1. Learning objectives

1. Number and numeration
2. Algebraic processes
3. Geometry and mensuration
4. Statistics and probability

2. Teaching and learning materials

Teachers should have the Mathematics textbook of the Junior Secondary School Course and Book 1 and Book 2 of the Senior Secondary School Course.

Students should have:
1. Book 2
2. An Exercise book
3. Graph paper
4. A scientific calculator, if possible.

3. Glossary of terms

**Algebraic expression** A mathematical phrase that contains ordinary numbers, variables (such as \(x\) or \(y\)) and operators (such as add, subtract, multiply, and divide). For example, \(3xy^2 - 3y^2 + 4\).

**Angle** A measure of rotation or turning and we use a protractor to measure the size of an angle.

**Angle of elevation** The angle through which the eyes must look upward from the horizontal to see a point above.

**Angle of depression** The angle through which the eyes must look downward from the horizontal to see a point below.

**Balance method** The method by which we add, subtract, multiply or divide by the same number on both sides of the equation to keep the two sides of the equation equal to each other or to keep the two sides balanced. We use this method to make the two sides of the equation simpler and simpler until we can easily see the solution of the equation.

**Cartesian plane** A coordinate system that specifies each point in a plane uniquely by a pair of numerical coordinates, which are the perpendicular distances of the point from two fixed perpendicular directed lines or axes, measured in the same unit of length. The word Cartesian comes from the inventor of this plane namely René Descartes, a French mathematician.

**Coefficient** A numerical or constant or quantity \(\neq 0\) placed before and multiplying the variable in an algebraic expression (for example, 4 in \(4x^3\)).

**Common fraction (also called a vulgar fraction or simple fraction)** Any number written as \(\frac{a}{b}\) where \(a\) and \(b\) are both whole numbers and where \(a < b\).

**Coordinates** of point A, for example, (1, 2) give its position on a Cartesian plane. The first coordinate (x-coordinate) always gives the distance along the x-axis and the second coordinate (y-coordinate) gives the distance along the y-axis.

**Data** Distinct pieces of information that can exist in a variety of forms, such as numbers. Strictly speaking, data is the plural of datum, a single piece of information. In practice, however, people use data as both the singular and plural form of the word.

**Decimal place values** A positional system of notation in which the position of a number with respect to the decimal point determines its value. In the decimal (base 10) system, the value of each digit is based on the number 10. Each position in a decimal number has a value that is a power of 10.

**Denominator** The part of the fraction that is written below the line. The 4 in \(\frac{3}{4}\), for example, is the denominator of the fraction. It also tells you what kind of fraction it is. In this case, the kind of fraction is quarters.

**Direct proportion** The relationship between quantities whose ratio remains constant. If \(a\) and \(b\) are directly proportional, then \(\frac{a}{b} = \) a constant value (for example, \(k\)).

**Direct variation** Two quantities, \(a\) and \(b\) vary directly if, when \(a\) changes, then \(b\) changes in the same ratio. That means that:
- If \(a\) doubles in value, \(b\) will also double in value.
- If \(a\) increases by a factor of 3, then \(b\) will also increase by a factor of 3.

**Directed numbers** Positive and negative numbers are called directed numbers and could be shown on a number line. These numbers have a certain direction with respect to zero.
- If a number is positive, it is on the right-hand side of 0 on the number line.
* If a number is negative, it is on the left-hand side of the 0 on the number line.

**Edge** A line segment that joins two vertices of a solid.

**Elimination** the process of solving a system of simultaneous equations by using various techniques to successively remove the variables.

**Equivalent fractions** Fractions that are multiples of each other, for example \( \frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{3 \times 3}{4 \times 3} \ldots = \) and so on.

**Expansion** of an algebraic expression means that brackets are removed by multiplication.

**Faces of a solid** A flat (planar) surface that forms part of the boundary of the solid object; a three-dimensional solid bounded exclusively by flat faces is a polyhedron.

**Factorisation of an algebraic expression** means that we write an algebraic expression as the product of its factors.

**Graphical method used** to solve simultaneous linear equations means that the graphs of the equations are drawn. The solution is where the two graphs intersect (cut) each other.

**Highest Common Factor (HCF)** of a set of numbers is the highest factor that all those numbers have in common or the highest number that can divide into all the numbers in the set. The HCF of 18, 24 and 30, for example, is 6.

**Inverse proportion** The relationship between two variables in which their product is a constant.

When one variable increases, the other decreases by a factor of 3, then \( a \) doubles, then \( b \) halves in value.

**Inverse variation** Two quantities \( a \) and \( b \) vary inversely if, when \( a \) changes, then \( b \) changes by the same ratio inversely. That means that:

* If \( a \) doubles, then \( b \) halves in value.
* If \( a \) increases by a factor of 3, then \( b \) decreases by a factor of \( \frac{1}{3} \).

**Joint variation** of three quantities \( x \), \( y \) and \( z \) means that \( x \) and \( y \) are directly proportional, for example, and \( x \) and \( z \) are inversely proportional, for example. So \( x \times \frac{3}{2} \) or \( x = k_2^y \), where \( k \) is a constant.

**Like terms** contain identical letter symbols with the same exponents. For example, \(-3x^2y^3\) and \(5x^2y^3\) are like terms but \(3x^2y^3\) and \(3xy\) are not like terms. They are unlike terms.

**Lowest Common Multiple (LCM)** of a set of numbers is the smallest multiple that a set of numbers have in common or the smallest number into which all the numbers of the set can divide without leaving a remainder. The LCM of 18, 24 and 30, for example, is 360.

**Median** The median is a measure of central tendency. To find the median, we arrange the data from the smallest to largest value.

* If there is an odd number of data, the median is the middle value.
* If there is an even number of data, the median is the average of the two middle data points.

**Mode** The value (data point) that occurs the most in a set of values (data) or is the data point with the largest frequency.

**Multiple** The multiple of a certain number is that number multiplied by any other whole number. Multiples of 3, for example, are 6, 9, 12, 15, and so on.

**Net** A plane shape that can be folded to make the solid.

**Numerator** The part of the fraction that is written above the line. The 3 in \( \frac{3}{8} \), for example, is the numerator of the fraction. It also tells how many of that kind of fraction you have. In this case, you have 3 of them (eighths).

**Orthogonal projection** A system of making engineering drawings showing several different views (for example, its plan and elevations) of an object at right angles to each other on a single drawing.

**Parallel projection** Lines that are parallel in reality are also parallel on the drawing.

**Pictogram (or pictograph)** Represents the frequency of data as pictures or symbols. Each picture or symbol may represent one or more units of the data.

**Pie chart** A circular chart divided into sectors, where each sector shows the relative size of each value. In a pie chart, the angle of the each sector is in the same ratio as the quantity the sector represents.

**Place value** Numbers are represented by an ordered sequence of digits where both the digit and its place value have to be known to determine its value. The 3 in 36, for example, indicates 3 tens and 6 is the number of units.

**Terms** in an algebraic expression are numbers and variables which are separated by + or – signs.

**Satisfy** an equation, means that there is a certain value(s) that will make the equation true. In the equation \( 4x + 3 = -9 \), \( x = -3 \) satisfies the equation because \( 4(-3) + 3 = -9 \).
Simplify means that you are writing an algebraic expression in a form that is easier to use if you want to do something else with the expression. If you want to add fractions, for example, you need to write all the fractions with the same denominator to be able to add them. Then the simplest form of $\frac{3}{4}$ is $\frac{9}{12}$, if 12 is the common denominator.

Simultaneous linear equations are equations that you solve by finding the solution that will make them simultaneously true. In $2x - 5y = 16$ and $x + 4y = -5$, $x = 3$ and $y = -2$ satisfy both equations simultaneously.

SI units The international system of units of expressing the magnitudes or quantities of important natural phenomena such as length in metres, mass in kilograms and so on.

Solve an equation means that we find the value of the unknown (variable) in the equation that will make the statement true. In the equation $3x - 4 = 11$, the value of the unknown (in this case, $x$) that will make the statement true, is 5, because $3(5) - 4 = 11$.

Variable In algebra, variables are represented by letter symbols and are called variables because the values represented by the letter symbols may vary or change and therefore are not constant.

Vertex (plural vertices) A point where two or more edges meet.

$x$-axis The horizontal axis on a Cartesian plane.

$y$-axis The vertical axis on a Cartesian plane.

Teaching notes
You should be aware of what your class knows about the work from previous years. It would be good if you could analyse their answer papers from the previous end of year examination to determine where the class lacks the necessary knowledge and ability in previous work. You can then analyse the students’ answers to determine where they experience difficulties with the work, and then use this chapter to concentrate on those areas.

A good idea would be that you review previous work by means of the summary given in each section. Then you let the students do Review test 1 of that section and you discuss the answers when they finished it. You then let the students write Review test 2 as a test, and you let them mark it under your supervision.