the left to the right to get: $14 \div 0,1 = 140$

2i) **A.** $14 \times 2\,000\,000 = 28\,000\,000$. So it is 28 000 000 cm from Joburg to Gaberone. There are 100 cm in a metre and 1000 metres in a km. So we must divide by 100 and then by 1000 to convert to km. So the answer is 280km.

2ii) **C.** $R300 \times 0,8 = R300 \times \frac{8}{10} = 240$ pula.

2iii) **A.** $1000 \div 0,8 = 10\,000 \div 8 = R1250$. (Or you can work backwards from the answers and see that $R1250 \times 0,8 = 1000$ pula)

3i) **C.** Although MP has the highest percentage (3,7%) of students at TVET colleges this is a percentage of the total number of students in the province which is only 1 310 000. GP has 3,4% of 3 327 000 students at TVET colleges so will have the largest NUMBER of students at TVET colleges.

3ii) **A.** 1% of 1 541 000 = 15 410 so 1,1% of 1 541 000 will be a bit more than this. So 17 000 would be a reasonable approximation.

3iii) **B.** There are 3 366 000 students in GP out of 16 222 000 students in RSA.

$\frac{3366000}{16222000}$ can be roughly approximated as: $\frac{3}{15} = \frac{1}{5} = \frac{20}{100} = 20\%$

4i) **A.** The median is the middle score. As more than half the learners got less than 50% for the test, the median must be less than 50% so 45% is the only option for the median.

4ii) **A.** The mean will be: $\frac{800+10 \times 97}{30} = \frac{800+970}{30} = \frac{1770}{30} = 59$. So the mean mark is 59%

5) **B.** If a price, P, is increased by 10% we say $P + 10\% \text{ of } P$ i.e. $P + 0,1P = 1,1P$

And if that new price 1,1P is increased by 10% we say $1,1P + 10\% \text{ of } 1,1P$

this gives $1,1P + 0,1 \times 1,1P = 1,1P + 0,11P = 1,21P$

So we have a 21% increase.

OR

If the letters confuse you, you can think of it like this:

Imagine the car cost R100 (a really really cheap car - but R100 is an easy price to work with when we do percentages!)

Then after the first 10% increase it will cost $R100 + 10\% \text{ of } R100 = R110$

Then the new price, R110, is increased by 10% so we get $R110 + 10\% \text{ of } R110 = R110 + R11 = R121$. So the car now costs R121.

The original R100 has gone up by R21 i.e. a 21% increase.

6i) **C.** Area of a rectangle = $length \times breadth$. So area of B = $8 \times 3,5 = 28 \text{ cm}^2$

6ii) **A.** D has the largest perimeter: $8 + 8 + 9 + 9 = 34 \text{ cm}$. A has the second largest perimeter: $4 + 4 + 9 + 9 = 26 \text{ cm}$. C has the third largest perimeter: $4 \times 6 = 24 \text{ cm}$. B has the smallest perimeter: $3,5 + 3,5 + 8 + 8 = 23 \text{ cm}$

7) **B.** 28 out of the 40 learners do not play basketball.

So the probability of picking a learner who does not play basketball is:

$$\frac{28}{40} = \frac{7}{10} = 0,7$$

8i) **B.** Percentage increase = $\frac{\text{end value} - \text{start value}}{\text{start value}} \times 100$

So the percentage by which the population of the WCape grew between 2003 and 2013 is:

$$\frac{6017000-4951000}{4951000} \times 100. \text{ This is approximately: } \frac{6000000-5000000}{5000000} \times 100 = \frac{1}{5} \times 100 = 20\%$$

8ii) **D.** Over 3 years the population grows by: $6362000 - 6017000 = 345000$

So $345000 \div 3 = 115000 \text{ people/year}$

9) **A.** The height of the water will rise most quickly in the thinnest beaker (X) and slowest in the widest beaker (Y)

$$10) \text{ C. } 0,2\% = \frac{0,2}{100} = \frac{2}{1000} = \frac{1}{500}$$

Testlet 2 ANSWERS

1) **B.** The grassed area is $5 \times 2 = 10 \text{ m}^2$. The larger rectangle (grass and paving) is $7 \times 4 = 28 \text{ m}^2$
So the paved area is $28 - 10 = 18 \text{ m}^2$

2) **A.** For the 1st position in the row I can choose any one of the 3 children.
For each choice of child for the 1st position, there are 2 possible choices for the 2nd position.
And then once the 1st and 2nd position are chosen, then there is only one choice the third position
So the total possible choices are $3 \times 2 \times 1 = 6$

3i) **D.** There are 20 men older than 30 years in the club of 200 members, so the probability of selecting one of them is $\frac{20}{200} = 0,1$

3ii) **C.** There are $18 + 16 = 34$ people under 18 years in the club of 200 members, so the probability of selecting one of them is $\frac{34}{200} = 0,17$

4) **D.** 400g makes 30 biscuits. So 200g makes 15 biscuits (divide both by 2). So 1000g makes $15 \times 5 = 75$ biscuits

5) **C.** Before doing the calculations make sure all the units are the same i.e. if your speed is in km/h then your time must be in HOURS. 45 minutes is $\frac{3}{4}$ of an hour.

$$\text{Distance} = \text{speed} \times \text{time} = 10 \times \frac{3}{4} = 7,5 \text{ km}$$

$$6) \text{ D. } 14\% \text{ of } 450 = \frac{14}{100} \times 450 = 14 \times 4,5 = 63$$

So the total amount will be $R450 + R63 = R513$

$$7i) \text{ C. } \frac{2}{3} = \frac{66,66...}{100} \text{ this is approximately } 67\% \text{ which is close to } 68\%$$

7ii) **D.** 19% of the vehicles were LDVs - Bakkies. 4% of the vehicles were motorcycles. $\frac{1}{5}$ of 19% is just less than 4%. $\frac{1}{5}$ of 600 000 will be 120 000 so 125 000 is a good approximation of the number of motorcycles.

7iii) **D.** 1% of 3 220 000 is 32 200 so 3% of 32 200 is 96 600.

8i) **A.** $6 : 252 = 1 : 42$ (divide both numbers in the ratio by 6 to simplify)

8ii) **D.** An increase of 50% means that we take 252 and add on 50% of 252 so $252 + 126 = 378$

$$9i) \text{ A. } 2 \times 3 + 1 = 6 + 1 = 7$$

9ii) **A.** $2x + 1 = 21$ so $2x = 20$ so $x = 10$

10i) **C.** The taxi section of the graph for school 4 represents roughly $20\% = \frac{20}{100} = \frac{1}{5}$

10ii) **A.** The bus section of the graph for school 1 goes from about 65% to 95% so approximately 30% of learners come to school by bus.

10iii) **C.** Just under 40% of the learners from school 3 walk to school. $40\% \text{ of } 300 = 120$. So 110 would be the best approximation.

Testlet 3 ANSWERS

1) **B.** Use the formula: $speed = \frac{distance}{time}$

For W: $\frac{40}{35} = \frac{8}{7}$ For X: $\frac{60}{40} = \frac{3}{2}$ For Y: $\frac{40}{30} = \frac{4}{3}$ For Z: $\frac{80}{60} = \frac{4}{3}$

So X is the fastest travelling 1,5 km every minute

2i) **A.** The question is asking specifically for League A which has a total of 20. So take the number that the Tigers won in League A (3) and put it over the total (20)

2ii) **B.** Go to column C and look for the team with the highest number. It is the Sharks with 5 wins

2iii) **C.** Identify the team that came second overall by looking at the Total column. It is the Ostriches with 14 wins. Create a fraction over the total wins (70) and multiply by 100 to get a percentage figure. So: $\frac{14}{70} \times 100 = 20\%$

3) **C.** $50\,000 + 0,07 \times 50\,000 = 53\,500$. Then $53\,500 + 0,08 \times 53\,500 = R57\,780$

4) **D.** There is an inverse relation between the number of machines and the days to produce the sculpture.

First, solve for how long 1 machine will take: $3 \times 6 = 18 \text{ days}$

Then divide this number by 9: $18 \div 9 = 2 \text{ days}$

5i) **D.** The mode is the value that occurs most often. This is 6 rooms

5ii) **B.** To find the total number of houses sampled we take each column's height and sum them together. So: $1 + 2 + 3 + 4 + 5 + 3 + 4 + 2 + 2 + 1 + 1 = 28$

5iii) **C.** To calculate the mean multiply each room number by the number of houses that have that many rooms and then sum these together. Finally divide by the total number of houses sampled.

So: $\frac{(2 \times 1) + (3 \times 2) + (4 \times 3) + (5 \times 4) + (6 \times 5) + (7 \times 3) + (8 \times 4) + (9 \times 2) + (10 \times 2) + (11 \times 1) + (12 \times 1)}{28} = \frac{184}{28} = \frac{46}{7} = 6\frac{4}{7}$

6i) **C.** $60 \div 2 = 30 \text{ apples}$

6ii) **A.** He buys 9 apples so $9 \times 2 = R18$. $60 - 18 = R42$ spent on bananas

6iii) **B.** $2A + 3B$ will give the total amount he spends on apples and bananas as it takes the amount he buys and multiplies it by the price and sums these values

6iv) **B.** $A + B$ will give the total number of pieces of fruit he bought

7) **C.** $\frac{12}{60} = \frac{1}{5} = 0,2$

8) **D.** The diameter of the bottom of the flask = $8 \times 20 = 160\text{mm}$

The radius is half of the diameter so it equals 80mm

9) **D.** The graph must start at 0 as Nolo starts from rest. It must then have a positive gradient as she is increasing her velocity. She then runs constantly so it must have a flat gradient. Increasing her velocity means it must have a positive gradient again. Finally decreasing her velocity means the graph must go downwards as it will now have a negative gradient.

Testlet 4 ANSWERS

1i) **C.** As the base is a rectangle the formula for its area is $l \times b$ so: $15 \times 10 = 150 \text{ cm}^2$

1ii) **B.** The pyramid has 4 triangles and 1 rectangle. You must count all of these:

$$2(125) + 2(183) + 150 = 766 \text{ cm}^2$$

1iii) **D.** Take 40% of the total volume of 1200 ml: $\frac{40}{100} \times 1200 = 480 \text{ ml}$

This must be converted to litres: $480 \div 1000 = 0,48 \text{ l}$

2) **C.** For the 1st position in the row I can choose any one of my friends.

For each choice of friend for the 1st position, there are 3 possible choices for the 2nd position.

Once the 1st and 2nd position are chosen, there is 2 possible choices for the 3rd position

And then once the 1st, 2nd and 3rd positions have been chosen, there is only one choice for the final position. So the total possible choices are $4 \times 3 \times 2 \times 1 = 24$

3) **A.** First establish the ratio:

15 kiwis : 2 litres

1 kiwi : $\frac{2}{15}$ litres

Solve for 6 kiwis: $\frac{2}{5} \times 6 = \frac{12}{15} = \frac{4}{5} = 0,8 \text{ litres}$

Covert to millilitres: $0,8 \times 1000 = 800 \text{ ml}$

4) **D.** One side of the square will be 6m since $6 \times 6 = 36$

So the perimeter of the square will be $6 + 6 + 6 + 6 = 4 \times 6 = 24\text{m}$

5) **C.** The correct statement is $p = 2g$ since if we multiply the price of gold by two we get the price of platinum

6i) **B.** Add together the columns. So: $35 + 26 + 15 + 30 = 106$

6ii) **D.** The modal group is the group with the most students. So the answer is Soccer

6iii) **C.** The probability of choosing a hockey player can be calculated by $\frac{15}{106}$ As 106 is greater than 100 the probability must be less than 0,15

7i) **D.** Divide the Rand by 16 to get the Pounds value: $20\ 000 \div 16 = \text{£}1\ 250$

OR remember you can always work backwards from the answers to make the calculations easier:

We can see £320 000 or £300 000 are too big.

£1 000 $\times 16 = 16\ 000$ which is less than 20 000 so the answer must be £1 250

7ii) **D.** For every Pound she gets €1,25. So multiply the Pounds by this:

$$500 \times 1,25 = \text{€}625$$

NOTE: One way to do this calculation is to say $(1 \times 500) + \left(\frac{1}{4} \times 500\right) = 500 + 125 = 625$

7iii) **B.** We know £1 = R16 and £1 = €1,25 so it must be that €1,25 = R16

So €125 = R1 600 and therefore €250 = R3 200

8i) **D.** By observation: Looking at the sector for Secondary Education we can see it is bigger than $\frac{1}{4}$ (the angle from the centre is more than 90°) but smaller than $\frac{1}{2}$. Therefore the answer must be $\frac{1}{3}$

By calculation:

Total number of people equals: $22465086 + 11886912 + 1235250 + 2269421 = 37856669$

So fraction for secondary education is: $\frac{11886912}{37856669}$ which is approximately $\frac{12000000}{38000000} = \frac{6}{19}$ which is approx. $\frac{1}{3}$

8ii) **A.** By observation: Looking at the sector for Primary Education we can see it is bigger than 50% (the angle from the centre is more than 180°) but smaller than 75% (the angle from the center is smaller than 270°). However it is closer to 50% than 75% so the answer would approximately be 60%

By calculation: $\frac{22465086}{37856669}$ which is approx. $\frac{23000000}{40000000} = \frac{23}{40}$

To find percentage: $\frac{23}{40} \times 100 = 57,5\%$ and this is close to 60%

9i) **C.** 7 000 000 is 7 million. We can round 55,6 to 56 so $\frac{7}{56} = \frac{1}{8} = 12,5\%$

9ii) **A.** $25\% = \frac{1}{4}$ and $\frac{1}{4}$ of 55,6 = $55,6 \div 4 = 13,9$ and 13,9 million = 13 900 000

9iii) **B.** 55,6 million = 55 600 000 = $5,56 \times 10^7$

9iv) **C.** $10\% \times 55,6 \text{ million} = 5,56 \text{ million}$ and $55,6 \text{ million} + 5,56 \text{ million} = 61,16 \text{ million}$

10i) **B.** $\text{Time} = \text{Distance} / \text{Speed} = \frac{330}{60} = \frac{33}{6} = 5,5 \text{ hours}$

10ii) **D.** $0,75 = \frac{3}{4}$ and $\frac{3}{4} \times 60 \text{ mins} = 45 \text{ mins}$ and $4 \text{ hours} = 4 \times 60 = 240 \text{ mins}$

So $4,75 \text{ hours} = 45 + 240 = 285 \text{ mins}$

10iii) **B.** Car A travels 330 km in 5,5 hours. Car B travels 380 km (i.e. a greater distance) in 4,5 hours (i.e. in a shorter period of time). So Car B must be going at a faster average speed.

Testlet 5 ANSWERS

1i) **A.** 86%

1ii) **D.** Zimbabwe. Roughly 30% of Zimbabweans had access to electricity in 1991 and approximately 32% of Zimbabweans had access to electricity in 2014.

1iii) **D.** The graph for Swaziland rises most steeply so Swaziland shows the fastest growth.

1iv) **B.** $\frac{1}{4} = 25$. The Swaziland graph first goes above 25% in 2001

2i) **A.** The "mixed farming" section of the bar for the Western Cape goes from about 17% to about 39% so represents about 22%

2ii) **D.** The "crops only" section of the bar for the Free State goes from about 18% to 73% so represents about 55%. So those not involved in "crops only" would be $100\% - 55\% = 45\%$

3i) **C.** $5 \times 25 = 125 \text{ students}$

3cii) **A.** $500 \div 25 = 20 \text{ lecturers}$

4i) **C.** The scale is 1 : 50 so 2 : 100. The door is 100 cm wide and this equals 1 m

4ii) **D.** 10 m = 1000 cm. The scale is 1 : 50 and we want to know ? : 1000

$1000 \div 50 = 20$, so 1 : 50 = 20 : 1000 . The drawing of house will have a length of 20 cm

5i) **D.** The population of Greece decreased from 10,8 million to 10,7 million.

5ii) **D.** 15% of the 10,8 million people in Greece were between - and 14 years old in 2016.

15% of 10 million is 1,5 million so the answer must be a bit more than that i.e. 1,6 million

5iii) **D.** India. Although only 6% of the India population is 65 years or older, the population of India is much, much bigger than all the other countries in the table and so India will have the most people aged 65 years or older.

(6% of 1 324,2 million is approximately 79 million - but we don't need to do that exact calculation to be able to see that 6% of 1 324,2 million is going to give us a bigger "older" population than that of all the other countries)

5iv) **B.** $\text{Percentage increase} = \frac{\text{new amount} - \text{old amount}}{\text{old amount}} \times 100$

$\frac{7,4 - 4,6}{4,6} \times 100 = \frac{2,8}{4,6} \times 100$. Since $\frac{2,8}{4,6}$ is greater than $\frac{1}{2}$ we know this fraction will be greater than 50% so the answer is 60%

5v) **D.** 20 : 62 is approximately 20 : 60 which is 1 : 3 which is around 33% so the answer is 32.

5vi) **D.** There are 55 900 000 people in South Africa so there are 55 900 lots of 1000 people in South Africa. Since the birth rate is 20 births per 1000 people the total births will be $55\,900 \times 20$ which is approximately equal to 1 100 000

6) **A.** Growth so must have a positive gradient and because it is an increasing rate the graph must get steeper and steeper.

The notes in this booklet have been adapted from the OLICO and Winning Teams Senior Phase summary book.

Data sources: Stats SA and World Bank.

Information about the AQL taken from "The National Benchmark Tests: Preparing your learners for the Academic and Quantitative Literacy Test" by Natalie le Roux and Kabelo Sebolai from nbt.ac.za

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