

**Demonstrate an understanding of and use of the numbering systems**

**US No: 14084 Level 1, Credits 1**

**LEARNER MANUAL**

|  |  |
| --- | --- |
| Learner’s name |  |
| Facilitator’s name |  |
| Starting date |  |

**Before we start…**

Dear Learner - on completion of this Learner Guide, you will have acquired all the knowledge and skills to be assessed against the following unit standard:

Title: Demonstrate an understanding of and use the numbering system

US No: 7447 NQF Level: 1 Credits: 1

The full unit standard is attached at the end of this module. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

You will also be handed a Learner Workbook. This Learner Workbook should be used in conjunction with this Learner Guide. The Learner Workbook contains the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed as part of your Portfolio of Evidence, which will be required during your final assessment.

You will be assessed during the course of your study. This is called formative assessment. You will also be assessed on completion of this unit standard. This is called summative assessment. Before your assessment, your assessor will discuss the unit standard with you.

**How to use this guide …**

Throughout this guide, you will come across certain re-occurring “boxes”. These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

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| **Definition** | **What does it mean?** Each learning field is characterized by unique terms and **definitions** – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner. |

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| **Activity** | You will be requested to complete **activities,** which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box. |

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| **Example** | Examples of certain concepts or principles to help you contextualise them easier, will be shown in this box. |

**What are we going to learn?**

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| --- | --- | --- |
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**What will I be able to do?**

**When you have achieved this unit standard, you will be able to:**

* Count and/or estimate a number of items and an amount of money and record the number or amount orally and in writing.
* Demonstrate understanding of and use the continuous, recurring, patterned nature of the whole number system to generate order and compare numbers, and identify and complete simple number and visual patterns.
* Work with fractions and demonstrate understanding of the size, concept and use of fractions and the link between fractions, decimals and percentages.
* Demonstrate understanding of and use mathematical language, symbols and notation to represent and communicate mathematical relations, concepts and generalizations.
* Explain the origin and logic of, and use an alternative means of counting and recording quantity.

**Learning Outcomes**

When you have achieved this unit standard, you will be able to:

* Count and/or estimate a number of items and an amount of money and record the number or amount oral.
* Demonstrate understanding of and use the continuous, recurring, patterned nature of the whole number.
* Work with fractions and demonstrate under-standing of the size.
* Demonstrate understanding of and use mathematical language, symbols and notation.
* Explain the origin and logic of, and use, an alternative means of counting and recording quantity.

**Learning Assumed to be in Place**

The following competencies at ABET level 3 Numeracy are assumed to be in place:

* Solve realistic and abstract problems involving changing quantities by addition, subtraction, multiplication and division.
* Solve realistic and abstract problems involving variables in non-symbolic form.
* Demonstrate knowledge of different ways of expressing fractions and work with fractions, percentages and decimals to describe situations and calculate change situations.
* Demonstrate knowledge of the development of mathematics as a human activity and use alternate number system to the base ten system.
* Demonstrate understanding of appropriate measurements and relationships between different units of measure, solve problems involving measurement, perimeter, area, volume and time.
* The ability to construct and use tables and graphs to organise and interpret information.
* Construct and use tables and graph to organise and interpret information.

**Attitudes and misconceptions**

Do your experiences in math cause you anxiety? Have you been left with the impression that math is difficult and only some people are 'good' at math? Are you one of those people who believe that you 'can't do math', that you're missing that 'math gene'? Do you have the dreaded disease called Math Anxiety? Read on, sometimes our school experiences leave us with the wrong impression about math. There are many misconceptions that lead one to believe that only some individuals can do math. It's time to dispel those common myths…

**Tick off true or false?**

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| Statement | False | True |  |
| 1. There is only one way to solve a problem… |  |  | There are a variety of ways to solve math problems and variety of tools to assist with the process. |
| 2. You need a 'Mathematics gene' or dominance of your left-brain to be successful at Mathematics… |  |  | Like reading, the majority of people are born with the ability to do math. Children and adults need to maintain a positive attitude and the belief that they can do math. This self-belief has often been scarred somewhere in the past… today is the day to make a fresh start and begin from scratch! |
| 3. People don't learn the basics anymore because of a reliance on calculators and computers…. |  |  | Research at this time indicates that calculators do not have a negative impact on achievement. The calculator is a powerful teaching tool when used appropriately. Most facilitators now help you to learn how to use any technological tool to your advantage! |
| 4. You need to memorize a lot of facts, rules and formulas to be good at Mathematics… |  |  | As stated earlier, there's more than one way to solve a problem. Memorizing procedures is not as effective as conceptually understanding concepts! |

The question to ask yourself is: Do I really understand how, why, when this will work?

**Positive attitudes towards math are the first step to success!**

Think of the following problem:

You bought a take-away pizza to share between yourself and four other friends. It has 6 slices. How would you divide 6 slices equally between 5 people?

**Write down your method…**

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Some of you will visualize the pizzas, some will add the total number of slices and divide by 5. Does anyone actually write the algorithm? Not likely! There are a variety of ways to arrive at the solution, and everyone uses their own learning style when solving the problem.

**When does the most powerful learning usually occur?**

* When one makes a mistake!
* If you take the time to analyse where you go wrong, you can't help but learn. Never feel badly about making mistakes in mathematics!
* Math has never been more important, technology demands that we work smarter and have stronger problem solving skills!

**Now ... Let’s do math!**

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| **Session 1: Count and/or estimate a number of items and an amount of money and record the number or amount oral** |

After completing this session, you will be able to**: SO 1: Explain the origin and logic of, and use, an alternative means of counting and recording quantity. Describe and compare counting systems from different cultures.**

**In this session we are going to explore the following concepts:**

* The origin and logic of, and use, an alternative means of counting and recording quantity.
* Ancient, self-generated or cultural number systems. Logic to be explained only in terms of how it works and how it is generalized.
* The system used to count at least 3 different quantities in the range of whole numbers 1 to 100.
* The origin of the system.
* How the system works.
* How the system can be generalized.
* The use of the system in accordance with its logic to correctly express the quantity being counted.
* Let’s describe and compare counting systems from different cultures. Our own, African culture other than own, and one other type.
* Let’s learn to translate numbers from one base system to another.
* How counting systems developed and their significance.
* Examples of how the systems might have been used, and the limitations of the system.

**1.1 Number systems – for antiquity until now!**

**Let’s look at a short history of numbers and number systems**

Thousands of years ago there was no basic understanding of even the most basic number sense, for example there was no representation of “two” or “three”. People used only terms of “herds” (of sheep), “heaps” (of grain) and “many” (people). Then barter systems started and people started to think in terms of money. Viola! People started counting and came to the earth-shattering discovery of two plus two equals four!

How many grandfathers do you have? Two. And great grandfathers? Four. And great-great grandfathers? Eight. And great-great-great grandfathers? Sixteen. The further back into the past you venture, it seems, the more people there were. And yet strangely enough… there must have been less people in earlier times than there are today!

How does this all fit together? The answer to this little bit of trivia, you can figure out for yourself! Bur fact is, that you would never even have been able to think in terms of this paradox if you did not have the ability to count. And numbers rule our lives in far more important areas than genealogy – in so far as modern civilisation would have been impossible if we had no concept of numbers and figure.

Different civilisations throughout history developed different types of number systems. But one of the most commonly used one that is used in most modern civilisations, is one where objects are grouped in groups of ten. This is called the base-ten numbering system or decimal numbering system. This is also the numbering system that we know and that all our measurements are based on.

The base-ten numbering system, no doubt developed due to the fact that it fits in with the human body… we do after all have 10 fingers and 10 toes. To count in tens was thus not a difficult process for early humans in ancient times.

In some cultures number systems were used that was based on numbers like 3, 4 and 5. The old Babylonians used a system based on base-six with the number 60 as measure. The old Romans however used the base-twelve number system and the Mayan tribes the base-twenty number system. The binary system, based on the number 2, was used by some civilisations, and is what is used today in conjunction with a 16-base number systems, to program computers.

**Where did number digits originate?**

Thousands of years ago there were no number digits for the concepts “two” or“three”. In place of these digits, fingers, toes, stones, sticks or even eyes were used to represent different numbers. There were no watches, calendars or any other time measuring devices available by then.

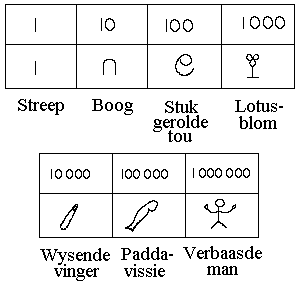
The sun was used, to differentiate between noon (twelve o’clock), and late afternoon (five o’clock). Stars and the moon in the night sky indicated the unnumbered progress of time in the night sky. In most old civilisations there were no number larger than two! They thus had to develop terms like “herds” (sheep), “heaps” (grain) and “many” (people), to describe things.

Let’s admit that back then a numbering system might not have been strictly necessary. This need only developed when people started living together in organised tribes in specific places. Out of this development, the need for barter systems grew, and thus the need for money based counting systems. The challenge was how to distinguish between five and fifty when the only concept of counting that you have in your vocabulary, are “herds”, “heaps” and “many”.

Paper and pencils to write down numbers, did not exist. They developed other methods to communicate in writing and to teach the other people around them the use of number systems.

The Babylonians “wrote” number in clay, by pressing a stick to different depths and at different angles into the clay.

The Egyptians in turn learnt to chisel their number into stone. For the representation of specific number specific symbols were used, rather than a digit as we know it today. The Egyptians had number symbols as follows:



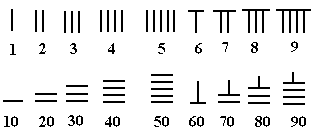
**Exercise**

1. Think of the following problem

You bought a take-away pizza to share between yourself and four other friends. It has 6 slices. How would you divide 6 slices equally between 5 people?

1. Write down your method.
2. Now compare you method with the person next to you and other learners in the class. Did you all use the same method?
3. Some of you will visualize the pizzas, some will add the total number of slices and divide by 5. Does anyone actually write the algorithm? Not likely! There are a variety of ways to arrive at the solution, and everyone uses their own learning style when solving the problem.

The innovative Chinese had one of the oldest number systems that we know of. It was based on sticks placed on a table to make calculations. It looked something like this:



From around 450 BC the Greeks came up with various ways to write numbers. The most common methods was to use the first ten letters of their alphabet to represent the first ten numbers. To distinguish between different numbers and the use of that same symbol for a word, they often used the symbol (/ or?), in between:

Let’s look how they wrote:



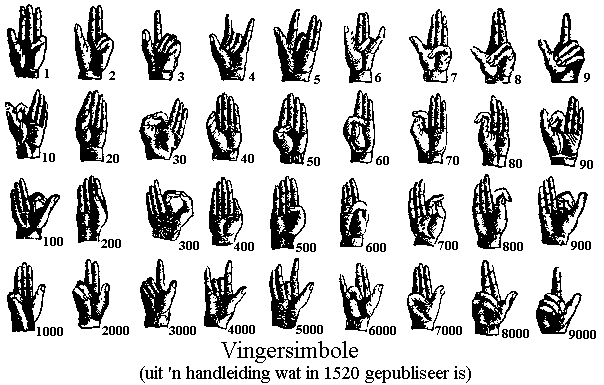
The Roman numbering system is still used today, even though the symbols change from time to time. The Romans often used to write Four as IIII instead of the accepted IV or I before V. Today Roman numerals are often used to indicate the chapters in books, as well as divisions in written work, such as paragraphs, points, etc.

The earliest forms of Roman numerals and values were as follows:



Finger number systems were used by Greeks, Romans en Europeans all through the middle Ages and then later by Asian civilisations. We still often see children use this same system of finger number systems in order to learn how to count.

The old systems looked something like this:



Our current numbering systems are based on a Hindu system that was developed around 2400 BC, and is still in use daily. Some of the old symbols that was developed a few centuries ago are still very recognisable in our current number representation symbols. However with the changes in typography as related to the changes that we have made in the way we write certain symbols, one cannot help but wonder how our number systems will evolve over the next few millennia. And will we still use our fingers for counting or will humanity find a new numeric workhorse?

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| **Session 2: Demonstrate understanding of and use the continuous, recurring, patterned nature of the whole number** |

After completing this session, you will be able to**: SO 2: Demonstrate understanding of and use the continuous, recurring, patterned nature of the whole number. Count and/or estimate a number of items and an amount of money and record the number or amount oral.**

**In this session we are going to explore the following concepts:**

Place value, role of 0 in our number system, patterned nature of whole numbers, history and contestations:

* The use of the continuous, recurring, patterned nature of the whole number.
* Number patterns could be based on doubling, halving, fixed differences, increasing or decreasing differences. Patterns do not include squared or cubed numbers, or those based on ratios. Numbers and money are generated or expanded by groupings of 1s; 10s; 100s and 1 000s.
* Identified patterns are consistent throughout the pattern.
* Completed patterns are internally consistent.
* Numbers are correctly sequenced according to size or identified patterns.
* Numbers generated or expanded using groupings of 1s; 10s; 100s and 1 000s equate to the original numbers.
* The language of comparison is used where appropriate and demonstrates the relationship between numbers.
* Including but not limited to: more than, less than, bigger, smaller, the same as, equal to, nearly, fewer, least, different.
* Count and/or estimate a number of items and an amount of money and record the number or amount oral.
* Count in 1s, 2s, 4s, 5s, 10s, 20s, 25s, 50s, 100s, 200s in ascending and descending order, starting at any number up to at least 1 000.
* The quantity or amount expressed and recorded is correct in terms of number names and symbols used.
* The form of written numbers is in accordance with the conventions for writing numbers.
* Money is written in accordance with established conventions.
* Including but not limited to the following forms: R5, 86; R5 4. 86 586c.
* The language of estimation is used where appropriate.
* Including but not limited to: about, more-or-less, close to, less than, more than, approximately, nearly.
* The accuracy of estimates is appropriate in terms of the context, the need for speed and the purpose of the estimates.
* The link between the number of items, the number names and the number symbols is demonstrated.

**2.1 Let’s explore patterns in counting**

**Let’s look at an example of the patterns that are formed whilst applying a counting system**

* **Counting by two’s**

**You can count by two’s by either:**

* Adding 2 to the previous number or
* Counting and skipping every other number.

The numbers that you would count if you started with 0 and counted by twos would be:

0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 and so on.

Notice that all of the counts are even numbers. The numbers that you would count if you started with 1 and counted by twos would be:

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 and so on.

Notice that all of the counts are odd numbers.

* **Counting by Fives**

**Counting by Fives with numbers**

5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100

**Counting by Fives with words**

Five, ten, fifteen, twenty, twenty-five, thirty, thirty-five, forty, forty-five, fifty, fifty-five, sixty, sixty-five, seventy, seventy-five, eighty, eighty-five, ninety, ninety-five, one hundred

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| **Example** | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | | **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** | | **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** | | **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** | | **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** | | **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** | | **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |   **A number pattern exists when counting by fives. The numbers first end with the number five and then end with a zero. This pattern is repeated 5, 0, 5, 0, 5, 0, etc.** |

* **Counting by Tens**

Counting by Tens with numbers: 10, 20, 30, 40, 50, 60, 70, 80, 90

Counting by Tens with words:

Ten, twenty, thirty, forty, fifty, sixty, seventy, eighty, ninety, one hundred

Number Patterns when counting by Tens:

When you count by tens the numbers create a pattern. All the numbers end with a zero. The first digits are just like the numbers when you count. This pattern gives the numbers 10, 20, 30, 40, 50, etc.

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| **Example** | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | | **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** | | **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** | | **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** | | **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** | | **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** | | **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |   **When you count by tens the numbers create a pattern. All the numbers end with a zero. The first digits are just like the numbers when you count (1, 2, 3, 4, 5, etc.). This pattern gives the numbers 10, 20, 30, 40, 50, etc.** |

**Exercise**

You are working in a pack store, where apples are packed. You are asked to count the number of apples that are packed in an hour. Give a detailed account of the following:

1. Where would you start?

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1. If you were told to estimate the number of apples packed in the hour, how would you go about it?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If you were told to count the exact number of apples packed in an hour, how would you go about it?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If you asked the driver of the tractor and he told you that he arrived every hour with a load of 10 picking baskets that could always fit approximately 100 apples each, how would it make your estimate easier?

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1. If you know that there are 50 apples packed in a box, ready for distribution, and at the end of an hour you find that 70 boxes have been filled, how would that make your accurate calculation task easier?

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1. Explore different counting patterns using a calculator

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1. Use the numbers 2, 3, 5, 10, 20, 25, 30 and 50. Skip counting by what numbers will include 100 as part of the pattern?

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1. What pattern do you see when you count by twos and begin with 2?

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1. What do you notice when you count by twos and begin with 1? Why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Will there be a pattern if you skip-count by fives and begin with 3? Why? Why not?

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1. What happens if you skip-count by tens and start with 37? What do you notice?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.2 Let’s explore international currency symbols for money**

|  |  |  |
| --- | --- | --- |
| **Country and Currency** | **Currency Code** | **Graphic Image** |
| America (United States of America), Dollars | USD | $ |
| Australia, Dollars | AUD | $ |
| Britain (United Kingdom), Pounds | GBP | £ |
| Euro | EUR | € |
| Namibia, Dollars | NAD | $ |
| South Africa, Rand | ZAR | R |
| Zimbabwe, Dollars | ZWD | $ |

**2.3 Let’s explore how one can record money values correctly**

|  |  |
| --- | --- |
| **Example** | **The price of fuel is:**  Five rand and sixteen cent per litre.  **We can write that as:**  **R 5.16** or **5.16** or **516c** or **ZAR 5.16** or we can estimate and say the price is approximately **R5.** |

**Exercise**

Fill in the gaps and write the values in the same formats as the example in the first row.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value** | **Format in**  **South Africa** | **Format in**  **Cents** | **Format**  **Internationally** | **Format without**  **currency symbols** | **Format**  **Rounded off** |
| Five rand  and sixteen  cents | R 5.16 | 516c | ZAR 5.16 | 5.16 | R5 |
| One rand |  |  |  |  |  |
|  | R 7.10 |  |  |  |  |
|  |  | 888c |  |  |  |
|  |  |  | ZAR 12.50 |  |  |
|  |  |  |  | 2.90 |  |
|  |  |  |  |  | R10 |

**2.4 Let’s explore the language of estimation**

**Exercise**

John and his foreman are having a conversation. The foreman had asked John to complete pruning of block 7 in the orchard this morning. Now he would like to know how far they got… John answers that they are ABOUT quarter way.

They have pruned NEARLY all the first 7 rows. That would mean that they have pruned MORE OR LESS 700 vines. If they had APPROXIMATELY 4 more hours left for today, then they would have pruned CLOSE TO half the block.

He thinks that is MORE THAN they pruned in the same time last year, but LESS THAN they could have pruned if every worker was trained properly.

1. Do you think that John has answered his boss sufficiently? Why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If the workers were being paid per tree that they are pruning, do you think that he would need to be more accurate or that he could estimate in the same way?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Can you think of a time when you needed to estimate something really quickly?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Can you think of a time when you had to be more accurate? Why? Did it take longer to do?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Give 5 examples of things you would estimate.

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1. Give 3 examples of things that you would calculate very accurately.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Do you think that you can sometimes use estimation to check if somebody else has calculated accurately? Give an example.

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1. If you earn R 400.00 per week or R 1600.00 per month, would you be able to afford to buy a car of R 200 000.00 and pay it off in 12 months? Motivate your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Did you use estimation when you answered question 8?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If you earn R 400.00 per week or R 1600.00 per month, would you be able to afford to buy a television set of R 1200.00 and pay it off in instalments of R 100.00 per month? How long would it take you to pay it off?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Did you use estimation or calculation to help you answer question 10?

**2.5 Let’s explore recurring patterns of whole numbers**

**Exercise**

Look at the following number block:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| **101** | **102** | **103** | **104** | **105** | **106** | **107** | **108** | **109** | **110** |

1. Can you recognise any patterns in our counting system?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. When you learnt to count to a thousand, did you learn a thousand words off by heart, or was there a pattern in the number system that helped you count?

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1. Why do you think it was easier to have a base-ten number system for counting and calculation?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.6 Let’s talk about writing big numbers**

We come across large numbers in our everyday life so it is important to be able to read them. To help with numbers that have more than five figures, which might be difficult to read, we use place value.



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Remember**  Place value is the idea that a figure has a different value when used in different places. Below is a place value table with the numbers 7 853 and 5 387. *Note: Each column can only contain one figure from 0 to 9.*   |  |  |  |  | | --- | --- | --- | --- | | **Thousands** | **Hundreds** | **Tens** | **Units** | | Th | H | T | U | | 7 | 8 | 5 | 3 | | 5 | 3 | 8 | 7 |   In the number 7 853 (seven thousand eight hundred and fifty three) the 7 has the value. 7 thousand. This number is 7 000 + 800 + 50 + 3.  In the number 5 387 (five thousand three hundred and eighty seven) the 7 has the value.  7 units. This number is 5 000 + 300 + 80 + 7.  In these two numbers the 7 stands for different values when it is in different places. |

|  |
| --- |
| **Session 3: Work with fractions and demonstrate understanding of the size** |

After completing this session, you will be able to**: SO 3: Critically analyse the development of the base ten number system.**

**In this session we are going to explore the following concepts:**

* Critically analyse the development of the base ten number system.
* Place value, role of 0 in our number system, patterned nature of whole numbers, history and contestations.
* The development and significance of zero is explained.
* The place value of numbers.
* The patterned nature of whole numbers and its historical development.
* The contestations around, and use and popularisation of the decimal number system are described

**3.1 The development and significance of zero**

The idea of place value is at the heart of our number system. First, however, a symbol for nothing--our zero--had to be invented. Zero "holds the place" for a particular value, when no other digit goes in that position.

For example, the number "100" in words means one hundred, no tens, and no ones. Without a symbol for nothing, our decimal number system wouldn't work!

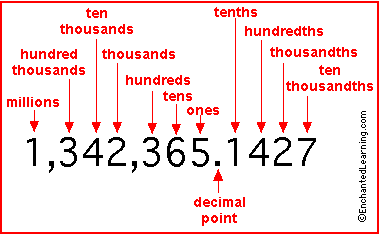
Beginning with the ones place at the right, each place value is multiplied by increasing powers of 10. For example, the value of the first place on the right is "one", the value of the place to the left of it is "ten," which is 10 times 1. The place to the left of the tens place is hundreds, which is 10 times 10, and so forth.

|  |  |
| --- | --- |
| **Example** | **Examples**  Numbers can be represented in many ways, but standard form is usually the easiest and shortest way. Here are some numbers expressed in different forms, with their standard form shown alongside. Which form do you think is the best?  **Example 1 -** one billion, sixty million, five hundred twenty thousand = 1 060 520 000  **Example 2 -** four hundred sixteen thousand, seven hundred thirty-one = 416 731  **Example 3** - 6 000 000 + 70 000 + 20 + 1 = 6 070 021. |

**3.2 Writing numbers up to a million**

Using the place value table can help you to write large numbers. Look at the following numbers:

|  |  |
| --- | --- |
| **Numbers in figures** | **Numbers in words** |
| 10 | Ten |
| 100 | Hundred |
| 1 000 | Thousand |
| 10 000 | Ten thousand |
| 100 000 | Hundred thousand |
| 1 000 000 | Million |



You will notice that the numbers are grouped in three figures. There is a space between each group of three figures (counting from right to left). You will sometimes see a comma used to separate the three figures. (If there is no comma in a large number and you have problem saying it, try putting in the comma.) In South Africa we DO NOT normally use a comma to separate large numbers we rather use it only to write decimal numbers (we will look at decimals in depth later)

This grouping can help you to say the number 405 000. The first group of three figures is four hundred and five and the last three figures show thousands (since there are three zeros in a thousand). The number is four hundred and five thousand.

Note how important the figure Zero is when we write this number in a place value table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Millions** | **Hundreds of Thousands** | **Tens of thousands** | **Thousands** | **Hundreds** | **Tens** | **Units** |
| **M** | **MTh** | **TTh** | **Th** | **H** | **T** | **U** |
|  | 4 | 0 | 5 | 0 | 0 | 0 |
|  |  | 4 | 5 | 0 | 0 | 0 |
|  |  |  | 5 | 0 | 0 | 0 |

**3.3 Writing numbers in words in figures**

There are times when you may need to write down a large number in figures that someone has told you in words. Newspaper stories often have large numbers written in figures that may be difficult to make sense of unless you can say them in words.

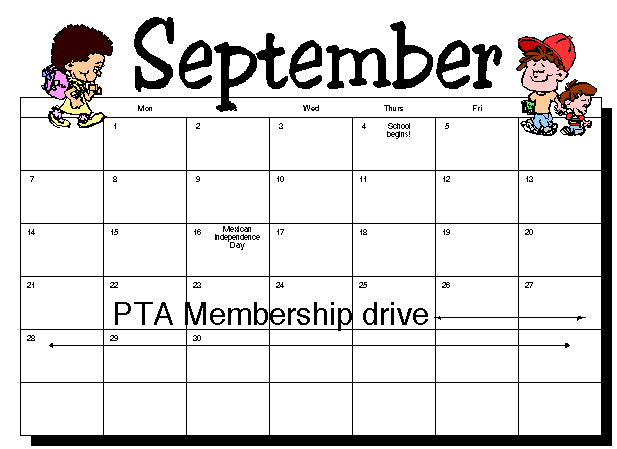
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example** | **Write five thousand, three hundred and six in figures.**  Put the 5 in the thousands column and the 3 in the hundreds column. The 6 should go in the units column so make sure you fill the tens column with a 0 to show no tens.   |  |  |  |  | | --- | --- | --- | --- | | **The** | **H** | **T** | **H** | | 5 | 3 | 0 | 6 |   The number is **5 306** |

**3.4 Write twenty six thousand, seven hundred and fifty in figures**

For this number we would start with the tens of thousands column. Any number larger than 9 999 would have 5 figures. Start with the 2 in the tens of thousands column and continue by putting the 6 in the thousands column, the 7 in the hundreds column and the 5 in the tens column. The unit’s column must have a 0 to show no units.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TTh** | **The** | **H** | **T** | **U** |
| 2 | 6 | 7 | 5 | 0 |

The number is **26 750.**



**3.5 Ordering large numbers**

When you have a series of large numbers, which are not in number order, it is sometimes difficult to make sense of them.

Here is a table showing the daily profits of a supermarket written in order of days.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Saturday** | **Sunday** |
| **Profit** | R 5 934 | R 7 656 R | R 7 573 | R 8 678 | R10834 | R14976 | R5 004 |

If these numbers were put into a place value table, it would be easier to arrange them in order.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Days** | **TTh** | **Th** | **H** | **T** | **U** |
| Mon |  | 5 | 9 | 3 | 6 |
| Tue |  | 7 | 6 | 5 | 4 |
| Wed |  | 7 | 5 | 7 | 3 |
| Thu |  | 8 | 6 | 7 | 8 |
| Fri | 1 | 0 | 8 | 3 | 4 |
| Sat | 1 | 4 | 9 | 7 | 6 |
| Sun |  | 5 | 0 | 0 | 4 |

Look at each column in turn. The figures for Friday and Saturday will be the largest as these have figures in the tens of thousands column. Looking at the thousands column shows that since there is a 4 in the thousand column for Saturday and a 0 in the thousands column for Friday that Saturday has the largest number. Carry on for each of the other numbers.

**3.6 Writing figures in words**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **0** | Zero | **10** | Ten | 20 | Twenty |
| **1** | One | **11** | Eleven | 30 | Thirty |
| **2** | Two | **12** | Twelve | 40 | Forty |
| **3** | Three | **13** | Thirteen | 50 | Fifty |
| **4** | Four | **14** | Fourteen | 60 | Sixty |
| **5** | Five | **15** | Fifteen | 70 | Seventy |
| **6** | Six | **16** | Sixteen | 80 | Eighty |
| **7** | Seven | **17** | Seventeen | 90 | Ninety |
| **8** | Eight | **18** | Eighteen | 100 | Hundred |
| **9** | nine | **19** | Nineteen | 1 000 | Thousand |
|  |  |  |  | 1 000 000 | Million |

**Big numbers glossary**

Here are some of the words you may come across to do with big numbers.

* **Place value**

A figure has a different value when used in different places.

|  |  |
| --- | --- |
| **Example** | In these three numbers, the 4 stands for a different value:  45 The number 4 has a value of 40 (4 tens)  405 The number 4 has a value of 400 (4 hundreds)  54 The number 4 has a value of 4 (4 units) |

* **Digit**

A figure or a number. 45 is a two-digit number whereas 405 is a three-digit number.

* **Billion**

Have a look at this bag of money. Think of a million pounds as being the bag of money. If you had a billion pounds, you would have a thousand of these bags! When we talk about a billion we mean a thousand million or 1 000 000 000. If you see a billion in a news story it is referring to a thousand million. Such big numbers can be difficult to imagine.

**Exercise**

Read these handy tricks and test them for yourself. Please note that you do not have to **KNOW** them, but it can make your life much easier if you did!

* Divisibility Math Tricks to Learn the Facts (Divisibility)
* Dividing by 2

All even numbers are divisible by 2. E.g., all numbers ending in 0,2,4,6 or 8.

* Dividing by 3. Add up all the digits in the number. Find out what the sum is. If the sum is divisible by 3, so is the number For example: 12123 (1+2+1+2+3=9) 9 is divisible by 3, therefore 12123 is too!
* Dividing by 4 - Are the last two digits in your number divisible by 4? If so, the number is too! For example: 358912 ends in 12, which is divisible by 4, thus so is 358912.
* Dividing by 5 Numbers ending in a 5 or a 0 are always divisible by 5
* Dividing by 6 If the Number is divisible by 2 and 3 it is divisible by 6 also
* Dividing by 9 Almost the same rule and dividing by 3. Add up all the digits in the number. Find out what the sum is. If the sum is divisible by 9, so is the number. For example: 43785 (4+3+7+8+5=27) 27 is divisible by 9, therefore 43785 is too!
* Dividing by 10 if the number ends in a 0, it is divisible by 10.

**3.7 Comparing numbers**

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Meaning** | **Example in symbols** | **Example in words** |
| > | Greater than  More than  Bigger than  Larger than | 7 > 4 | 7 is greater than 4  7 is more than 4  7 is bigger than 4  7 is larger than 4 |
| < | Less than  Fewer than  Smaller than | 4 < 7 | 4 is less than 7  4 has fewer than 7  4 is smaller than 7 |
| = | Equal to  Same as | 7 = 7 | 7 is equal to 7  7 is the same as 7 |

Study the above pictures. Do we first compare how many TENS the numbers have or how many ONES the numbers have?

* Compare first how many \_\_\_\_\_\_ the numbers have.
* If the numbers have the same amount of \_\_\_, then compare the \_\_\_\_.

**For example,**

* 92 has more TENS than 89. Therefore 92 is greater than 89.
* 62 has the same amount of TENS as 66, but it has less ONES than 66. Therefore 62 is less than 66. The symbol \_\_\_\_\_\_ means "greater than", and \_\_\_\_\_\_ means "less than".

3 < 5 14 > 3 60 > 50 48 < 99 7 < 17

**You can also use the number line for help.**



Since 44 comes before 47 when you read the number line from left to right, 44 < 47.

**3.8 Ordering ascending numbers**

Numbers have an order or arrangement. The number two is between one and three. Three or more numbers can be placed in order. The order may be ascending (getting larger in value) or descending (becoming smaller in value.

* **Seven digit numbers**

How do you write one million rand in numbers? Like this R1 000 000

The number 1 000 000 has seven digits. These are the seven columns.



1 0 0 0 0 0 0



How would you write one million five hundred thousand?

1 5 0 0 0 0 0

That is 1 500 000.

How would you write one million, three hundred and twenty thousand a fifty four? Put place holder zeros into the empty columns like this



1 3 2 0 0 5 4

That number is 1 320 054. It would be very different if it was 1 302 054



1 3 0 2 0 5 4

That is one million, three hundred and two thousand and fifty four, which is smaller than 1 320 054

1 302 054 < 1 320 054

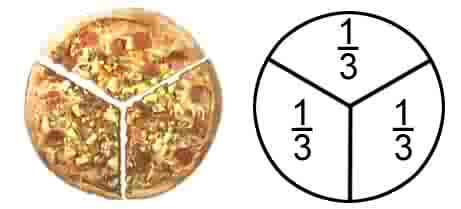
|  |
| --- |
| **Session 4: Demonstrate understanding of and use mathematical language symbols and notation** |

After completing this session, you will be able to**: SO 4: Demonstrate understanding of and use mathematical language, symbols and notation.**

Fractions are traditionally a very frightening part of maths to master. It is also one of the clearest indications why we needed outcomes based education. The old way of teaching fractions often included being told to “memorise” rather than to understand. A lot of learners simply gave up and started believing that they were unable to “do” fractions!

But little do they realise that they are in fact masters of fractions! They divide cakes, pizzas and make payments on their accounts without a second thought…

**4.1 What is a fraction?**



**4.1 Mathematical**

This pizza has been cut into three equal parts. We call these thirds. A third is written as 1/3

The whole pizza cut into three equal parts - gives us three thirds.



Think about just one slice. We can write this using a fraction.



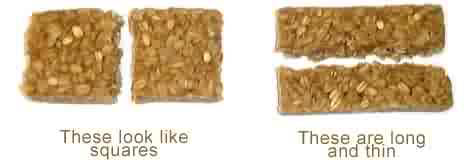
Think about two slices. Two slices is two thirds. The top number of the fraction tells us how many slices we have. We call it the numerator. The bottom number tells us how many parts in the whole pizza. We call it the denominator.

* **Fractions of a whole**

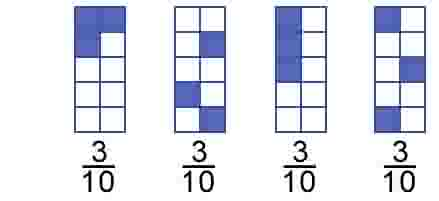
What if you have a cake cut into six equal parts**?**



If all six slices are put together they make the whole cake. Here are all the fractions you can make.



When you divide things into fractions it doesn't matter how you do this as long as the parts are all equal in size. The rectangles below have each been divided into ten parts. Each of the parts is. The rectangles all have three out of their ten parts shaded, which is written. All the rectangles have the same fraction shaded.



These shapes also have the same fraction shaded. They have ten parts and three of the parts have been shaded.



* **Fractions in words**



You might see fractions in shops, on bills, in newspapers and recipes. It's a good idea to recognise fractions when they are written as words.

|  |  |  |
| --- | --- | --- |
| **Fraction** | **Word** | **Plural** |
| ½ | One half (A half) | Halves |
| 1/3 | One third | Thirds |
| ¼ | One quarter | Quarters |
| 1/5 | One fifth | Fifths |
| 1/6 | One sixth | Sixths |
| 1/7 | One seventh | Sevenths |
| 1/8 | One eighth | Eighths |
| 1/9 | One ninth | Ninths |
| 1/10 | One tenth | Tenths |

* **How to simplify fractions**

Perhaps you think that fractions can never be simple, but they can often be written more simply. The way to simplify fractions is to make the top and bottom numbers smaller. You can only do this by finding a number that divides into them. Any other method would change the value of the fraction.

The important thing is that you must find a number that divides into both the top and bottom numbers at the same time. This is sometimes called cancelling down. This is the case with the fractions above. You can divide the top and bottom of each one by the number that happens to be on the top.

* **Improper fractions**

You might have noticed that in these fractions the top number is bigger than the bottom number. These are called improper or 'top heavy' fractions.

|  |  |
| --- | --- |
| **Activity**  Now complete  activity **8** in  your workbook | **My Notes**  **­­­­­­­­­­** |

* **Comparing unit fractions**

A unit fraction has a 1 on the top of the fraction. The number on the top is called the numerator. So a unit fraction means a fraction with 1 as the numerator. In a unit fraction the larger the number on the bottom the smaller the value of the fraction.

* **Compare fractions with the same denominator**

These fractions all have 4 on the bottom.

* **Multiplying Common Fractions**

When we multiply fractions, we first multiply the numerators and then the denominators. Remember the word “of” means multiply

* **Multiplying Mixed Fractions**

Before multiplying, convert mixed fractions to improper fractions

* **Multiply Decimals**

When multiplying decimals:

* Multiply the numbers as if there were no decimal places.
* Count the number of decimal places in the original sum. This will tell you the number of decimal places needed in the answer.
* Place the comma in the correct position in the answer.

2, 04 x 3, 12 4 decimal places in original sum

204 x 312

= 63648

= 6, 3648 4 decimal places in answer

* **Dividing fractions**

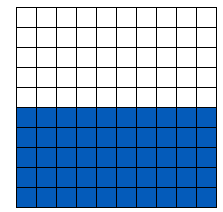
When dividing by a fraction, "tip and times" the divisor (i.e. the fraction you are dividing by), and then multiply. Always use improper fractions when dividing.

* **Dividing Decimals**
* Move the comma of the divisor until it has no decimal places.
* Move the comma of the other number (the dividend) by the same number of places i.e. you are multiplying by 10, 100, 1000 etc.
* Divide as you would with whole numbers.
* **What does % mean?**

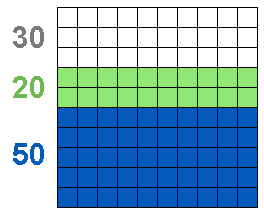
You probably already know a bit about percentages. Shops use percentages in sales. Banks use them for loan rates. Weather forecasts use them to tell us the chances of rain. But what does percentage mean?



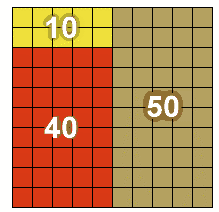
'Per cent' means 'out of every 100'



Look at this square. It has been divided into 100 equal parts. 50 parts are shaded blue. We say that fifty per cent of the square is shaded blue. You can write this using a percentage symbol as 50%



Now 20 parts have been coloured green. 20 out of the 100 is 20%, so 20% of the square is green. There are 30 parts not shaded. 30 out of 100 is 30%, so 30% of the square is white. What happens if you add up the percentages for the blue, green and white parts? 50% + 20% + 30% = 100% so the whole square is equal 100% 100% is '100 out of 100'. It means full marks in a test, or 100% fitness means full fitness. If you give 100 % you give everything.



* **Fractions and %**

Skirts are in the sale with 50% off the original price of R20. How much are they now? If you said R10 well done! It is quite easy to find the answer if you can remember that finding 50% is the same as finding a half, or dividing by two. Here are the fractions for some other percentages:

|  |  |
| --- | --- |
| **Percentage** | **Fraction** |
| 10% | 1/10 |
| 20% | 1/5 |
| 25% | ¼ |
| 50% | ½ |
| 75% | 3/4 |

**4.2 Powers**

Base 25 exponent

A shorter way of writing 2 x 2 x 2 x 2 x 2 is 25. This is called a power and is read as "2 to the power 5". The 2 is called the base and the 5 is called the exponent.

* **Place Value**

The symbol “0” or zero is a place holder, to show that there is nothing in that place. It gives the other digits their correct place value.

* **Base 10 Number System**

Each "column" in our number system represents a power of 10. We call our number system the decimal or base ten number system, e.g. 25487 = (2 x 104) + (5 x 103) + (4 x 102) + (8 x 101) + 7

* **Identity Element for Adding and Subtracting: 0**

When you add or subtract zero, the number does not change at all. Zero is called the identity element for addition and subtraction, e.g. 5 + 0 = 5 and 17 – 0 = 17

* **Identity Element for Multiplication and Division: 1**

When you multiply any number by zero, the answer is zero. [6 x 0 = 0] When you multiply by 1, the number does not change. 1 is the identity element for multiplication, e.g. 6 x 1 = 6

When 0 is divided by a number, the answer is zero. [0 ÷8 = 0]. But dividing by zero is meaningless. When dividing by 1, the number does not change. 1 is therefore the identity element for division, e.g. 16 ÷1 = 16

**4.3 Integers**

The set of positive and negative whole numbers is called a set of integers

Answer the following questions

**Exercise 1**

1. Would you prefer to have –R10 or –R20?
2. If sea level is 0m, would you prefer to be 2m or -2m in relation to the sea?
3. Write down an integer which is greater than -7, but less than -2
4. Write down four integers between -2 and 4.
5. Write down an integer which is 6 greater than -2.
6. If you are -200m in a mine shaft and the lift takes you down another 200m, write an expression to calculate your new level.
7. If your bank account is at –R100 and you deposit R35, write an expression to calculate your new bank balance.
8. If the night temperature tonight is -2ºC and then it is 5 ºC less tomorrow night, write an expression to calculate tomorrow night’ temperature.

**Exercise 2**

Fill in >, <, or = to make the following mathematical statements true.

1. -13\_\_\_\_\_\_\_\_\_\_10

2. 3½ \_\_\_\_\_\_\_\_\_\_3, 5

3. -4 \_\_\_\_\_\_\_\_\_\_-2

4. -22\_\_\_\_\_\_\_\_\_-222

5. 1\_\_\_\_\_\_\_\_\_\_-10

* **Adding numbers with the Same Sign**

When you add numbers with the same sign, you must add the numerical values and use the same sign as the numbers you are adding, e.g.

(-4) + (-2) = 6 And

14 + 3 = 17

* **Adding numbers with opposite signs**

When you add numbers with opposite signs, you must write down the sign of the bigger numerical value and then subtract, e.g.

(-9) + 5

= - (9 – 5)

= - 4

And

9 + (-5)

= + (9 – 5)

= 4

* **Additive Inverse**

When you add 12 and –12, you get an answer of zero. –12 is called the additive inverse of +12 and +12 is the additive inverse of –12.

Subtracting a number is the same as adding the additive inverse, e.g.

4 – (6) = 4 + (-6) = -2

(-4) – (6) = -4 + (-6) = -10

4 – (-6) = 4 + (=6) = 10

(-4) – (-6) = (-4) + (+6) = 2

**Exercise 1**

Solve the following

1. 14 – 8 =

2. (-14) – (-8) =

3. (-12) – 19 =

4. 12 – (-19) =

5. (-3) – 4 + (-2) =

Exercise 2

Calculate

1. –2 – 3 =

2. 5 – 6 =

3. –10 – 5 + 2 =

4. 6 + 2 – 1 + 5 =

5. 10 – 5 – 6 + 2 =

**Exercise 3**

Solve the following problems.

1. Theresa owes you R350, Alice owes you R450 and you have R200 in the bank. How much will you have when they pay you back?
2. The midnight temperature in Worcester in July is -4ºC. If the midday temperature is 12 ºC, by how much has the temperature risen?
3. You owe Jet R220 on your clothes account. You pay Jet R150, but then you buy more clothes amounting to R175 over the next month. How much will you owe Jet next month?

* **Multiplying two numbers with opposite signs**

When you multiply two numbers together which have opposite signs, the answer (product) will always be a negative number, e.g. (-6) x 4 = -24

* **Multiplying or dividing two numbers with the same signs**

When you multiply or divide two numbers together which have the same signs (both plus of both minus), the answer (product) will always be a positive number, e.g. (-6) x (-4) = +24 and 24 ÷6 = 4

* **Multiplying or dividing more than two numbers**

If you’re multiplying or dividing more than two numbers together, always do two at a time in order to be sure that you get the sign correct, e.g.

(-3) x (-4) x (-5) = (-3) x (-4) = +12 and then 12 x (-5) = -60

If you are multiplying an even number of negative integers, the answer will be positive. If you are multiplying an odd number of negative integers, the answer will be negative. Positive integers remain positive.

* **Integers raised to a power**

A negative integer raised to an even power, produces a positive answer. The reason the answer is positive, is that you have an even number of negatives. A negative integer raised to an odd power, produces a negative answer. The reason the answer is negative, is that you have an odd number of negatives, e.g. (-3)2 = 9 and (-3)3 = -27

Always remember that exponent acts only on the number immediately below it. If the negative symbol is not in a bracket, it is not subject to the power. Look carefully at the sum to determine the sign, e.g. (-4)2 means (-4) x (-4) which equals +16 and –42 means – (4 x 4) which equals –16.

**Exercise 1**

Solve the following

1. -15 x -6 =

2. 2 x (-7) x (-3) =

3. 2(-9) + 5(-7) =

4. (-12) x (11) x 0 =

5. [(-5) + (-5)] x 0, 1) =

Exercise 2

Find solutions to the following

1. (-3)2 x (-2)3

=

=

2. (-2)3 x (-2)1

=

=

3. (-5) x (-7) + (-15)

=

=

4. (-3) x (-2) x (-1)2

=

=

5. (-4)2 x (-2)5 + (-3)3

=

=

**Exercise 3**

Solve the following problems

1. You play cards and you score 2 points for every game you win and -1 point for every time you lose. If you win 20 times and lose 10 times, what is your total?
2. Your bank account contains R1000. You make 6 withdrawals of R200 each. What is your new bank balance? After how many months will you pay back only R50 per month?

|  |
| --- |
| **Session 5: Explain the origin and logic of, and use, an alternative means of counting and recording quantity** |

After completing this session, you will be able to: **SO 5: Express and interpret a range of contexts using mathematical symbols and find applications for numerical models.**

**In this session we are going to explore the following concepts:**

* Mathematical sentences – what are they and why do we use them?
* How we can use mathematical sentences to reflect a situation completely and accurately.
* Let’s look at some everyday problems, and how we can express them with mathematical sentences.
* Let’s explore some numerical models -
  + Equations
  + Expressions
  + Terms.
* How we would apply these numerical models
  + The meaning of symbols
  + Relationships between symbols

**5.1 Mathematical sentences-What are they and why do we use them?**

**5.2 How can we use Mathematical sentences to reflect a situation completely and accurately?**

One of the goals of studying mathematics is to develop the ability to think critically. The study of critical thinking, or reasoning, is called logic.

All reasoning is based on the ways we put sentences together. Let's start our examination of logic by defining what types of sentences we will be using.

A mathematical sentence is one in which a fact or complete idea is expressed. Because a mathematical sentence states a fact, many of them can be judged to be true or false. Questions and phrases are not mathematical sentences since they cannot be judged to be true or false.

* "An isosceles triangle has two congruent sides." is a true mathematical sentence.
* "10 + 4 = 15" is a false mathematical sentence.
* "Did you get that one right?" is NOT a mathematical sentence - it is a question.
* "All triangles" is NOT a mathematical sentence - it is a phrase.

There are two types of mathematical sentences:

* An open sentence is a sentence which contains a variable.
  + "x + 2 = 8" is an open sentence -- the variable is "x."
  + "It is my favourite colour." is an open sentence-- the variable is "It."
* A closed sentence, or statement, is a mathematical sentence which can be judged to be true or false. A closed sentence, or statement, has no variables.
  + "Garfield is a cartoon character." is a true closed sentence, or statement.
  + "A pentagon has exactly 4 sides." is a false closed sentence, or statement.

A compound sentence is formed when two or more thoughts are connected in one sentence.

* Today is a vacation day and I sleep late."
* "You can call me at 10 o'clock or you can call me at 2 o'clock."
* "If you are going to the beach, then you should take your sunscreen."
* **Outline**

Algebra provides the basics for all higher math. You will work with numbersand letters (variables) to form sentences (expressions) that you can solve.The best way to learn math is by practicing it, so each lesson will includeexercises using the skills learned.

* **A place to begin**
  + Letters in math are called variables. They can stand for different numbers at different times.
  + A mathematical sentence is called an expression. It can include numbers, variables, signs of operation, and symbols of inclusion.
  + Signs of operation tell you what to do to the sentence. The four operations are addition, subtraction, multiplication, and division.
  + Symbols of inclusion are parentheses ( ) and brackets [ ].

|  |  |
| --- | --- |
| **Hint** | **Important caution**  Be very neat in your calculations. Many an algebra problem is missed because the student misread what he or she had written or did not "line up" the column correctly for subtraction or division. Always double check operations.  You don't want to miss a problem because you added incorrectly. |

* **Let’s get started**
  + To "evaluate" an expression means to find its value, or to solve it. The first rule to learn about algebra is "what to do when." The order in which an expression's operations are done can completely change the answer.
  + When evaluating an algebraic expression, first look for the symbols which show the innermost work. That can be expressed by use of parentheses or brackets. If BOTH parentheses and brackets are present, the parentheses are usually the innermost and should be worked first.

**5.3 Let’s explore some numerical models**

|  |  |
| --- | --- |
| **Definition** | **Equation:** A mathematical sentence with an equals sign to indicate that two  expressions name the same number e.g. 4 + 2 = 6  **Expression:** A formula: a group of symbols that make a mathematical statement, and that is an ‘expression” of value. a – 1 > b + 2  **Term:** Parts of an expression or series separated by + or – signs, or the parts of a sequence separated by commas. |

* + The basic functions, such as square root and percentage (%).