BREEDING ARENA College

THE BREEDER'S GUIDE

MATHEMATICS

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Term Sow 2024/2025

SCHEME OF WORK

MATHEMATICS

Science & Technology **JANUARY 6TH – APRIL 13TH**

WEEK	TOPIC	SUB-TOPICS
1	Revision	
2	Simple Equation	➢ Algebraic equation ➢ Differenced between algebraic expression and equation
3	Simple Equation (cont'd)	➢ Word problem leading to simple equations ➢ Algebraic fractions
4	Linear Inequalities	➢ Definition ➢ Plotting of number lines ➢ Simple inequality with one variable
5	Graphs	➢ Graph of linear equation in two variables ➢ Graph of Cartesian plan; plotting of linear graphs of two variables.
6	Graphs	➢ Real life situations ➢ Word problems on graph
7	Midterm test and Break	
8	Scale Drawing of Length and Distance (cont'd)	➢ Definition ➢ Purpose of scale drawing ➢ Application of scale drawing to real life problems
9	Scale Drawing of Length and Distance	➢ Representing real life measurements and information on paper using scale. ➢ Finding the used in drawing real objects on a piece of paper.
10	Revision	
11	Revision	
12	Examination	
13	Examination	
WEEK	TOPIC	SUB-TOPICS

1. REVISION

Objective: By the end of this class, all students should be able to recall all they were taught in the previous term.

Duration: 190mins

Week: 1

Entry Behaviour (*How you plan to start your Class*):

2. SIMPLE EQUATIONS

Objective: By the end of this class, all the students should be able to (I) Distinguish between expression and equation (II) Solve simple equations with one variable.

Duration: 190mins

Week: 2

Entry Behaviour (*How you plan to start your Class*):

Introduction

When most people talk about equations, they mean algebraic equations. These equations involve letters as well as numbers. Letters are used to replace some of the numbers where a numerical expression would be too complicated, or where you want to generalize rather than use specific numbers.
Algebraic equations are solved by working out what numbers the letters represent. We can turn the two simple equations above into algebraic equations by substituting x for one of the numbers:
$2 + 2 = x$
We know that $2 + 2 = 4$, which means that x must equal 4. The equation answer is therefore $x = 4$.
$5 + 3 > 3 + x$
We know that $5 + 3 = 8$. The equation tells us that 8 is greater than (>) $3 + x$.
Take 3 away from 8, to get 5.
We can see that x must be less than 5 or x is 4 or less. $x < 5$ or $x <= 4$
We cannot say more precisely what x is with the information that we are given.
There is no magic about using the letter x. You can use any letter you like, although x and y are commonly used to represent the unknown elements of equations.

Terms of an Equation

A term is a part of the equation that is separated from other parts by an addition or subtraction sign.
Terms may be just numbers, or they may be just letters, or they may be a combination of letters and numbers, such as 2x, 3xy or 4×2.
In a term involving letters and numbers, the number is known as the coefficient, and the letter as the variable.
Terms that have exactly the same variable are said to be like terms, and you can add, subtract, multiply or divide them as if they were simple numbers.

You cannot add or subtract unlike terms. However, you can multiply them by combining variables and multiplying the coefficients together.
So, for example, $3y \times 2x = 6xy$ (because 6xy simply means 6 times x times y).
You can divide unlike terms by turning them into fractions and cancelling them down. Start with the numbers, then the letters.
So, for example, $6xy \div 3x = 6xy/3x = 2y$

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
New General Mathematics for Junior Secondary School – Book 2	• Equation • Expression • Like terms • Algebraic equation	1. Solve these equations - $3x - 8 = 10$ - $4 + 5a = 19$ - $4b + 24 = 0$ - $X + 7 = 19 + 2x$ - $11 + 9n = 6n + 13$ - $2(x + 5) = 18$ - $8(2d - 3) = 3(4d - 7)$

Remark:

3. SIMPLE EQUATIONS (CONT'D)

Objective: By the end of this class, all the students should be able to (I) Interpret and solve word problems leading to simple equations (II) Solve equations with fractions.

Duration: 190mins

Week: 3

Entry Behaviour (*How you plan to start your Class*):

Equations with fractions

To solve equations with fractions, always clear the fraction before collecting like terms. To clear fractions, multiply both sides of the equation by the LCM of their denominator.

Example:

1. Solve the equation: $\frac{4m}{5} - \frac{2m}{3}$ = 4.

The LCM of 5 and 3 is 15.

Add the two fraction using the LCM

$\frac{3(4m)-5(2m)}{15}$ = 4

$\frac{12m - 10m}{15}$= 4

$\frac{2m}{15}$ = 4

Cross multiply

2m = 4 * 15

2m = 60

Divide both sides by the coefficient of 'm', which is 2.

:· m = 30.

2. Solve the equation

   $\frac{(3x-2)}{6} - \frac{(2x+7)}{9}$ = 0

   The LCM of 6 and 9 is 18.

   Combine the two fractions using the LCM.

   $\frac{3(3x-2)-2(2x+7)}{18}$ = 0

   Cross multiply

   $3(3x-2) - 2(2x+7)$ = 18 * 0

   9x – 6 – 4x – 14 = 0

   Collect like terms

9x – 4x – 6 – 14 = 0

5x – 20 = 0

5x = 20

Divide both sides by the coefficient of x, which is 5

X = 4

Word problems

We can use equations to solve **word problems**, that is, problems using everyday language instead of just numbers or algebra. There is always an unknown in a word problem.

There are steps to take when solving a word problem.

1. Choose a letter for the unknown
2. Write down the information of the question in algebraic form.
3. Make an equation
4. Solve the equation
5. Give the answer in written form
6. Check the result against the information given in the question.

Examples

1. I think of a number. I multiply it by 5. I add 15. The result is 100. What is the number I thought of?

Solution

Let the number be n

I multiply n by 5 : $5n$

I add 15 : $5n + 15$

The result is 100 : $5n + 15 = 100$

Subtract 15 from both sides

$5n + 15 – 15 = 100 – 15$

$5n = 85$

Divide both sides by 2

$5n/5 = 85/5$

$n = 17$

The number is 17

Check: 17 * 5 = 85; 85 + 15 = 100

2. A rectangle is 8m long and its perimeter is 30m. find the breadth of the rectangle.

   Solution

   Let the breadth of the rectangle be b metres

   Perimeter = 8 + b + 8 + b metres

$= 16 + 2b$

Thus $16 + 2b = 30$

Subtract 16 from both sides

$2b = 30 - 16 = 14$

Divide both sides by 2

$b = 14/2 = 7$

The breadth of the rectangle is 7 metres.

Check: 8 m + 7 m + 8 m + 7 m = 30 m

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
New General Mathematics for Junior Secondary School – Book 2	• Fraction • Equation • Algebra • Word problems	1. Solve these equations - $\frac{x}{3} = 5$ - $\frac{22-3x}{4} = 2x$ - $\frac{3(2a+1)}{4} = \frac{5(a+5)}{6}$ - $\frac{2a-1}{3} - \frac{a+5}{4} = \frac{1}{2}$ - $\frac{3m}{5} - \frac{m}{3} = \frac{8}{5}$ 2. A regular hexagon has a perimeter of 90cm. find the length of one side of the hexagon. 3. A number is multiplied by 6 and then 4 is added. The result is 34. Find the number. 4. I subtract 8 from a certain number; I then multiply the result by 3. The final answer is 21. Find the original number.

Remark:

4. LINEAR INEQUALITIES

Objective: By the end of this class, all the students should be able to (I) Define inequalities (II) Simplify linear inequality with one variable (III) Plot solutions on number line

Duration: 190mins

Week: 4

Entry Behaviour (*How you plan to start your Class*):

Linear Inequalities

In mathemarics we use the equals sign, =, to show that quantities are the same. However, very often, quantities are different, or **unequal**. For example, a mother is always older than her child their ages are always different. We say that there is inequality in their ages. This chapter explains the use of inequalities in arithmetic, algebra and in everyday life. It also introduces the inequality symbols.

Greater than, less than

The sum 5 + 3 = 8 is a simple **equality**. However, as we know, quantities are often not equal. For example:

$5 + 5 \neq 8$

where ≠ means 'is not equal to'. We can also write:

$5 + 5 > 8$

where > means 'is greater than'. Similarly, we can write the following:

$3 + 3 \neq 8$

$3 + 3 < 8$

where < means 'is less than'.

≠, >, < are **inequality symbols**. They tell us that quantities are not equal. The > and < symbols are more helpful than ≠. They tell us more. For example, $x \neq 0$ tell us that x does not have the value 0; x can be any positive or negative number. However, $x<0$ tell us that x is less than 0; x must be a negative number.

The symbols can be used to change word statements into algebraic statements. See examples below.

1. The distance between two villages is over 18km. Write this as an algebraic statement.
   Let the distance between the villages be d km. Then, $d > 18$
   A statement like $d > 18$ is called an inequality.

2. I have x naira. I spent N200. The amount I have left is less than N50. Write an inequality in x.
   I spend N200 out of x naira.
   Thus I have $x – 200$ naira left.
   Thus $x – 200 < 50$.

Not greater than, not less than

In most towns there is a speed limit of 50 km/h. If a car, travelling at s km/h, is within the limit, then s is not greater than 50. If $s < 50$ or if $s = 50$, the speed limit will not be broken. This can be written as one inequality:

$s \leq 50$

where ≤ means 'less than or equal to'. Thus, not greater than means the same as less than or equal to.

In most countries, voters in elections must not be less than 18years of age. If a person of age a years is able to vote, then a is not less than 18. The person can vote if $a > 18$ or if $a = 18$. This can be written as one inequality:

$a \geq 18$, where ≥ means 'is greater than or equal to'. Thus, not less than means the same as greater than or equal to.

Graphs of inequalities

Linear inequalities

Inequalities like $3x > -12$ and $2x - y \leq 7$ have unknowns, or variables, with an index of 1 (i.e. $x = x^1$ and $y = y^1$). Inequalities with variables of index 1 are called linear inequalities.

$3x > -12$ is a linear inequality in one variable (x); $2x - y \leq$ is a linear inequality in two variables (x and y). This chapter is restricted to linear inequalities in one variable.

Linear Inequalities in one variable

When working with linear equations involving one variable whose highest degree (or order) is one, you are looking for the one value of the variable that will make the equation true. But if you consider an inequality such as $x + 2 < 7$, then values of x can be 0, 1, 2, 3, any negative number, or any fraction in between. In other words, there are many solutions for this inequality. Fortunately, solving an inequality involves the same strategies as solving a one variable equation. So even though there are an infinite number of answers to an inequality, you do not have to work any harder to find the answer. To review how to solve one variable equations.

However, there is one major difference that you must keep in mind when working with any inequality. If you multiply or divide by a negative number, you must change the direction of the inequality sign. You'll see why this is the case soon.

Let's go back and look at $x + 2 < 7$. If this were an equation, you would only need to subtract 2 from both sides to have x by itself.

$x + 2 < 7$

$-2 \quad -2$

....

$x \; < \; 5$

Keep in mind that the new rule for inequalities only applies to multiplying or dividing by a negative number. You can still add or subtract without having to worry about the sign of the inequality.

But what would happen if you had $-2x \geq 10$? Before solving, If you let x = -5 or -6 or any other value that is less than -5, then the inequality will be true. So you would write your solution as $x \leq -5$. In the process of solving this inequality using algebraic methods, you would have something that looks like the following:

-2/-2 10/-2

x   -5

Let's Practice

$2x + 3 > -11$

Begin by getting the variable on one side by itself by subtracting 3 from both sides. Then divide both sides by 2. Since you are dividing by a positive 2, there is no need to worry about changing the sign of the inequality.

$2x + 3 > -11$

$2x > -14$

$x > -7$

$4 - 3x \; 20$

The solution to this problem begins with subtracting 4 from both sides and then dividing by -3. As soon as you divide by -3, you must change the sign of the inequality.

$4 - 3x \; 20$

$-3x \; 16$

$x \;\; -16/3$

$5x - 7 > 3x + 9$

This solution will require a little more manipulation than the previous examples. You have to gather the terms with the variables on one side and the terms without the variables on the other side.

$5x - 7 > 3x + 9$

$-3x \qquad -3x$

$2x - 7 > 9$
$+7 \quad +7$
$2x > 16$
$x > 8$
There is another type of inequality called a double inequality. This is when the variable appears in the middle of two inequality signs. This is simply a shortcut way of writing two separate inequalities into one and using a shorter process for finding the solution.

<u>Basic Rules of Inequalities</u>

Rule 1

If $a > b$ then $b < a$, i.e. if a is greater than b then b is less than a, If $a < b$ then $b > a$ and if a is less than b then b is greater than a

Rule 2

If $a > b$ and $b > e$ then $a > e$, e. g. if $6 > 4$ and $4 > 2$ then $6 > 2$, If a < band $b < e$ then $a < e$, e. g. if $3 < 7$ and $7 < 10$ then $3 < 10$

Rule 3

If $a > b$ then $a + e > b + c$ or $a - c > b - c$, If $a < b$ then $a + e < b + c$ or $a - c < b - c$
i.e. we can add to or subtract from both sides of an inequality the same quantity without changing the sense (or sign) of the inequality.

Rule 4

If $a > b$ and c is a positive number, i.e. $c > 0$ then $ac > bc$ and $a/c > b/c$, If $a < b$ and $c > 0$ then $ac < bc$ and $a/c < b/c$
i.e. both sides of an inequality can be multiplied or divided by the same positive number without changing the sense of the inequality.

Rule 5

If $a > b$ and c is negative i.e. $c < 0$ then $ac < bc$ and $a/c < b/c$, If $a < b$ and $c < 0$ then $ac > bc$ and $a/c > b/c$
Note: Both sides of an inequality can be multiplied or divided by a negative number, but the sense of the inequality is reversed.
The sense of an inequality is changed if both sides are multiplied or divided by the same negative number.

Rule 6

If $a > b$ and $c > d$ then adding the inequalities $a + c > b + d$, If $a < b$ and $c < d$ then $a + c < b + d$
i.e. Inequalities having the same sense can be added side by side to each other without changing the sense of the inequalities.

Rule 7

If $a > b$ and $c > d$ then either $a - c > b - d$ or $c - a > d - b$ is true but not the two of them are true at the time.
Similarly if $a < b$ and $c < d$ then either $a - c < b - d$ or $c - a < d - b$ is true but not the two of them.

Rule 8

If $a > b > 0$ and $c > d > 0$ or $a < b < 0$ and $c < d < 0$ then $ac > bd$

Rule 9

If $a > b$ and $n > 0$ then $an > bn$
e.g. $5 > 3$ and $2 > 0$
$52 > 32$ i.e. $25 > 9$
If $a > b$ and $n < 0$ then $an < bn$
If $a < b$ and $n > 0$ then $an < bn$
If $a < b$ and $n < 0$ then $an > bn$
e.g. $4 < 6$ and $-2 < 0$
$4-2 > 6-2$
i.e. $1/16 > 1/36$

Example

$-2 \quad 6x - 1 \quad 10$

The strategy for solving this inequality is not that much different than the other examples. Except in this case, you are trying to isolate the variable in the middle rather than on one side or the other. But the process for getting the x by itself in the middle, you should add 1 to all three parts of the inequality and then divide by 6.

-2 6x – 1 10

-1 6x 11

-1/6 x 11/6

Graphing One-Variable Inequalities

Before graphing linear inequalities, we summarized below the different forms of inequalities, with its corresponding interval form and graph:

Let's take a look at the inequality symbols and their meanings again.

There are just a few important concepts that you must know in order to graph an inequality. Let's review a number line.

The negative numbers are on the left of the zero and the positive numbers are on the right.

Example

$r > -5$

This is read as "r is greater than -5." This means it includes all numbers greater than, or to the right, of -5 but does not include -5 itself. We will have to show this by using an open circle and having the arrow shoot out to the right.

Example 2

$x \leq 0.4$

This is read as "x is less than or equal to 0.4." This time we include the 0.4 by using a closed circle and the arrow will shoot out to the left. The number 0.4 is in between the 0 and the 1 on a number line.

Here is a summary of the important details in graphing inequalities.

Make sure you read the inequality starting with the variable!

"greater than" or "greater than or equal to" – arrow shoots out to the right

"less than" or "less than or equal to" – arrow shoots out to the left will have open circles

$\leq$ and $\geq$ will have closed circles.

<u>Solution of inequalities</u>

Balance method

Consider a compound in which 23 people live. Then any one time there may be x people in the compound. If all 23 people are in the compound, then $x = 23$. This is an equation.

If some people have left the compound, then $x < 23$. This is the inequality.

The equation has only one solution: $x = 23$. The inequality has many solutions: if $x < 23$, then x could be 0, 1, 2, 3, . . ., 20, 21, 22.

Notice that negative and fractional values of x are impossible in this example.

Inequalities are solved in much the same way as equations. We use the balance method.

However, there is one important difference to be shown later on.

Example

Solve the inequality $x + 4 < 6$.

$x + 4 < 6$

subtract 4 from both sides.

$x + 4 – 4 < 6 – 4$

$x < 2$

$x < 2$ is the solution.

When solving inequalities, we do not normally try to list the values of the unknown.

Example
Find the values of x that satisfy the inequality $3x - 3 > 7$, such that x is an integer.
Note: an integer is any whole number
-3, 0, 22 are examples of integers.
$3x - 3 > 7$
Add 3 to both sides.
$3x > 10$
Divide both sides by 3.
$x > 3\ 1/3$
But x must be an integer.
Thus x can have values 4, 5, 6, ...
$x = 4, 5, 6, \ldots$ is the solution.

Multiplication and division by negative numbers
Consider the following true statement: $5 > 3$. Multiply both sides of the inequality by -2.
This gives $-10 > -6$.
But this is a false statement. In fact, -10 is less than -6.
Similarly, dividing both sides of $15 > -12$ (true) by -3 gives $-5 > 4$ (false, since $-5 < 4$).
In general, when multiplying or dividing both sides of an inequality by a negative number, reverse the inequality sign to keep the statement true.
For example, if $-2x \geq 14$ is true, then dividing both sides by -2 gives the equivalent true statement $x \leq -7$.

Example
Solve $5 - x > 3$
Either
$5 - x > 3$
Subtract 5 from both sides.
$-x > -2$
Multiply both sides by -1 and reverse the inequality.
$(-1) X (-x) < (-1) X (-2)$
$x < 2$
or:
$5 - x > 3$
Add x to both sides.
$5 > 3 + x$
Subtract 3 from both sides.
$2 > x$
thus, $x < 2$
The second method in Example above shows that the rule of reversing the inequality sign when multiplying by a negative number is correct.

A linear inequality involves the relationship between linear functions, just as do linear equations. The difference, however, is that linear inequalities relate two linear functions using the symbols $<$, $\leq$, $>$, or $\geq$, which correspond respectively to less than, less than or equal to, greater than, and greater than or equal to. Because these relationships do not involve a strict equality, solutions for expressions that contain them are more complex than similar expressions that do involve strict equality. For the most part, the same rules we have used for linear equations also apply to linear inequalities-a few nuances must be considered, however.

Note that we use a solid line because the inequality is of the form "greater than or equal to." The shaded region in the graph, including the solid line, is the solution set of the inequality $-7x - 5 \leq -2 + x$.

Practice Problem: Find and graph the solution set of $3x - 4 < 1 - x$.

Solution: First, we can manipulate the inequality to find a corresponding solution set in terms of the independent variable x.

$3x - 4 < 1 - x$

$3x - 4 + 4 < 1 - x + 4$

$3x < 5 - x$

$3x + x < 5 - x + x$

$4x < 5$

$x < 5/4$

We can check this result by using a value that satisfies $x < 5/4$; let's try x= 0.

$3(0) - 4 < 1 - (0)$

$-4 < 1$ Inequality holds

Now, let's graph the result. Note that we use an open circle at $x = 5/4$ because the solution set is a strict inequality (the < symbol is used).

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
New General Mathematics for Junior Secondary School – Book 2	• Inequality • Variable • Graph • Greater than • Less than • Equal to	1. Answer the following questions Write either > or < instead of the words. - 6 is less than 11 —— - -1 is greater than -5 ——— - 0 is greater than -2.4 ——— - -3 is less than +3 - x is greater than 12 2. State whether each of the following is true, T, or false, F. - 13 > 5 → T - 19 < 21 → - -2 < -4 → - -15 > 7 → - 3 +9 < 10 → 3. Solve the following inequalities. Sketch a graph of each solution. - $x - 2 < 3$ - $x + 3 \geq 6$ - $a + 5 > 7$ - $y - 3 \leq 5$ 4. In each question, first make an inequality, then solve the inequality. - If 9 is added to a number *x*, the result is greater than 17. Find the range of values of *x*. - Three times a certain number is not grater than 54. Find the range of values of the number. - A triangle has a base of length 6cm and an area of less than $12cm^2$. What can we say about its height?

Remark:

5. GRAPHS

Objective: By the end of this class, all the students should be able to (I) Identify x-axis and y-axis (II) Compute a table of values (III) Plot and join points on the Cartesian plane.

Duration: 190mins

Week: 5

Entry Behaviour (*How you plan to start your Class*):

Linear Graph

A **graph** is a picture that represents numerical data. Most of the graphs that you have been taught are **straight-line** or **linear graphs**. This topic shows how to use linear graphs to represent various real-life situations.
If the rule for a relation between two variables is given, then the graph of the relation can be drawn by constructing a table of values.
To plot a **straight line graph** we need to find the coordinates of *at least two points* that fit the rule.

Example
Plot the graph of $y = 3x + 2$.
Solution
Construct a table and choose simple x values

X	-2	-1	0	1	2
Y					

In order to find the y values for the table, substitute each x value into the rule y = 3x + 2
When x = -2, y = 3(-2) + 2
= - 6 + 2 = = -4
When x = -1, y = 3(-1) + 2
= - 3 + 2 = 1
When x = 0, y = 3 X 0 + 2
= 0 + 2 = 2
When x = 1, y = 3 X 1 + 2
= 3 + 2 = 5
When x = 2, y = 3 X 2 + 2
= 6 + 2 = 8
The table of values obtained after entering the values of y is as follows:

X	-2	-1	0	1	2
Y	-4	-1	2	5	8

Draw a Cartesian plane and plot the points. Then join the points with a ruler to obtain a straight line graph.

Setting out:
Often, we set out the solution as follows.
Y = 3x + 2
When x = -2, y = 3(-2) + 2
= -6 + 2 = -4
When x = -1, y = 3(-1) + 2
= -3 + 2 = = -1
When x = 0, y = 3 X 0 + 2
= 0 + 2 = 2
When x = 1, y = 3 X 1 + 2
= 3 + 2 = 5
When x = 2, y = 3 X 2 + 2
= 6 + 2 = 8

X	-2	-1	0	1	2
Y	-4	-1	2	5	8

Example
Plot the graph of *y* = –2*x* + 4.
Solution
Y = -2x + 4
When x = -2, y = -2(-2) + 4
= 4 + 4 = 8
When x = -1, y = -2(-1) + 4
= 2 + 4 = 6
When x = 0, y = -2 X 0 + 4
= 0 + 4 = 4
When x = 1, y = -2(1) + 4
= -2 + 4 = 2
When x = 2, y = -2(2) + 4
= -4 + 4 = 0
When x = 3, y = -2(3) + 4
= -6 + 4 = -2
When x = 4, y = -2(4) + 4
= -8 + 4 = -4

x	-2	-1	0	1	2	3	4
y	8	6	4	2	0	-2	-4

Speed-time graphs
A **speed-time graph,** velocity-time graph, shows how the speed of an object varies with time during a journey.
There are two very important things to remember about velocity – time graphs.
The distance travelled is the area under the graph.

The gradient or slope of the graph is equal to the acceleration. If the gradient is negative, then there is a deceleration. We may use the equations (1) or some rearrangement of this equation.

GRAPHS – CARTESIAN PLANE AND COORDINATES

The position of points

A **graph** is a picture of numerical data. We used graphs in statistics in class 1, where they represented number patterns. Here we extend graphs to identifying and drawing the position of points.

Points on a line

Writing numbers down on a Number Line makes it easy to tell which numbers are bigger or smaller.
Numbers on the left are stronger than numbers on the right.
Example
5 is smaller than 8
-1 is smaller than 1
-8 is smaller than -5

Example

Example: John owes $3, Virginia owes $5 but Alex doesn't owe anything, in fact he has $3 in his pocket. Place these people on the number line to find who is poorest and who is richest.
Having money in your pocket is positive, owing money is negative.
So John has "−3", Virginia "−5" and Alex "+3"
Now it is easy to see that Virginia is poorer than John (−5 is less than −3) and John is poorer than Alex (−3 is smaller than 3), and Alex is, of course, the richest!

Plotting Points on a Cartesian Plane

A Cartesian plane (named after French mathematician Rene Descartes, who formalized its use in mathematics) is defined by two perpendicular number lines: the ***x*-axis**, which is horizontal, and the ***y*-axis**, which is vertical. Using these axes, we can describe any point in the plane using an ordered pair of numbers.
The Cartesian plane extends infinitely in all directions. To show this, math textbooks usually put arrows at the ends of the axes in their drawings.
The location of a point in the plane is given by its coordinates, a pair of numbers enclosed in parentheses: (x, y). The first number x gives the point's horizontal position and the second number y gives its vertical position. All positions are measured relative to a "central" point called the origin, whose coordinates are (0, 0). For example, the point (5, 2) is 5 units to the right of the origin and 2 units up, as shown in the figure. Negative coordinate numbers tell us to go left or down. See the other points in the figure for examples.
The Cartesian plane is divided into four quadrants. These are numbered from I – IV, starting with the upper right and going around counter clockwise. (For some reason everybody uses roman numerals for this).
In Quadrant I, both the x– and y-coordinates are positive; in Quadrant II, the x-coordinate is negative, but the y-coordinate is positive; in Quadrant III both are negative; and in Quadrant IV x is positive but y is negative.
Points which lie on an axis (i.e., which have at least one coordinate equal to 0) are said not to be in any quadrant. Coordinates of the form $(x, 0)$ lie on the horizontal x-axis, and coordinates of the form $(0, y)$ lie on the vertical y-axis.

Coordinate Graphing

Coordinate graphing sounds very dramatic but it is actually just a visual method for showing relationships between numbers. The relationships are shown on a **coordinate grid**. A coordinate grid has two perpendicular lines, or **axes**, labeled like number lines. The **horizontal axis** is called the ***x*-axis**. The **vertical axis** is called the ***y*-axis**. The point where the *x*-axis and *y*-axis intersect is called the **origin**.

The numbers on a coordinate grid are used to locate points. Each point can be identified by an **ordered pair** of numbers; that is, a number on the *x*-axis called an ***x*-coordinate**, and a number on the *y*-axis called a **y-coordinate**. Ordered pairs are written in parentheses (*x*-coordinate, *y*-coordinate). The origin is located at (0,0). Note that there is no space after the comma.

The location of (2,5) is shown on the coordinate grid below. The *x*-coordinate is 2. The *y*-coordinate is 5. To locate (2,5), move 2 units to the right on the *x*-axis and 5 units up on the *y*-axis.

The order in which you write *x*– and *y*-coordinates in an ordered pair is very important. The *x*-coordinate always comes first, followed by the *y*-coordinate. As you can see in the coordinate grid below, the ordered pairs (3,4) and (4,3) refer to two different points!

The function table below shows the *x*– and *y*-coordinates for five ordered pairs. You can describe the relationship between the *x*– and *y*-coordinates for each of these ordered pairs with this rule: the x-coordinate plus two equals the y-coordinate. You can also describe this relationship with the algebraic equation $x + 2 = y$.

To graph the equation x + 2 = y, each ordered pair is located on a coordinate grid, then the points are connected. Notice that the graph forms a straight line. The arrows indicate that the line goes on in both directions. The graph for any simple addition, subtraction, multiplication, or division equation forms a straight line.

Plotting Points

To plot a point means to raw its position on a Cartesian plane. The easiest way to plot a point is as follows:

1. Start at the origin.
2. Move along the x-axis by an amount and in a direction given by the x-coordinate of the point.
3. Move up or down parallel to the y-axis by an amount and in a direction given by the y-coordinate.

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
New General Mathematics for Junior Secondary School – Book 2	• Graph • Plot • Coordinate • Cartesian plane	1. Plot the graph of the following equations and highlight the x-intercept and y-intercept. - $Y = 4x – 9$ - $Y = 3x + 8$ - $Y = 3x – 10$ Take the range of values of x to be -3 to 4. 2. Use the information in question one to find the x and y intercept in each graph.

Remark:

6. GRAPHS (CONT'D)

Objective: By the end of this class, all the students should be able to (I) Plot graphs of linear equations in 2 variables (II) Interpret plotted graphs

Duration: 190mins

Week: 6

Entry Behaviour (*How you plan to start your Class*):

Linear Equations and graphs

Now that you have your points, you need to draw your axes. REMEMBER TO USE YOUR RULER! If you don't use a ruler, you will have messy axes and inconsistent scales on the axes, and your points will NOT line up properly. Don't "fake it" with your graphs. Get in the habit now of drawing neatly. It will save you so much trouble down the line! (And, no, using graph paper is not the same as, nor does it replace, using a ruler!)

Also, make sure you draw your axes large enough that your graph will be easily visible. On a standard-sized sheet of paper (8.5 by 11 inches, or A4), you will be able to fit two or three graphs on a page. If you are fitting more than three graphs on one side of a sheet, then you're probably drawing them too small. Here are my axes:

Remember that the arrows indicate the direction in which the values are increasing. Your book (and even your teacher) may draw things incorrectly, but that's no excuse for you. Arrows go on the upper numerical ends of each axis, and NOWHERE ELSE (unless you have an educator who *wants* it drawn wrong; then just remember the right way for later courses).

Once I've drawn my axes, I have to label them with an appropriate scale. "Appropriate" means "one that is neat and that fits the numbers I'm working with". For instance, considering the values I'm working with, I'll count off by ones. But if I were doing a graph for a word problem about government waste, I would probably count off by hundred thousand or maybe even by millions. Adjust the scales and axes to suit the case at hand. And ALWAYS use a ruler to make sure that your tick-marks are even! Here's my scale:

Note that I've made every fifth tick-mark a bit longer. This isn't a rule, but I've often found it helpful for counting off the larger points; it's more of a time-saver than anything else.

Now I'll plot (draw) the points I'd computed in my T-chart:

Graph $y = (–5/3)x – 2$

First I'll do the chart.

X	-6	-3	0	3
(-5/3)x	10	5	0	-5
-2	-2	-2	-2	2-
Y = (-5/3)x – 2	8	3	-2	-7

Since I am multiplying x by a fraction, I will x-values that are multiples of 3, so the denominator will cancel out and I will not have fractions. Then I will plot my point and draw my graph.

First I will do the chart Graph $y = 7 – 5x$

x	-1	0	1	2	3
7	7	7	7	7	7
-5x	5	0	-5	-10	-15
Y=7 – 5x	2	7	2	-3	-8

This equation is an example of a situation in which you will probably want to be particular about the *x*-values you pick. Because the *x* is multiplied by a relatively large value, the *y*-values grow quickly. For instance, you probably wouldn't want to use *x* = 5 or *x* = –3. You could pick larger *x*-values if you wished, but your graph would get awfully tall.

Form of linear equation
y = mx + c

Another way of arranging the equation y = 4x – 7 is to put the variables in alphabetical order, equating to zero: 4x – y – 7 = 0. This equation is in the form ax + by + c = 0, where the graph y = 4x – 7 is also the graph of 4x – y – 7 = 0.

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
New General Mathematics for Junior Secondary School – Book 2	• Graph • Plot • Coordinate • Cartesian plane	3. Plot the graph of the following equations and highlight the x-intercept and y-intercept. - *Y = 4x – 9* - *Y = 3x + 8* - *Y = 3x – 10* Take the range of values of x to be -3 to 4. Use the information in question one to find the x and y intercept in each graph.

Remark:

7. MIDTERM TEST AND BREAK

Objective: By the end of this class, all the student should be able to participate in the midterm test.

Duration: 190mins

Week: 7

Entry Behaviour (*How you plan to start your Class*):

What

8. SCALE DRAWING OF LENGTH AND DISTANCE

Objective: By the end of this class, all the students should be able to (I) Explain the term scale drawing and state the purpose of scale drawing (II) Apply scale drawing to solve real life problems on measurement

Duration: 190mins

Week: 8

Entry Behaviour (*How you plan to start your Class*):

Scale Drawing

A drawing that shows a real object with accurate sizes except they have all been reduced or enlarged by a certain amount (called the scale).
The scale is shown as the length in the drawing, then a colon (":"), then the matching length on the real thing.

Example
If a drawing has a scale of "1:10", so anything drawn with the size of "1" would have a size of "10" in the real world, so a measurement of 150mm on the drawing would be 1500mm on the real horse.
Since it is not always possible to draw on paper the actual size of real-life objects such as the real size of a car, an airplane, we need scale drawings to represent the size like the one you can see of a van.
In real-life, the length of a van may measure 240 inches. However, the length of a copy or print paper that you could use to draw this van is a little bit less than 12 inches
Since 240/12 = 20, you will need about 20 sheets of copy paper to draw the length of the actual size of the van
In order to use just one sheet, you could then use 1 inch on your drawing to represent 20 inches on the real-life object
You can write this situation as 1:20 or 1/20 or 1 to 20
Notice that the first number always refers to the length of the drawing on paper and the second number refers to the length of real-life object.

Example
Suppose a problem tells you that the length of a vehicle is drawn to scale. The scale of the drawing is 1:20
If the length of the drawing of the vehicle on paper is 12 inches, how long is the vehicle in real life?
Set up a proportion that will look like this:
Length of drawing/Real length = 1/20
Do a cross product by multiplying the numerator of one fraction by the denominator of the other fraction
We get:
Length of drawing × 20 = Real length × 1
Since length of drawing = 12, we get:
12 × 20 = Real length × 1
240 inches = Real length

Example

The scale drawing of this tree is 1:500

If the height of the tree on paper is 20 inches, what is the height of the tree in real life?

Set up a proportion like this:

Height of drawing/Real height = 1/500

Do a cross product by multiplying the numerator of one fraction by the denominator of the other fraction

We get:

Height of drawing × 500 = Real height × 1

Since height of drawing = 20, we get:

20 × 500 = Real length × 1

10000 inches = Real height

<table>
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Scale drawing
Enlargement scale
Reduction scale
Actual length
Drawn length</td>
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Remark:

9. SCALE DRAWING OF LENGTH AND DISTANCES (CONT'D)

Objective: By the end of this class, all the students should be able to (I) Demonstrate real measurements and represent the information using scale on plain paper or cardboard (II) Find the scale used in drawing real objects on a piece of paper.

Duration: 190mins

Week: 9

Entry Behaviour (*How you plan to start your Class*):

Scale Drawings

A map cannot be of the same size as the area it represents. So, the measurements are **scaled down** to make the map of a size that can be conveniently used by users such as motorists, cyclists and bushwalkers. A scale drawing of a building (or bridge) has the same shape as the real building (or bridge) that it represents but a different size. Builders use scaled drawings to make buildings and bridges.
A ratio is used in scale drawings of maps and buildings. That is:
The scale of a drawing = Drawing length : Actual length
Likewise, we have:
Map scale = Map distance : Actual distance
A scale is usually expressed in one of two ways:
Using units as in 1 cm to 1 km
Without explicitly mentioning units as in 1 : 100 000.

Note
A scale of 1 : 100 000 means that the real distance is 100 000 times the length of 1 unit on the map or drawing.

Example
Write the scale 1 cm to 1 m in ratio form.
Solution
1 cm to 1m = 1 cm : 1m
= 1 cm : 100 cm
= 1 : 100

Example
Simplify the scale 5 mm : 1 m.
Solution
5 mm : 1 m = 5 mm : 100 cm

= 5 mm : 1000 mm
= 5 : 1000
= 1 : 200

Example
Simplify the scale 5 cm : 2 km.
Solution
5 cm : 2 km = 5 cm : 2000 m
= 5 cm : 200 000 cm
= 5 : 200 000
= 1 : 40 000

Calculating the Actual Distance using the Scale
If the scale is 1 : *x*, then multiply the map distance by *x* to calculate the actual distance.

Example
A particular map shows a scale of 1 : 5000. What is the actual distance if the map distance is 8 cm?
Solution
Scale = 1 : 5000 = 1 cm : 5000 cm
∴ Map distance : Actual distance = 1 : 5000
Map distance = 8 cm
Let the actual distance be *a* cm.
∴ 8 : a = 1: 5000 {Units are in cm}
8/a = 1/5000 {Invert the fractions}
a/8 = 5000/1 {Multiply by 8}
8 X a/8 = 8 X 5000
a = 40 000
∴Actual distance = 40 000 cm
= 40 000/100 m
= 400 m
Alternative Way
Map distance = 8 cm
Scale = 1 : 5000 = 1 cm : 5000 cm
∴ Map distance : Actual distance = 1: 5000
= 1 X 8 : 5000 X 8
= 8 : 40 000
∴ Actual distance = 40 000 cm
=40 000/100 m
= 400 m

Calculating the Scaled Distance using the Actual Distance
If the scale is 1 : *x*, then divide the actual distance by *x* to calculate the map distance.

Example

A particular map shows a scale of 1 cm : 5 km. What would the map distance (in cm) be if the actual distance is 14 km?

ANSWER

Scale = 1 cm : 5 km
∴ Scale factor = 5
Actual distance = 14 km
Map distance = Actual distance/Scale factor
=14/5
= 2.8
So, the map distance is 2.8 cm

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Remark:

10. REVISION

Objective: By the end of this class, all the students should be able to recall all they have learnt in the term.

Duration: 190mins

Week: 10

Entry Behaviour (*How you plan to start your Class*):

What

11. REVISION

Objective: By the end of this class, all the students should be able to recall all they have learnt during the term

Duration: 190mins

Week: 11

Entry Behaviour (*How you plan to start your Class*):