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# NUMBERS

## GRADE 8

### Whole numbers

1. Revise multiplication of whole numbers to at least  $12 \times 12$  (**TIMETAB**)
2. Revise prime numbers to at least 100(**PRIMENUM**)
3. Revise the properties of whole numbers:
  - a. The commutative, associative, distributive properties of whole numbers (**PROPNUM**)
  - b. 0 in terms of its additive property (identity element for addition)(**ZEROPROP**)
  - c. 1 in terms of its multiplicative property (identity element for multiplication)(**ONEPROP**)
  - d. Recognize the division property of 0, whereby any number divided by 0 is undefined (**DIVZERO**)
4. Revise calculations using all four operations on whole numbers, estimating and using calculators where appropriate (**OPWHOLE**)
5. (**CALCTEC**) Use a range of techniques to perform and check written and mental calculations of whole numbers, including
  - a. Long division
  - b. Adding, subtracting and multiplying in columns
  - c. Estimation
  - d. Rounding off and compensating
  - e. Using a calculator
6. Prime factors of numbers to at least 3-digit whole numbers (**LADDER**)
7. LCM and HCF of numbers to at least 3-digit whole numbers, by inspection or factorization (**HCF**) (**FACMETH**)
8. Solve problems involving whole numbers, including:
  - a. Comparing two or more quantities of the same kind (ratio) (**RATIO**)

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- b. Comparing two quantities of different kinds (rate) **(RATE)**
  - c. Sharing in a given ratio where the whole is given **(ADT)**
  - d. Increasing or decreasing of a number in a given ratio **(INCRAT)**
9. **(PERCENTCALC)** Solve problems that involve whole numbers, percentages and decimal fractions in financial contexts such as:
- a. Profit, loss, discount and VAT
  - b. Budgets
  - c. Accounts
  - d. Loans
  - e. Simple interest**(SIMCOM)**
  - f. Hire purchase**(SIMCOM)**
  - g. Exchange rates**(CONEX)**

## **Integers**

- 1. Revise addition and subtraction with integers**(ADDSUB)**
- 2. Multiply and divide with integers**(MULINT)**
- 3. Perform calculations involving all four operations with integers**(OPNUM)**
- 4. Perform calculations involving all four operations with numbers that involve the squares, cubes , square roots and cube roots of integers**(OPMORE)**
- 5. Recognize and use commutative, associative and distributive properties of addition and multiplication for integers**(PROPNUM)**
- 6. Recognize and use additive and multiplicative inverses for integers **(ZEROPROP) (ONEPROP)**
- 7. Solve problems in contexts involving multiple operations with integers

## **GRADE 9**

### **Whole numbers**

- 1. **(CLASSNUM)** Describe the real number system by recognizing, defining and distinguishing properties of
  - a. Natural and whole numbers
  - b. Integers
  - c. Rational numbers
  - d. Irrational numbers

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2. Revise calculations using all four operations on whole numbers, estimating and using calculators where appropriate(**OPWHOLE**)
3. Use a range of techniques to perform and check written and mental calculations of whole numbers including (**CALCTEC**)
  - a. Long division
  - b. Adding, subtracting and multiplying in columns
  - c. Estimation
  - d. Rounding off and compensating
  - e. Using a calculator
4. Use prime factorisation of numbers to find LCM and HCF (**FACMETH**)
5. Solve problems in contexts involving
  - a. Ratio and rate(**RATIO**) (**RATE**) (**ADT**) (**INCRAT**)
  - b. Direct and indirect proportion (**PROP**)
6. Solve Problems that involve whole numbers, percentages and decimal fractions in financial contexts such as:
  - a. Profit, loss, discount and VAT (**PERCENTCALC**)
  - b. Budgets
  - c. Accounts
  - d. Loans
  - e. Simple interest (**SIMPINT**)
  - f. Hire purchase (**HIRE**)
  - g. Exchange rates (**CONEX**)
  - h. Commission
  - i. Rentals
  - j. Compound interest (**SIMPINT**)

## **Integers**

1. Revise:
  - a. commutative, associative and distributive properties of addition and multiplication for integers (**PROPNUM**)
  - b. Additive and multiplicative inverses for integers (**ZEROPROP**) (**ONEPROP**)
2. Solve problems in contexts involving multiple operations with integers

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# **FRACTIONS**

## GRADE 8

### **Common fractions**

1. Addition and subtraction of common fractions, including mixed numbers (**ADDFRAC**)
2. Finding fractions of whole numbers (**FRACWHOLE**)
3. Multiplication of common fractions, including mixed numbers (**MULTFRAC**)
4. Divide whole numbers and common fractions by common fractions (**DIVFRAC**)
5. Calculate the squares, cubes, square roots and cube roots of common fractions (**ROOTFRAC**)
6. Convert mixed numbers to common fractions in order to perform calculations with them (**TICK**)
7. Use knowledge of multiples and factors to write fractions in the simplest form before or after calculations (**SIMPFRAC**)
8. Use knowledge of equivalent fractions to add and subtract common fractions (**EQUIFRAC**)
9. Solve problems in contexts involving common fractions and mixed numbers, including grouping, sharing and finding fractions of whole numbers
10. Finding percentages of whole numbers (**PERCNUM**)
11. Calculating the percentage of part of a whole (**PERCPART**)
12. Calculating percentage increase or decrease (**INCDEC**)
13. Calculate amounts of given percentage increase or decrease (**INCDECAM**)
14. Solve problems in contexts involving percentages
15. Revise equivalent forms between:
  - a. Common fractions (fractions where one denominator is a multiple of the other) (**EQUIFRAC**)
  - b. Common fraction and decimal fraction forms of the same number (**COMDEC**)
  - c. Common fraction, decimal fraction and percentage forms of the same number (**COMDECPER**)

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## Decimal fractions

1. Ordering, comparing and place value of decimal fractions to at least 3 decimal places (**ORCOPLADEC**)
2. Rounding off decimal fractions to at least 2 decimal places (**ROUNDOFF**)
3. Addition, subtraction, multiplication of decimal fractions to at least 3 decimal places (**OPDEC**)
4. Division of decimal fractions by whole numbers (**DIVDEC**)
5. Extend multiplication to "multiplication by decimal fractions" not limited to one decimal place (**OPDEC**)
6. Extend division to "division of decimal fractions by decimal fractions" (**DECDIVDEC**)
7. Calculate the squares, cubes, square roots and cube roots of decimal fractions (**DECROOT**)
8. Use knowledge of place value to estimate the number of decimal places in the result before performing calculations (**DECEST**)
9. Use rounding off and a calculator to check results where appropriate (**ROUNDOFF**)
10. Solve problems in context involving decimal fractions

## GRADE 9

### Common fractions

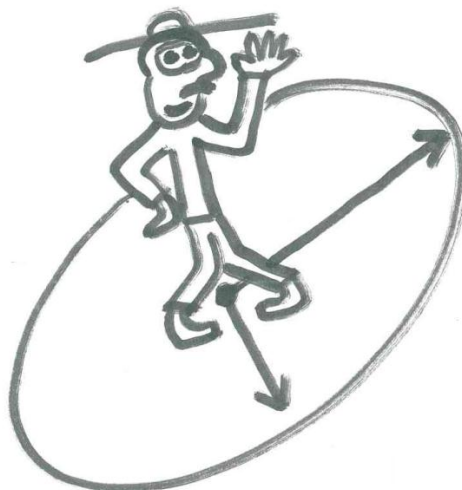
1. All four operations with common fractions and mixed numbers (**BODFRAC**)
2. All four operations with numbers that involve the squares, cubes, square roots and cube roots of common fractions (**BODROOT**)
3. Revise:
  - a. Convert mixed numbers to common fractions in order to perform calculations with them (**TICK**)
  - b. Use knowledge of multiples and factors to write fractions in the simplest form before or after calculations (**SIMPFRAC**)
  - c. Use knowledge of equivalent fractions to add and subtract common fractions (**EQUIFRAC**)
  - d. Use knowledge of reciprocal relationships to divide common fractions (**DIVFRAC**)

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4. Solve problems in contexts involving common fractions, mixed numbers and percentages
5. Revise equivalent forms between:
  - a. Common fractions (fractions where one denominator is a multiple of the other) (**EQUIFRAC**)
  - b. Common fraction and decimal fraction forms of the same number (**COMDEC**)
  - c. Common fraction, decimal fraction and percentage forms of the same number (**COMDECPER**)

## **Decimal fractions**

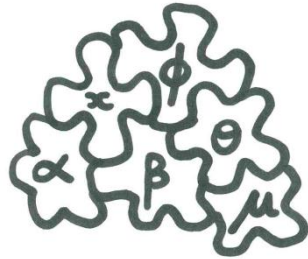
1. Multiple operations with decimal fractions, using a calculator where appropriate (**BODDEC**)
2. Multiple operations with or without brackets, with numbers that include the squares, cubes, square roots and cube roots of decimal fractions (**BODDECROOT**)
3. Use knowledge of place value to estimate the number of decimal places in the result before performing calculations (**DECEST**)
4. Use rounding off and a calculator to check results where appropriate (**ROUNDOFF**)
5. Solve problems in context involving decimal fractions
6. Revise equivalent forms between:
  - a. Common fraction and decimal fraction forms of the same number (**COMDEC**)
  - b. Common fraction, decimal fraction and percentage forms of the same number (**COMDECPER**)



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# ALGEBRAIC

# EXPRESSIONS



## GRADE 8

### **Algebraic expressions**

1. Recognize and interpret rules or relationships represented in symbolic form (**INTEREL**)
2. Identify variables, constants, coefficients and exponents in given formulae and/or equations (**VARCON**)
3. Recognize and identify conventions for writing algebraic expressions (**EXPRESSCON**)
4. Use commutative, associative and distributive laws for rational numbers and laws of exponents to:
  - a. Add and subtract like terms in algebraic expressions (**LICOL**)
  - b. Multiply integers and monomials by monomials, binomials and trinomials (**ONEFORALL**)
  - c. Divide the following by integers or monomials: monomials, binomials and trinomials (**DIVMON**)
5. Simplify algebraic expressions involving the above operations (**BODALG**)
6. Determine the squares, cubes, square roots and cube roots of single algebraic terms or like algebraic terms (**ALGROOT**)
7. Determine the numerical value of algebraic expressions by substitution (**ALGSUB**)

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## GRADE 9

### **Algebraic expressions**

1. Revise the following work done in Grade 8:
  - a. Recognize and identify conventions for writing algebraic expressions (**EXPRESSCON**)
  - b. Identify and classify like and unlike terms in algebraic expressions (**LICOL**)
  - c. Identify variables, constants, coefficients and exponents in given formulae and/or equations (**VARCON**)
  - d. Recognize and differentiate between monomials, binomials and trinomials (**MONBITRI**)
2. Revise the following done in Grade 8, using the commutative, associative and distributive laws for rational numbers and laws of exponents to:
  - a. Add and subtract like terms in algebraic expressions (**LICOL**)
  - b. Multiply integers and monomials by monomials, binomials and trinomials (**ONEFORALL**)
  - c. Divide the following by integers or monomials: monomials, binomials and trinomials (**DIVMON**)
3. Simplify algebraic expressions involving the above operations (**BODALG**)
4. Determine the squares, cubes, square roots and cube roots of single algebraic terms or like algebraic terms (**ALGROOT**)
5. Determine the numerical value of algebraic expressions by substitution (**ALGSUB**)
6. Extend the above algebraic manipulations to include:
  - a. Multiply integers and monomials by polynomials (**ONEFORALL2**)
  - b. Divide polynomials by integers or monomials (**DIVMON**)
  - c. The product of two binomials (**HANDSHAKE**)
  - d. The square of a binomial (**SQUABIN**)
7. Factorize algebraic expressions that involve:
  - a. Common factors (**COMFAC**)
  - b. Difference of two squares (**DOTS**)
  - c. Trinomials of the form  $x^2 + bx + c$  or  $ax^2 + bx + c$ , where  $a$  is a common factor (**TRIBASIC**)



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8. Simplify algebraic expressions that involve the above factorisation processes (**EXFAC**)
9. Simplify algebraic fractions using factorization (**ALGFAC**)

## GRADE 10

### **Algebraic expressions**

1. Understand that real numbers can be rational or irrational (**CLASSNUM**)
2. Establish between which two integers a given simple surd lies (**SURDNUM**)
3. Round real numbers to an appropriate degree of accuracy (**ROUNDOFF**)
4. Multiplication of a binomial by a trinomial (**HANDSHAKE2**)
5. Factorization to include types taught in grade 9 and trinomials, grouping in pairs, sum and difference of two cubes (**COMFAC**) (**DOTS**) (**TRIBASIC**) (**FACS**)
6. Simplification of algebraic fractions using factorisation with denominators of cubes (**ALGFAC2**)

## GRADE 12

### **Functions and polynomials**

1. Factorise third-degree polynomials (**SYNDIV**)
2. Apply the remainder and factor theorems to polynomials of degree at most 3 (no proofs required) (**REMFAC**)

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## EXPONENTS

## AND SURDS

### GRADE 8

#### Exponents

1. Squares to at least  $12^2$  and their square roots (**OPMORE**)
2. Cubes to at least  $6^3$  and their cube roots (**OPMORE**)
3. Revise, compare, represent whole numbers in exponential form (**EXFORM**)
4. Compare and represent integers in exponential form (positive exponents) (**EXFORMINT**)
5. Compare and represent numbers in scientific notation (**SCINOT**)
6. (**EXLAW**) Establish general laws of exponents, limited to:
  - a.  $a^m \cdot a^n = a^{m+n}$
  - b.  $a^m \div a^n = a^{m-n}$  if  $m > n$
  - c.  $(a^m)^n = a^{m \cdot n}$
  - d.  $(a \times b)^n = a^n \times b^n$
  - e.  $a^0 = 1$
7. Recognize and use the appropriate laws of operations using numbers involving exponents and square and cube roots (**OPEX**)
8. Perform calculations involving the four operations with numbers that involve the squares, cubes, square roots and cube roots of integers (**OPEX2**)
9. Calculate the squares, cubes, square roots and cube roots of rational numbers (**ROOTRAT**)
10. Solve problems in contexts involving numbers in exponential form.

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## GRADE 9

### Exponents

1. Revise, compare and represent integers in exponential form (**EXFORMINT**)
2. Compare and represent numbers in scientific notation (**SCINOT**)
3. Extend scientific notation to include negative exponents (**SCINOT**)
4. (**EXLAW**) Revise the following general laws of exponents:
  - a.  $a^m \cdot a^n = a^{m+n}$
  - b.  $a^m \div a^n = a^{m-n}$  if  $m > n$
  - c.  $(a^m)^n = a^{m \cdot n}$
  - d.  $(a \times b)^n = a^n \times b^n$
  - e.  $a^0 = 1$
5. Extend the general laws of exponents to include (**EXLAW2**):
  - a.  $a^{-m} = \frac{1}{a^m}$
  - b. Perform calculations involving all four operations using numbers in exponential form, using the laws of exponents
6. Solve problems in contexts involving numbers in exponential form, including scientific notation

## GRADE 10

### Exponents

1. Revise laws of exponents learnt in grade 9 where  $x, y > 0$  and  $m, n \in Z$  (**EXLAW**) (**EXLAW2**)
2. Use the laws of exponents to simplify expressions and solve equations, accepting that the rules also hold for  $m, n \in Q$  (**EXLAW3**)

## GRADE 11

### Exponents and surds

1. Simplify expressions and solve equations using the laws of exponents for rational exponents where  $x^{\frac{p}{q}} = \sqrt[q]{x^p}$  (**EXLAW3**) (**EXLAW4**)
2. Add, subtract, multiply and divide simple surds (**SURDLAW**)
3. Solve simple equations involving surds (**EQUASURD**)

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# EQUATIONS AND INEQUALITIES

## GRADE 8

### Algebraic equations

1. Set up equations to describe problem situations (**WORDSUM**)
2. Analyse and interpret equations that describe a given situation (**WORDSUM**)
3. Solve equations by inspection (**INSPECT**)
4. Determine the numerical value of an expression by substitution (**ALGSUB**)
5. Identify variables and constants in given formulae or equations (**VARCON**)
6. Use substitution in equations to generate tables of ordered pairs (**MAKTAB**)
7. Extend solving equations to include:
  - a. Using additive and multiplicative inverses (**RAINBUBBLE**)
  - b. Using laws of exponents (**SOLVEX**)

## GRADE 9

### Algebraic equations

1. Revise the following done in Grade 8:
  - a. Set up equations to describe problem situations (**WORDSUM**)
  - b. Analyse and interpret equations that describe a given situation (**WORDSUM**)
  - c. Solve equations by inspection (**INSPECT**)
  - d. Using additive and multiplicative inverses (**RAINBUBBLE**)
  - e. Using laws of exponents (**SOLVEX**)
  - f. Determine the numerical value of an expression by substitution (**ALGSUB**)
2. Use substitution in equations to generate tables of ordered pairs (**MAKTAB**)

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3. Extend solving equations to include:
  - a. Using factorization (**EQUAFACT**)
  - b. Equations of the form: *a product of factors = 0* (**EQUAPROD**)

## GRADE 10

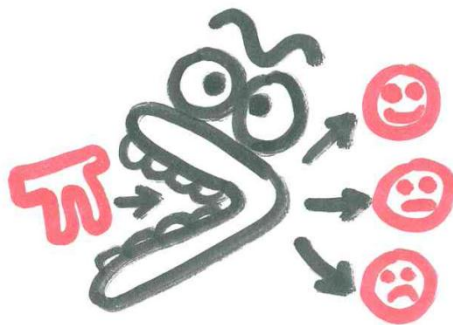
### Equations and inequalities

1. Revise the solution of linear equations (**RAINBUBBLE**)
2. Solve quadratic equations (by factorisation) (**EQUAFACT**)
3. simultaneous linear equations in two unknowns (**EQUASIM**)
4. Solve word problems involving linear, quadratic or simultaneous linear equations
5. Solve literal equations (changing the subject of a formula) (**REV**)
6. Solve linear inequalities (and show solution graphically). Interval notation must be known (**SOLVIN**)

## GRADE 11

### Equations and inequalities

1. Complete the square (**COMPSQUARE**)
2. Quadratic equations (by factorisation and using the quadratic formula) (**QUADFORM**)
3. Quadratic inequalities in one unknown (interpret solutions graphically) (**QUADIN**)
4. Equations in two unknowns, one of which is linear and the other quadratic (**EQUASIM2**)
5. Nature of roots (**NATURE**)



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# GRAPHS AND FUNCTIONS

## GRADE 8

### Graphs

1. **(TREND)** Analyse and interpret global graphs of problem situations, with a special focus on the following trends and features:
  - a. Linear or non-linear
  - b. Constant, increasing or decreasing
2. **(TREND2)** Extend the focus on features of graphs to include:
  - a. Maximum or minimum
  - b. Discrete or continuous
3. Draw global graphs from given descriptions of a problem situation, identifying features listed above
4. Use tables of ordered pairs to plot points and draw graphs on the Cartesian Plane (**PLOTDRAW**)

## GRADE 9

### Graphs

1. Revise the following done in Grade 8:
  - a. **(TREND) (TREND2)** Analyse and interpret global graphs of problem situations, with a special focus on the following trends and features:
    - i. Linear or non-linear
    - ii. Constant, increasing or decreasing
    - iii. Maximum or minimum
    - iv. Discrete or continuous
2. Extend the above with special focus on the following features of linear graphs:
  - a.  $x$ -intercept and  $y$ -intercept (**INTERCEPT**)
  - b. Gradient (**SLOPE**)

# CONTENTS

3. Revise the following done in Grade 8:
  - a. Draw global graphs from given descriptions of a problem situation, identifying features listed above
  - b. Use tables of ordered pairs to plot points and draw graphs on the Cartesian Plane (**PLOTDRAW**)
4. Extend the above with special focus on:
  - a. Drawing linear graphs from given equations (**LINDRAW**)
  - b. Determining equations from given linear graphs (**EQUALINE**)

## GRADE 10

### Functions

1. The concept of a function, where a certain quantity (output value) uniquely depends on another quantity (input value). Work with relationships between variables using tables, graphs, words and formulae. Convert flexibly between these representations. Note: the graph defined by  $y = x$  should be known from Grade 9. (**FUNCTION**)
2. Point by point plotting of basic graphs defined by  $y = x^2$ ,  $y = \frac{1}{x}$  and  $y = b^x$ ;  $b > 0$  and  $b \neq 1$  to discover shape, domain(input values), range (output values), asymptotes, axes of symmetry, turning points and intercepts on the axes (where applicable) (**PLOTTING**)
3. Investigate the effect of  $a$  and  $q$  on the graphs defined by  $y = a.f(x) + q$ , where  $f(x) = x$ ,  $f(x) = x^2$ ,  $f(x) = \frac{1}{x}$  and  $f(x) = b^x$ ,  $b > 0, b \neq 1$  (**EFFECTAQ**)
4. Point by point plotting of basic graphs defined by  $y = \sin\theta$ ,  $y = \cos\theta$ ,  $y = \tan\theta$  for  $\theta \in [0; 360]$  (**TRIGGRAPH**)
5. Study the effect of  $a$  and  $q$  on the graphs defined by  $y = a\sin\theta + q$ ,  $y = a\cos\theta + q$ ,  $y = a\tan\theta + q$  for  $\theta \in [0; 360]$  (**EFFECTAQ2**)
6. Sketch graphs, find the equations of given graphs and interpret graphs (**PLOTDRAW**)(**PLOTTING**)(**INTERGRAPH**)

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## GRADE 11

### Functions

1. Revise the effect of the parameters  $a$  and  $q$  and investigate the effect of  $p$  on the graphs of the functions defined by: **(EFFECTAQ)**  
**(EFFEP)**
  - a.  $y = f(x) = a(x + p)^2 + q$
  - b.  $y = f(x) = \frac{a}{x+p} + q$
  - c.  $y = f(x) = a \cdot b^{x+p} + q$  where  $b > 0$  and  $b \neq 1$
2. Investigate numerically the average gradient between two points on a curve and develop an intuitive understanding of the concept of the gradient of a curve at a point **(GRADPOINT)**
3. Point by point plotting of basic graphs defined by  $y = \sin\theta$ ,  $y = \cos\theta$  and  $y = \tan\theta$  for  $\theta \in [-360^\circ; 360^\circ]$  **(TRIGGRAPH)**
4. Investigate the effect of the parameter  $k$  on the graphs of the functions defined by  $y = \sin(kx)$ ,  $y = \cos(kx)$  and  $y = \tan(kx)$  **(TRIGGRAPH2)**
5. Investigate the effect of the parameter  $p$  on the graphs of the functions defined by  $y = \sin(x + p)$ ,  $y = \cos(x + p)$  and  $y = \tan(x + p)$  **(TRIGGRAPH3)**
6. Draw sketch graphs defined by  $y = a\sin(kx + p)$ ,  $y = a\cos(kx + p)$  and  $y = a\tan(kx + p)$ , at most two parameters at a time **(TRIGGRAPH4)**

## GRADE 12

### Functions

1. Definition of a function **(DEFUNC)**
2. General concept of the inverse of a function and how the domain of the function may need to be restricted (in order to obtain a one-to-one function) to ensure that the inverse is a function. **(INFUNC)**
3. Determine and sketch graphs of the inverses of the functions defined by: **(SKETINV)**
  - a.  $y = ax + q$
  - b.  $y = ax^2$
  - c.  $y = b^x (b > 0, b \neq 1)$



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4. Focus on the following characteristics:
  - a. Domain and range (**DOMRAN**)
  - b. Intercepts with the axes (**INTERCEPT**)
  - c. Turning points (**TEEPEE**)
  - d. Minima and maxima (**TEEPEE**)
  - e. Asymptotes (horizontal and vertical)  
(**PLOTDRAW**)(**PLOTTING**)(**INTERGRAPH**)
  - f. Shape and symmetry (**PLOTDRAW**)(**PLOTTING**)(**INTERGRAPH**)
  - g. Average gradient (average rate of change) (**GRADPOINT**)
  - h. Intervals on which the function increases/decreases  
(**INTERVAL**)

## **Functions: exponential and logarithmic**

1. Revision of the exponential function and the exponential laws and graphs of the function defined by  $y = b^x$  where  $b > 0$  and  $b \neq 1$  (**PLOTTING**)(**EFFECTAQ**)
2. Understand the definition of a logarithm:  $y = \log_b x \leftrightarrow x = b^y$ , where  $b > 0$  and  $b \neq 1$  (**LOGDEF**)
3. The graph of the function defined by  $y = \log_b x$  for both the cases  $0 < b < 1$  and  $b > 1$  (**PLOTDRAW**)(**PLOTTING**)(**INTERGRAPH**)

# **ANALYTICAL GEOMETRY**

## **GRADE 10**

### **Analytical Geometry**

Represent geometric figures on a Cartesian co-ordinate system.

Derive and apply for any two points  $(x_1; y_1)$  and  $(x_2; y_2)$  the formulae for calculating the:

1. Distance between the two points (**DISTANCE**)
2. Gradient of the line segment connecting the two points (and from that identify parallel and perpendicular lines); and (**SLOPE**)  
(**SLOPE2**)
3. Coordinates of the midpoint of the line segment joining the two points (**MIDCOR**)

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## GRADE 11

### **Analytical geometry**

Derive and apply:

1. The equation of a line through two given points (**EQUALINE**)
2. The equation of a line through one point and parallel or perpendicular to a given line (**EQUALINE2**)
3. The inclination ( $\theta$ ) of a line where  $m = \tan\theta$  is the gradient of the line and  $0^\circ \leq \theta \leq 180^\circ$  (**INCLINE**)

## GRADE 12

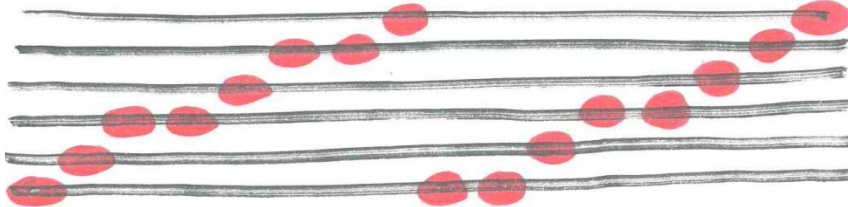
### **Analytical Geometry**

1. The equation  $(x - a)^2 + (y - b)^2 = r^2$  defines a circle with radius  $r$  and centre  $(a; b)$  (**EQUACIRC**)
2. Determine the equation of a tangent to a given circle. (**EQUATANG**)

# CONTENTS

## PATTERNS, SEQUENCES

### AND SERIES



#### GRADE 8

##### **Numeric and geometric patterns**

1. Investigate and extend numeric and geometric patterns looking for relationships between numbers, including patterns: **(ARIGEO)**
  - a. Represented in physical or diagram form
  - b. Not limited to sequences involving a constant difference or ratio
  - c. Of learner's own creation
  - d. Represented algebraically
2. Describe and justify the general rules for observed relationships between numbers in own words or in algebraic language **(PATRULE)**
3. Determine input values, output values or rules for patterns and relationships using:
  - a. Flow diagrams
  - b. Tables
  - c. Formulae
  - d. Equations **(PATRULE) (FUNCTION)**
4. Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented: **(PATSAME)**
  - a. Verbally
  - b. In flow diagrams
  - c. In tables
  - d. By formulae
  - e. By equations

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## GRADE 9

### **Numeric and geometric patterns**

1. Investigate and extend arithmetic and geometric patterns looking for relationships between numbers, including patterns:
  - a. Represented in physical or diagram form
  - b. Not limited to sequences involving a constant difference or ratio
  - c. Of learner's own creation
  - d. Represented in tables
  - e. Represented algebraically (**ARIGEO**)
2. Describe and justify the general rules for observed relationships between numbers in own words or in algebraic language (**PATRULE**)
3. Determine input values, output values or rules for patterns and relationships using:
  - a. Flow diagrams
  - b. Tables
  - c. Formulae
  - d. Equations (**PATRULE**) (**FUNCTION**)
4. Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented:
  - a. Verbally
  - b. In flow diagrams
  - c. In tables
  - d. By formulae
  - e. By equations
  - f. By graphs on a Cartesian Plane (**PATSAME**)

## GRADE 10

### **Numbers patterns**

1. Patterns: investigate number patterns leading to those where there is a constant difference between consecutive terms, and the general term (without using a formula) is therefore linear (**PATRULE**)

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## GRADE 11

### Number patterns

1. Patterns: investigate number patterns leading to those where there is a constant second difference between consecutive terms, and the general term is therefore quadratic (**QUADRAPAT**)

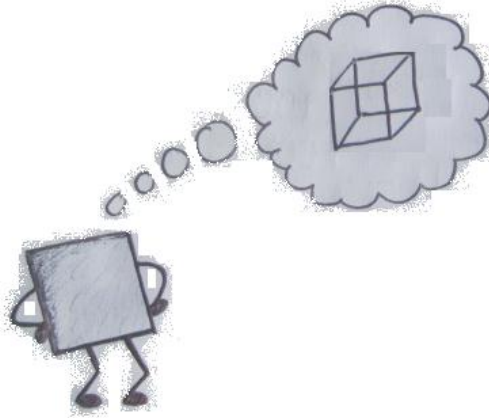
## GRADE 12

### Patterns, sequences and series

1. Number patterns, including arithmetic and geometric sequences and series (**PATTERN**)
2. Derivation and application of the formulae for the sum of arithmetic and geometric series:
  - a.  $S_n = \frac{n}{2}[2a + (n - 1)d]$
  - b.  $S_n = \frac{n}{2}(a + l)$
  - c.  $S_n = \frac{a(r^n - 1)}{r - 1}$  ;  $r \neq 1$
  - d.  $S_\infty = \frac{a}{1 - r}$  ;  $-1 < r < 1$  (**PATSUM**)
3. Sigma notation (**SIGMA**)

# CONTENTS

# GEOMETRY



## GRADE 8

### Geometry of 2D shapes

1. Identify and write clear definitions of triangles in terms of their sides and angles, distinguishing between (**DEFTRI**):
  - a. Equilateral triangles
  - b. Isosceles triangles
  - c. Right-angled triangles
2. Identify and write clear definitions of quadrilaterals in terms of their sides and angles, distinguishing between: (**QUADPROP**)
  - a. Parallelogram
  - b. Rectangle
  - c. Square
  - d. Rhombus
  - e. Trapezium
  - f. Kite
3. Identify and describe the properties of congruent shapes (**CONSHAPE**)
4. Identify and describe the properties of similar shapes (**SIMSHAPE**)
5. Solve geometric problems involving unknown sides and angles in triangles and quadrilaterals, using known properties and definitions (**SOLTRIQUAD**)

# CONTENTS

## **Geometry of 3D objects**

1. Describe, name and compare the 5 Platonic solids in terms of the shape and number of faces, the number of vertices and the number of edges (**PLATO**)
2. Revise using nets to create models of geometric solids, including: (**NET**)
  - a. Cubes
  - b. Prisms
  - c. Pyramids

## **Geometry of straight lines**

1. Recognize and describe pairs of angles formed by:
  - a. Perpendicular lines
  - b. Intersecting lines
  - c. Parallel lines cut by a transversal (**ANGLINE**)
2. Solve geometric problems using the relationships between pairs of angles described above (**ANGLINE**)

## **Construction of geometric figures**

1. Accurately construct geometric figures appropriately using a compass, ruler and protractor, including:
  - a. Bisecting lines and angles
  - b. Perpendicular lines at a given point or from a given point
  - c. Triangles
  - d. Quadrilaterals
  - e. Construct angles of  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and their multiples without using a protractor (**GEOCONS**)
2. By construction, investigate the angles in a triangle, focusing on:
  - a. The sum of the interior angles of triangles
  - b. The size of angles in an equilateral triangle
  - c. The sides and base angles of an isosceles triangle (**DEFTRI**)

# CONTENTS

3. By construction, investigate sides and angles in quadrilaterals, focusing on:
  - a. The sum of the interior angles of quadrilaterals
  - b. The sides and opposite angles of parallelograms  
(**QUADPROP**)

## GRADE 9

### **Geometry of 2D shapes**

1. Revise properties and definitions of triangles in terms of their sides and angles, distinguishing between:
  - a. Equilateral triangles
  - b. Isosceles triangles
  - c. Right-angled triangles (**DEFTRI**)
2. revise and write clear definitions of quadrilaterals in terms of their sides and angles, distinguishing between:
  - a. Parallelogram
  - b. Rectangle
  - c. Square
  - d. Rhombus
  - e. Trapezium
  - f. Kite (**QUADPROP**)
3. Through investigation, establish the minimum properties for congruent triangles (**CONSHAPE**)
4. Through investigation, establish the minimum conditions for similar triangles (**SIMSHAPE**)
5. Solve geometric problems involving unknown sides and angles in triangles and quadrilaterals, using known properties of triangles and quadrilaterals, as well as properties of congruent and similar triangles (**SOLTRIQAD**) (**SIMSHAPE**) (**CONSHAPE**)

### **Geometry of 3D objects**

1. Revise properties and definitions of the 5 Platonic solids in terms of the shape and number of faces, the number of vertices and the number of edges (**PLATO**)
2. Recognise and describe the properties of:
  - a. Spheres
  - b. Cylinders



# CONTENTS

3. Use nets to create models of geometric solids, including:
  - a. Cubes
  - b. Prisms
  - c. Pyramids
  - d. Cylinders (**NET**)

## **Geometry of straight lines**

1. Revise and write clear descriptions of the relationship between angles formed by:
  - a. Perpendicular lines
  - b. Intersecting lines
  - c. Parallel lines cut by a transversal (**ANGLINE**)
2. Solve geometric problems using the relationships between pairs of angles described above (**ANGLINE**)

## **Construction of geometric figures**

1. Accurately construct geometric figures appropriately using a compass, ruler and protractor, including bisecting angles of a triangle.
2. Construct angles of  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and their multiples without using a protractor (**GEOCONS**)
3. By construction, investigate the angles in a triangle, focusing on the relationship between the exterior angle of a triangle and its interior angles (**DEFTRI**)
4. By construction, investigate sides, angles and diagonals in quadrilaterals, focusing on:
  - a. The diagonals of rectangles, squares, parallelograms, rhombi and kites
  - b. Exploring the sum of the interior angles of polygons (**QUADPROP**) (**POLY**)
5. By construction, explore the minimum conditions for two triangles to be congruent (**CONSHAPE**)

# CONTENTS

## GRADE 10

### **Euclidean Geometry**

1. Revise basic results established in earlier grades regarding lines, angles and triangles, especially the similarity and congruence of triangles. (**ANGLINE**) (**DEFTRI**) (**QUADPROP**) (**SIMSHAPE**) (**CONSHAPE**) (**SOLTRIQUAD**)
2. Investigate line segments joining the midpoints of two sides of a triangle (**MIDPOTH**)
3. Define the following special quadrilaterals: the kite, parallelogram, rectangle, rhombus, square and trapezium. Investigate and make conjectures about the properties of the sides, angles, diagonals and areas of these quadrilaterals. Prove these conjectures (**QUADPROP**) (**AREAPROB**)

### **Euclidean Geometry**

1. Solve problems and prove riders using the properties of parallel lines, triangles and quadrilaterals (**SOLTRIQUAD**) (**SOLTRIQUAD2**)

## GRADE 11

### **Euclidean geometry**

1. Accept results established in earlier grades as axioms and also that a tangent to a circle is perpendicular to the radius, drawn to the point of contact (**GEOCIRC**)
2. Investigate and prove the theorems of the geometry of circles:
  - a. The line drawn from the centre of a circle perpendicular to a chord bisects the chord. (**GEOCIRC**)
  - b. The perpendicular bisector of a chord passes through the centre of the circle (**GEOCIRC**)
  - c. The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (**GEOCIRC**)
  - d. Angles subtended by a chord of the circle, on the same side of the chord, are equal. (**GEOCIRC**)
  - e. The opposite angles of a cyclic quadrilateral are supplementary (**GEOCIRC**)

# CONTENTS

- f. Two tangents drawn to a circle from the same point outside the circle are equal in length (**GEOCIRC**)
  - g. The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment (**GEOCIRC**)
3. Use the above theorems and their converses, where they exist, to solve riders. (**GEOCIRC**)

## GRADE 12

### **Euclidean Geometry**

1. Revise earlier work on the necessary and sufficient conditions for polygons to be similar. (**SIMSHAPE**)
2. Prove (accepting results established in earlier grades):
  - a. That a line drawn parallel to one side of a triangle divides the other two sides proportionally (and the midpoint theorem as a special case of this theorem) (**MIDPOTH**)
  - b. That equiangular triangles are similar (**SIMSHAPE**)
  - c. The Pythagorean Theorem by similar triangles

# TRANSFORMATIONS

## GRADE 8

### **Transformation Geometry**

1. Recognize, describe and perform transformations with points on a coordinate plane, focusing on:
  - a. Reflecting a point in the x-axis or y-axis (**REFLECT**)
  - b. Translating a point within and across quadrants (**TRANSLATE**)
2. Recognize, describe and perform transformations with triangles on a coordinate plane, focusing on the coordinates of the vertices when:
  - a. Reflecting a triangle in the x-axis or y-axis (**REFLECT2**)
  - b. Translating a triangle within and across quadrants (**TRANSLATE2**)
  - c. Rotating a triangle around the origin (**ROTATE**)

# CONTENTS

- d. Use proportion to describe the effect of enlargement or reduction on area and perimeter of geometric figures (**ENLARGE**)

## GRADE 9

### Transformation Geometry

1. Recognize, describe and perform transformations with points, line segments and simple geometric figures on a coordinate plane, focusing on:
  - a. Reflection in the x-axis or y-axis (**REFLECT**) (**REFLECT2**)
  - b. Translation within and across quadrants (**TRANSLATE**) (**TRANSLATE2**)
  - c. Reflection in the line  $y = x$  (**REFLECT3**)
2. Identify what the transformation of a point is, if given the coordinates of its image. (**TRANSDISC**)
3. Use proportion to describe the effect of enlargement or reduction on area and perimeter of geometric figures (**ENLARGE**)
4. Investigate the coordinates of the vertices of figures that have been enlarged or reduced by a given scale factor (**ENLARGE2**)

## GRADE 12 (NCS SYLLABUS)

1. Assorted transformation rules (**MORETRANS**)



# CONTENTS

# MEASUREMENT AND PYTHAGORAS

## GRADE 8

### Area and perimeter of 2D shapes

1. Use appropriate formulae to calculate perimeter and area of:  
(**AREAPER**)
  - a. Squares
  - b. Rectangles
  - c. Triangles
  - d. Circles
2. Calculate the areas of polygons, to at least 2 decimal places, by decomposing them into rectangles and/or triangles (**AREAPOL**)
3. Use and describe the relationship between the radius, diameter and circumference of a circle in calculations (**RADICIR**)
4. Use and describe the relationship between the radius and area of a circle in calculations (**AREAPER**)
5. Solve problems, with or without a calculator, involving perimeter and area of polygons and circles (**AREAPROB**)
6. Use and describe the meaning of the irrational number pi ( $\pi$ ) in calculations involving circles (**PI**)
7. Use and convert between appropriate SI units, including  $mm^2 \leftrightarrow cm^2 \leftrightarrow m^2 \leftrightarrow km^2$  (**CONVERT**)

### Surface area and volume of 3D objects

1. Use appropriate formulae to calculate the surface area, volume and capacity of: (**VOLSURF**)
  - a. Cubes
  - b. Rectangular prisms
  - c. Triangular prisms
2. Describe the interrelationship between surface area and volume of the objects mentioned above (**VOLSURF**)

# CONTENTS

3. Solve problems, with or without a calculator, involving surface area, volume and capacity (**VOLSURF**)
4. Use and convert between appropriate SI units, including:
  - a.  $mm^2 \leftrightarrow cm^2 \leftrightarrow m^2 \leftrightarrow km^2$
  - b.  $mm^3 \leftrightarrow cm^3 \leftrightarrow m^3$
  - c.  $ml (cm^3) \leftrightarrow l \leftrightarrow kl$  (**CONVERT**)

## **The theorem of Pythagoras**

1. Investigate the relationship between the lengths of the sides of a right-angled triangle to develop the theorem of Pythagoras (**PYTHAGORAS1**)
2. Determine whether a triangle is a right-angled triangle or not if the length of the three sides of the triangle are known (**PYTHAGORAS2**)

## **GRADE 9**

### **Area and perimeter of 2D shapes**

1. Use appropriate formulae and conversions between SI units to solve problems and calculate perimeter and area of:
  - a. Polygons
  - b. Circles (**AREAPROB**) (**CONVERT**)
2. Investigate how doubling any or all of the dimensions of a 2D figure affects its perimeter and its area (**DUBDIM**).

### **The theorem of Pythagoras**

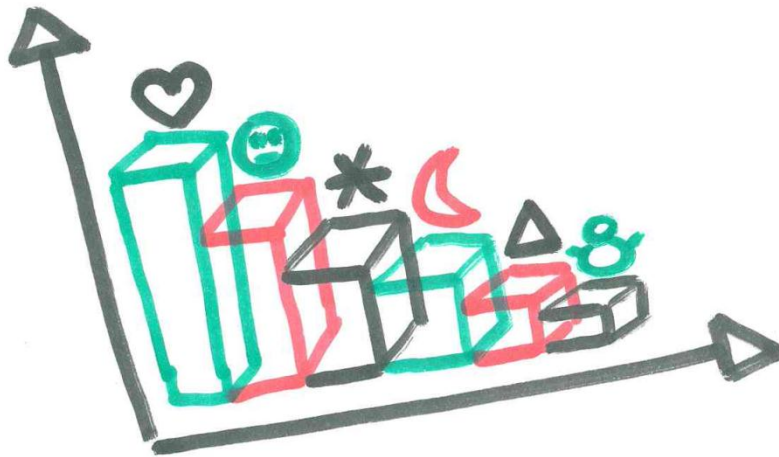
1. Use the Theorem of Pythagoras to solve problems involving unknown lengths in geometric figures that contain right-angled triangles (**PYTHAGORAS**)

# CONTENTS

## GRADE 10

### Measurement

1. Revise the volume and surface areas of right-prisms and cylinders (**VOLSURF**) (**VOLSURF2**)
2. Study the effect on volume and surface area when multiplying any dimension by a constant factor  $k$  (**DUBDIM2**)
3. Calculate the volume and surface areas of spheres, right pyramids and right cones (**VOLSURF3**)



# DATA AND STATISTICS

## GRADE 8

### Data Handling

1. Pose questions relating to social, economic and environmental issues (**QUESTION**)
2. Select appropriate sources for the collection of data (including peers, family, newspapers, books, magazines) (**SOURCE**)
3. Distinguish between samples and populations, and suggest appropriate samples for investigation (**SAMPOP**)
4. Design and use simple questionnaires to answer questions with multiple choice responses (**DESIGN**)

# CONTENTS

5. Organise (including grouping where appropriate) and record data using:
  - a. Tally marks
  - b. Tables
  - c. Stem-and-leaf displays
  - d. Group data into intervals (**DISPLAY1**)
6. Summarize data using measures of central tendency, including:
  - a. Mean
  - b. Median
  - c. Mode (**CENTEND**)
7. Summarize data using measures of dispersion, including:
  - a. Range
  - b. Extremes (**DISPERSE**)
8. Draw a variety of graphs by hand/technology to display and interpret data including:
  - a. Bar graphs and double bar graphs
  - b. Histograms with given and own intervals
  - c. Pie charts
  - d. Broken-line graphs (**DISPLAY2**)
9. Critically read and interpret data represented in:
  - a. Words
  - b. Bar graphs
  - c. Double bar graphs
  - d. Pie charts
  - e. Histograms
  - f. Broken-line graphs (**DISPLAY2**)
10. Critically analyse data by answering questions related to:
  - a. Data categories, including data intervals
  - b. Data sources and contexts
  - c. Central tendencies (mean, median, mode)
  - d. Scales used on graphs
  - e. Samples and populations
  - f. Dispersion of data
  - g. Error and bias in the data (**INTERPRET**)



# CONTENTS

11. Summarize data in short paragraphs that include
  - a. Drawing conclusions about the data
  - b. Making predictions based on the data
  - c. Identifying sources of error and bias in the data
  - d. Choosing appropriate summary statistics for the data (mean, median, mode, range)
  - e. The role of extremes in the data (**INTERPRET**)

## GRADE 9

### **Data Handling**

1. Pose questions relating to social, economic and environmental issues (**QUESTION**)
2. Select and justify appropriate sources for the collection of data (**SOURCE**)
3. Distinguish between samples and populations, and suggest appropriate samples for investigation (**SAMPOP**)
4. Select and justify appropriate methods for collecting data (**SOURCE**)
5. Organise numerical data in different ways in order to summarize by determining:
  - a. Measures of central tendency (**CENTEND**)
  - b. Measures of dispersion, including extremes and outliers (**DISPERSE**)
  - c. Organize data according to more than one criteria (**SOURCE**)
6. Draw a variety of graphs by hand/technology to display and interpret data including:
  - a. Bar graphs and double bar graphs
  - b. Histograms with given and own intervals
  - c. Pie charts
  - d. Broken-line graphs
  - e. Scatterplots (**DISPLAY2**)
7. Critically read and interpret data represented in a variety of ways (**DISPLAY**) (**DISPLAY2**)(**VARCRIT**)
8. Critically compare two sets of data related to the same issue

# CONTENTS

9. Critically analyse data by answering questions related to:
  - a. Data collection methods
  - b. Summary of data
10. Sources of error and bias in the data (**INTERPRET**)
11. Summarise data in short paragraphs that include:
  - a. Drawing conclusions about the data
  - b. Making predictions based on the data
  - c. Making comparisons between two sets of data
  - d. Identifying sources of error and bias in the data
  - e. Choosing appropriate summary statistics for the data (mean, median, mode, range)
  - f. The role of extremes and outliers in the data (**INTERPRET**)

## GRADE 10

### **Statistics**

1. Revise measures of central tendency in ungrouped data. (**CENTEND**)
2. Measures of central tendency in grouped data; calculation of mean estimate of grouped and ungrouped data and identification of modal interval and interval in which the median lies. (**CENTEND2**)
3. Revision of range as a measure of dispersion and extension to include percentiles, quartiles, interquartile and semi-interquartile range. (**DISPERSE**) (**DISPERSE2**)
4. Five number summary and box and whisker diagram. (**FIVEBOX**)
5. Use the statistical summaries (measures of central tendency and dispersion), and graphs to analyse and make meaningful comments on the context associated with the given data. (**INTERPRET**)

# CONTENTS

## GRADE 11

### Statistics

1. Histograms (**DISPLAY2**)
2. Frequency polygons (**DISPLAY3**)
3. Ogives (cumulative frequency curves) (**DISPLAY4**)
4. Variance and standard deviation of ungrouped data (**DEV**)
5. Symmetric and skewed data (**SYMSKEW**)
6. Identification of outliers (**OUTLIER**)

## GRADE 12

### Statistics

1. Revise symmetric and skewed data. (**SYMSKEW**)
2. Use statistical summaries, scatterplots, regression (in particular the least squares regression line) and correlation to analyse and make meaningful comments on the context associated with given bivariate data, including interpolation, extrapolation and discussions on skewness. (**REGRESSION**)

# CONTENTS



# TRIGONOMETRY

## GRADE 10

### Trigonometry

1. Define the trigonometric ratios  $\sin\theta$ ,  $\cos\theta$  and  $\tan\theta$ , using right angled triangles (**SOHCAHTOA**)
2. Extend the definitions of  $\sin\theta$ ,  $\cos\theta$  and  $\tan\theta$  for  $0^\circ \leq \theta \leq 360^\circ$  (**SOHCAHTOA2**)
3. Define the reciprocals of the trigonometric ratios:  $\sec\theta$ ,  $\cot\theta$  and  $\operatorname{cosec}\theta$  (**RECIP**)
4. Derive values of the trigonometric ratios for the special cases (without using a calculator) for  $\theta \in \{0, 30, 45, 60, 90\}$  (**SPECIAL**)
5. Solve two-dimensional problems involving right-angled triangles (**TWODI**)
6. Solve simple trigonometric equations for angles between 0 and 90 (**EQUATRIG**)
7. Use diagrams to determine the numerical values of ratios for angles from 0 to 360 (**SOHCAHTOA2**)

### Trigonometry

1. Problems in two dimensions (**TWODI**)

# CONTENTS

## GRADE 11

### Trigonometry

1. Derive and use the identities  $\tan\theta = \frac{\sin\theta}{\cos\theta}$  and  $\sin^2\theta + \cos^2\theta = 1$   
**(UNID)**
2. Derive and use reduction formulae to simplify the following expressions: **(REDUCE)**
  - a.  $\sin(90 \pm \theta)$ ;  $\cos(90 \pm \theta)$
  - b.  $\sin(180 \pm \theta)$ ;  $\cos(180 \pm \theta)$ ;  $\tan(180 \pm \theta)$
  - c.  $\sin(360 \pm \theta)$ ;  $\cos(360 \pm \theta)$ ;  $\tan(360 \pm \theta)$
  - d.  $\sin(-\theta)$ ;  $\cos(-\theta)$ ;  $\tan(-\theta)$
3. Determine for which values of a variable an identity holds **(VALID)**
4. Determine the general solutions of trigonometric equations. Also, determine solutions in specific intervals **(EQUATRIG2)**
5. Prove and apply the sine, cosine and area rules **(AREASINCOS)**
6. Solve problems in two dimensions using the sine, cosine and area rules **(TWODI2)**

## GRADE 12

### Trigonometry

1. Compound angle identities **(COMPANG)**
  - a.  $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$
  - b.  $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
2. Double angle identities **(DUBANG)**
  - a.  $\sin 2A = 2 \sin A \cos A$
  - b.  $\cos 2A = \cos^2 A - \sin^2 A$
  - c.  $\cos 2A = 2 \cos^2 A - 1$
  - d.  $\cos 2A = 1 - 2 \sin^2 A$
3. Solve problems in two and three dimensions **(THREEDI)**

# CONTENTS



# PROBABILITY

## GRADE 8

### Probability

1. Consider a simple situation (with equally likely outcomes) that can be described using probability and:
  - a. List all the possible outcomes (**OUTCOME**)
  - b. Determine the probability of each possible outcome using the definition of probability (**OUTCOME**)
  - c. Compare relative frequency with probability and explain possible differences (**RELATIVE**)

## GRADE 9

### Probability

1. Consider situations with equally probable outcomes, and:
  - a. Determining probabilities for compound events using two-way tables and tree diagrams (**TWOWAY**) (**TREE**)
  - b. Determine the probabilities for outcomes of events and predict their relative frequency in simple experiments (**RELATIVE**)
  - c. Compare relative frequency with probability and explain possible differences (**RELATIVE**)

# CONTENTS

## GRADE 10

### Probability

1. The use of probability models to compare the relative frequency of events with the theoretical probability (**RELATIVE**)
2. The use of Venn diagrams to solve probability problems, deriving and applying the following for any two events A and B in a sample space S:
  - a.  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$  (**ANDOR**)
  - b. A and B are mutually exclusive if  $P(A \text{ and } B) = 0$
  - c. If  $P(A) + P(B) = 1$ , then  $P(B) = P(\text{not } A) = 1 - P(A)$  (**ANDOR**)  
(**VENN**)

## GRADE 11

### Probability

1. Revise:
  - a. the addition rule for mutually exclusive events:  $P(A \text{ or } B) = P(A) + P(B)$  (**ANDOR**)
  - b. The complementary rule:  $P(\text{not } A) = 1 - P(A)$
  - c. The identity:  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$  (**ANDOR**)
2. Identify dependent and independent events and the product rule for independent events:  $P(A \text{ and } B) = P(A) \times P(B)$  (**DEPEND**)(**ANDOR**)
3. The use of Venn diagrams to solve probability problems, deriving and applying formulae for any three events A, B and C in a sample space S (**VENN**)
4. Use tree diagrams for the probability of consecutive or simultaneous events which are not necessarily independent. (**TREE**)

# CONTENTS

## GRADE 12

### Counting and probability

1. Revise:
  - a. Dependent and independent events
  - b. The product rule for independent events:  $P(A \text{ and } B) = P(A) \times P(B)$  (**ANDOR**)
  - c. The identity:  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$  (**ANDOR**)
  - d. The complementary rule:  $P(\text{not } A) = 1 - P(A)$
2. Probability problems using Venn diagrams, trees, two-way contingency tables and other techniques (like the fundamental counting principle) to solve probability problems (where events are not necessarily independent) (**TWOWAY**) (**TREE**) (**VENN**) (**FUNDAM**)
3. Apply the fundamental counting principle to solve probability problems (**FUNDAM**)



# CONTENTS

# FINANCE, GROWTH AND DECAY

## GRADE 8,9,10

### **Finance and growth**

Use the simple and compound growth formula  $A = P(1 + i.n)$  and  $A = P(1 + i)^n$  to solve problems, including annual interest, hire purchase, inflation, population growth and other real-life problems. Understand the implication of fluctuating foreign exchange rates (e.g. on the petrol price, imports, exports, overseas travel) (**SIMCOM**)

## GRADE 11

### **Finance, growth and decay**

1. Use simple and compound decay formulae:  $A = P(1 - in)$  and  $A = P(1 - i)^n$  to solve problems (including straight line depreciation and depreciation on a reducing balance. (**DECAY**))
2. The effect of different periods of compound growth and decay, including nominal and effective interest rates (**DIFFPER**)(**EFFNOM**).

## GRADE 12

### **Finance, growth and decay**

1. Solve problems involving present value and future value annuities (**ANNUITY**)
2. Make use of logarithms to calculate the value of  $n$ , the time period, in the equations  $A = P(1 + i)^n$  and  $A = P(1 - i)^n$  (**ANNUITY**)
3. Critically analyse investment and loan options and make informed decisions as to the best options (**ANNUITY**)

# CONTENTS

# CALCULUS



## GRADE 12

### Differential calculus

1. An intuitive understanding of the limit concept, in the context of approximating the rate of change or gradient of a function at a point. (**GRADPOINT**) (**LIMIT**)
2. Use limits to define the derivative of a function  $f$  at any  $x$ :  
$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$
 (**FIRSPRIN**)
3. Generalise to find the derivative of  $f$  at any point  $x$  in the domain of  $f$  i.e., define the derivative function  $f'(x)$  of the function  $f(x)$ . (**DERFUNC**)
4. Understand intuitively that  $f'(a)$  is the gradient of the tangent to the graph of  $f$  at the point with x-ordinate  $a$  (**LIMIT**)
5. Using first principles, find the derivative  $f'(x)$  for: (**FIRSPRIN**)
  - a.  $f(x) = ax^2 + bx + c$
  - b.  $f(x) = ax^3$
  - c.  $f(x) = \frac{a}{x}$
  - d.  $f(x) = c$
6. Use the formulae (**DIFF**)
  - a.  $\frac{d}{dx}(ax^n) = anx^{n-1}$
  - b.  $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}f(x) \pm \frac{d}{dx}g(x)$
  - c.  $\frac{d}{dx}[kf(x)] = k \cdot \frac{d}{dx}f(x)$

# WORDSUM

7. Find equations of tangents to graphs of functions (**TANGENT**)
8. Introduce the second derivative  $f''(x) = \frac{d}{dx} f'(x)$  and how it determines the concavity of a function (**SECONDER**)
9. Sketch graphs of cubic polynomial functions using differentiation to determine the coordinate of stationary points, and points of inflection (where concavity changes). Also, determine the x-intercepts of the graph using the factor theorem and other techniques (**SECONDER**, worked example 3)
10. Solve practical problems concerning optimisation and rate of change, including calculus of motion (**OPTIMISE**)

## **LINEAR** **PROGRAMMING**

### **GRADE 12**

1. The basic principles of linear programming:
  - a) Identifying constraints
  - b) Drawing the feasible region
  - c) Finding the profit function or cost function
  - d) Optimization (**LINPROG**)

## **ADDITIONAL HELP**

Go to (**ZEUS**) for additional help topics