MATHEMATICS
Secondary ONE
Year 2021

Name: ( ) **Class:**

Unit 5A: Linear Equations

Topical Enduring Understanding
Algebra is the language upon which the world can be modelled mathematically.

Topical Essential Questions
1. What is an equation and what is a formula?
2. How does algebra explain and predict relationships?
3. What does it mean if an equation is modelled after a process or experiment?

Unit 5B: Linear Inequalities

Topical Enduring Understanding
The manipulative laws that are applicable to equations have to be modified for inequalities.

Topical Essential Questions
1. How is an algebraic inequality different from an algebraic equation?
2. Why is the solution of an inequality not unique? (What does it mean to have a unique solution?)

Unit 5: Big Ideas

Notation and Equivalence.

References:
- Think! Mathematics New Syllabus Mathematics 1A (8th Edition) Chapter 5
  Student Learning Space (learning.moe.edu.sg)

Lesson sequence in the unit								
Student Learning Outcomes	Dimensions (Please tick the appropriate boxes)							
	FUNCTIONS F	INVARIANCE I	NOTATIONS N	DIAGRAMS D	MEASURES M	EQUIVALENCE E	PROPORTIONALITY P	MODELS M
Understanding what makes an algebraic equation			✓			✓		
Solving linear equations			✓			✓		
Solving linear equations (with fractional algebraic terms)			✓			✓		
Forming linear equations			✓			✓		
Understand what are Linear inequalities			✓			✓		
Solving linear inequalities			✓			✓		
Forming linear equalities.			✓			✓		

Unit Checklist.

Cognitive Level	Know, Understand, Demonstrate	Checklist
Level 0: Memorisation	Explain what is an algebraic equation and linear inequality. Be able to explain how the inequality symbols stand for.	
Level 1: Procedural tasks without connections	Apply the four operations for algebraic expressions and inequalities.	
Level 2: Procedural tasks with connections	Apply the distributive law, algebraic identities, factorisation to resolve more complex equations and inequalities.	
Level 3: Problem Solving	Form algebraic equations/inequalities* and resolve them to solve unknowns.	

Unit 5A.Part 1 Basic definitions

Recall that in Unit 4, we learnt about algebraic expressions. An algebraic expression is a collection of algebraic terms that are connected by the signs '+', '–', '×' or '÷'.

1. An **equation** is a **statement** that has two expressions that are equal.

   Example: $x-3=1$, $5y+3=3y+11$

2. In an equation, the unknown is referred to as the **variable**.

   Example: In the equation $4x-18=2-x$, x is the variable.

3. When we **solve** equations, we find the value of the unknown/variable, also called the **solution** of the equation.

   Example: When we solve $x-3=1$, we find $x=4$.

4. **Equivalent equations** are equations that give the same solution.

   Example: $x-3=1$ and $5x-18=2$ are equivalent equations as $x=4$ is the solution to both equations.

5. A **linear equation** is an equation in which the highest power of the variable/unknown is 1. There is no limit to the number of unknowns in a linear equation, as long as the highest power of every variable/unknown is 1.

   Example: $5x-18=2$ is a linear equation in a single variable x.

   $y=2x+1$ is a linear equation with two variables x and y.

Unit 5A.Part 2.1 Solving linear equations

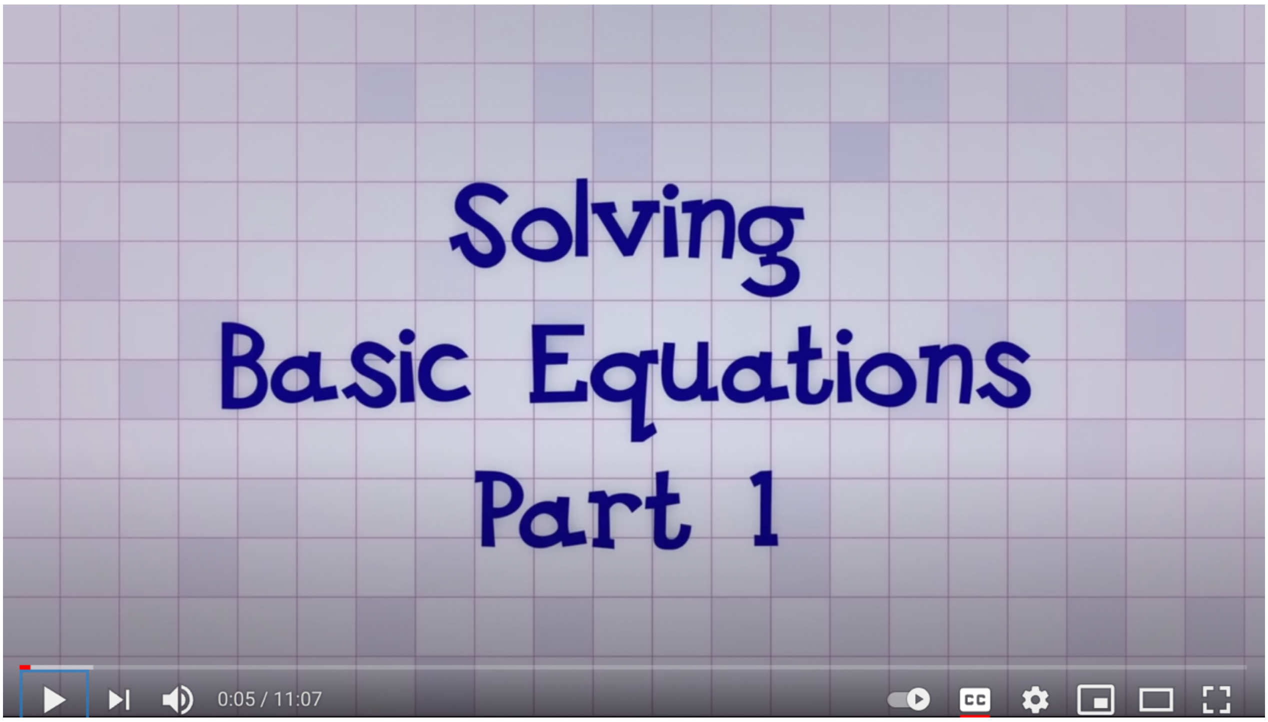
Key idea: When solving a linear equation, we try to **isolate** the unknown on the left-hand side of the equation.

So we try to turn… $5x - 18 = 2$ … into… $x = 4$ … while maintaining the *balance* of the left-hand side with the right-hand side.

To understand the idea of balance between the left-hand side and right-hand side, think of a set of balance weighing scales.

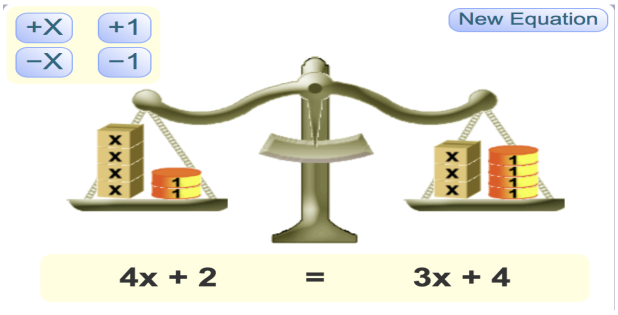
To start, let's take a look at the following video –

https://www.youtube.com/watch?v=l3XzepN03KQ&t=522s



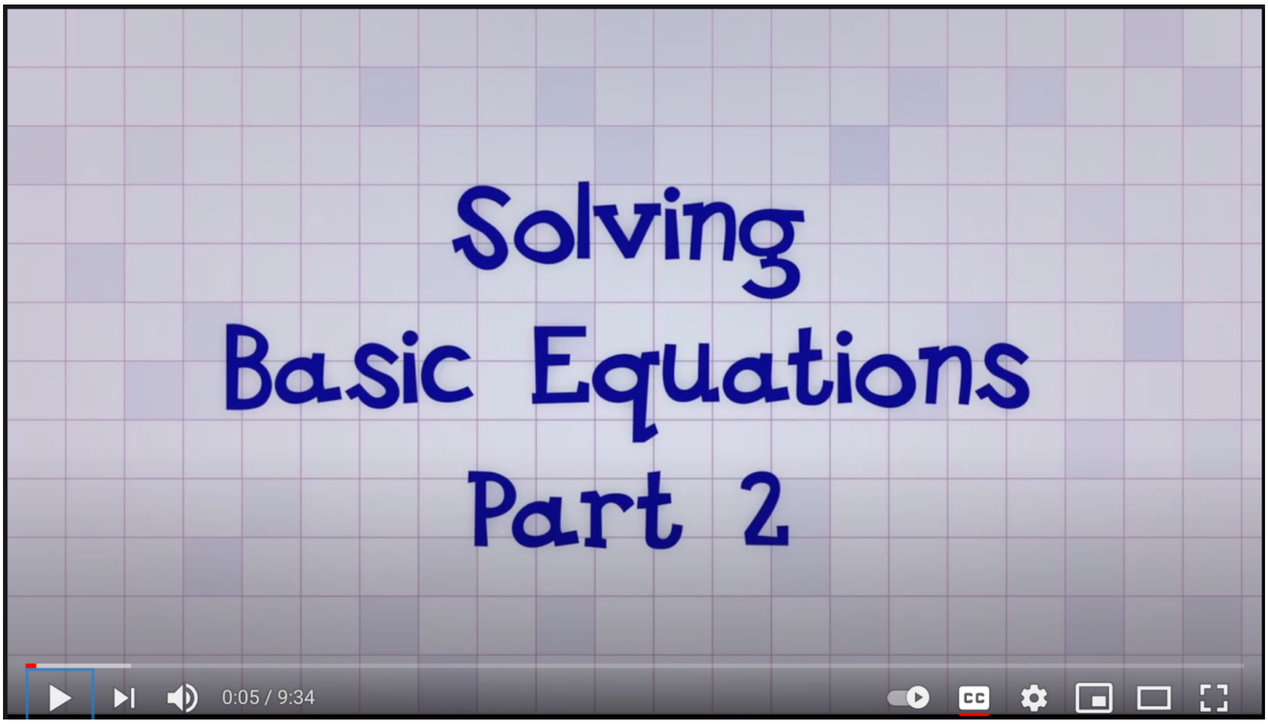
[Optional] Explore the concept of balance further with this activity:

https://www.mathsisfun.com/algebra/add-subtract-balance.html



And now, let's take a look at the following video –

https://www.youtube.com/watch?v=Qyd_v3DGzTM&t=29s



[Recap from video] **General rules for maintaining balance in an algebraic equation**:

a. When we **add** or **subtract** the same algebraic expression to or from each side of the equation, the resulting equation would be equivalent to the original equation.

Example:

If $a=b$, then $a+c=b+c$	If $a=b$, then $a-c=b-c$
If $a=6$, then $a+5=6+5$	If $a=6$, then $a-5=6-5$

b. When we **multiply** or **divide** both sides of an equation by the same non-zero algebraic expression, the resulting equation is equivalent to the original equation.

Example:

If $a=b$, then $ac=bc$	If $a=b$, then $\frac{a}{c}=\frac{b}{c}$ where $c\neq 0$
If $a=6$, then $a\times 5=6\times 5$	If $a=6$, then $\frac{a}{5}=\frac{6}{5}$

c. When we **square/cube** or take **square/cube root** of both sides of an equation, the resulting equation is equivalent to the original equation.

Example:

If $a=b$, then $a^2=b^2$	If $a=b$, then $\sqrt{a}=\sqrt{b}$
If $a=6$, then $a^2=6^2$	If $a=6$, then $\sqrt{a}=\sqrt{6}$

d. Remove all brackets by expanding the brackets.

Example:

$a(x+b)=ax+ab$ $a(x-b)=ax-ab$
$6(x+7)=6x+6\times 7$ $6(x-7)=6x-6\times 7$

Example: Solve $7x - 8 - 3x = 24$.

$7x - 3x - 8 = 24$	First make sure you combine all 'like' terms. In this problem $3x$ and $7x$ are like terms, so you must combine them first. Remember to also take the signs in front of them.
$4x - 8 = 24$	Simplify $7x - 3x = 4x$ and think about how to remove the 8!
$4x - 8 + 8 = 24 + 8$	Using the concept of a balance. To remove constant 8 from the left side of the equation you have to +8. Now add 8 to BOTH sides.
$4x = 32$	Simplify $-8 + 8 = 0$ on the left. 24 + 8 = 32. Now think about how to remove the coefficient 4.
$\frac{4x}{4} = \frac{32}{4}$	Since the opposite of multiply 4 is divide by 4. Divide BOTH sides by 4.
$x = 8$	This is the final solution. Keep the unknown/ variable to the left hand side.

Example 1 Solve the following equations.

(a) $3a - 4 = a$	(b) $\frac{1}{3}a - \frac{1}{4}a = 2$
(c) $\frac{18}{a} = 3$	(d) $1.5x - 1 = 4$
*(e) $x^2 = 81$	

Class Work 1 Solve the following equations.

(a) $3a-1=14$	(b) $-4y+4=-20$
(c) $2b+12=7-3b$	(d) $\frac{3}{5}m+1=1\frac{1}{2}$
(e) $7x=-28$	(f) $\frac{x}{5}=8$
(g) $2y-5.4=0.2y$	

Class Work 2 Solve the following equations.

(a) $x^2 = 2\frac{7}{9}$	(b) $2a = \sqrt{100}$
*(c) $-\frac{2}{a^3} = 16$	*(d) $y^3 + 1 = 28$

Unit 5A Part 2.2 Equations involving Brackets

Example 2 Solve the following equations.

(a) $2(2-0.3x)=1.4$	(b) $3(1+2x)-(5+x)=10+x$

Class Work 3 Solve the following equations.

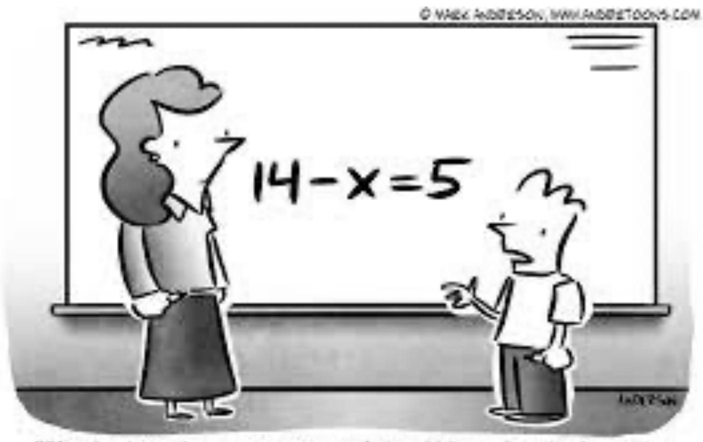
(a) $8(y+2)=3(2y+7)$	(b) $3a-4(a-2)=13-3(4+a)$
(c) $\frac{1}{2}(4w-5)+2w=3.2(w+2)-3.82$	(d) $2t-[9-3(4t-7)]=26$

Unit 5A Part 2.3 Simple Fractional Equations

Example 3 Solve the following equations.

(a) $\frac{x}{3}+3=4$	(b) $\frac{x}{6}-\frac{1}{2}=3\frac{1}{2}$

(c) $\dfrac{5+4y}{9}=-1$	(d) $\dfrac{2y+3}{4}-\dfrac{y-5}{6}=0$



"I'm just saying - sooner or later X is going to have to solve these things for itself."

(Source: https://andertoons.com/algebra/cartoon/8113/sooner-or-later-x-is-going-to-have-to-solve-things-itself)

Class Work 4

Simplify the following algebraic fractions before solving for the unknowns.

(a) $\frac{y-3}{y+4}=\frac{2}{5}$	(b) $1\frac{4}{5}k-\frac{3}{5}=1\frac{1}{5}k+10\frac{1}{5}$
(c) $\frac{y}{2}+\frac{y+1}{4}=1-\frac{3y-1}{8}$	(d) $\frac{2x+11}{5}-3\frac{1}{2}=2-\frac{7-4x}{6}$

[Extension] IT Exploration 1

At the end of the lesson, you would be able to represent the solution of a simple equation (with one unknown) graphically

Instructions

1. Solve the given equation algebraically on the left column.
2. Enter the same equation and check the diagram using *Desmos*.

Solving the equation ***algebraically***	How the equation looks like in the ***graph***
1. $x + 8 = 9$	Plot the following on the same pair of axes and record your observations. $y = x + 8$ $y = 9$
2. $2x - 3 = 7$	Plot the following on the same pair of axes and record your observations. $y = 2x - 3$ $y = 7$
3. $\frac{x}{5} = 4$	Plot the following on the same pair of axes and record your observations. $y = \frac{x}{5}$ $y = 4$

Solving the equation ***algebraically***	How the equation looks like in the ***graph***
4. $\frac{x}{3} - 2 = 0$	Plot the following on the same axes and record your observations. $y = \frac{x}{3} - 2$ $y = 0$

From the four questions above, what can you conclude about the solution of the equation (left column) and the graphical representations (right column)?

For Question 4, we are going to 'change' the variable x to y, i.e. $\frac{y}{3} - 2 = 0$
Draw the graphical representation below. Describe how different is this, compared to the diagram you obtained for Question 4.

Assignment 5A – Part 1

Reference: Think! Mathematics New Syllabus Mathematics 1A (8th Edition) Chapter 5 Exercise 5A (page 132)

Questions: 3(e), 4(a), 4(f), 5(f), 6(c), 7(a), 9(b), 9(c), 12(d) and 12(f)

Basic | Intermediate | Advanced

Exercise 5A

DOC

1. Solve each of the following equations.

(a) $x + 8 = 15$ (b) $x + 9 = -5$
(c) $x - 5 = 17$ (d) $y - 7 = -3$
(e) $4x = -28$ (f) $-24x = -144$
(g) $3x - 4 = 11$ (h) $9x + 4 = 31$
(i) $12 - 7x = 6$ (j) $3 - 7y = -12$

2. Solve each of the following equations.

(a) $3x - 7 = 4 - 8x$ (b) $4x - 10 = 5x + 7$
(c) $30 + 7y = -2y - 6$ (d) $2y - 7 = 7y - 23$

3. Solve each of the following equations.

(a) $2(x + 3) = 8$ (b) $5(x - 7) = -15$
(c) $7(-2x + 4) = -4x$ (d) $3(2y + 3) = 4y + 3$
(e) $2(y + 4) = 3(y + 2)$ (f) $5(5y - 6) = 4(y - 7)$
(g) $5(b + 6) = 2(3b - 4)$ (h) $3(2c + 5) = 4(c - 3)$
(i) $9(2d+7) = 11(d+14)$ (j) $28(f - 1) = 5(7f - 3)$

4. Solve each of the following equations.

(a) $7y - 2\frac{3}{4} = \frac{1}{2}$ (b) $1\frac{1}{2} - 2y = \frac{1}{4}$
(c) $\frac{1}{3}x = 7$ (d) $\frac{3}{4}x = -6$
(e) $\frac{1}{3}x + 3 = 4$ (f) $\frac{y}{4} - 8 = -2$
(g) $3 - \frac{1}{4}y = 2$ (h) $15 - \frac{2}{5}y = 11$

5. Solve each of the following equations.

(a) $y - 2.4 = 3.6$ (b) $y + 0.4 = 1.6$
(c) $-3y - 7.8 = -9.6$ (d) $4y - 1.9 = 6.3$
(e) $-2.7 + a = -6.4$ (f) $2(2x - 2.2) = 4.6$
(g) $4(3y + 4.1) = 7.6$ (h) $3(2 - 0.4x) = 18$

6. Solve each of the following equations.

(a) $x = 12 - \frac{1}{3}x$ (b) $\frac{3}{5}x = \frac{1}{2}x + \frac{1}{2}$
(c) $\frac{y}{2} - \frac{1}{5} = 2 - \frac{y}{3}$ (d) $\frac{2}{3}y - \frac{3}{4} = 2y + \frac{5}{8}$

7. Solve each of the following equations.

(a) $\frac{2}{x} = \frac{4}{5}$ (b) $\frac{12}{y-1} = \frac{2}{3}$

8. Solve each of the following equations.

(a) $-3(2 - x) = 6x$
(b) $5 - 3x = -6(x + 2)$
(c) $-3(9y + 2) = 2(-4y - 7)$
(d) $-3(4y - 5) = -7(-5 - 2y)$
(e) $3(5 - h) - 2(h - 2) = -1$

9. Solve each of the following equations.

(a) $10x - \frac{5x+4}{3} = 7$
(b) $\frac{4x}{3} - \frac{x-1}{2} = 1\frac{1}{4}$
(c) $\frac{x-1}{3} - \frac{x+3}{4} = -1$
(d) $1 - \frac{y+5}{3} = \frac{3(y-1)}{4}$
(e) $\frac{6(y-2)}{7} - 12 = \frac{2(y-7)}{3}$
(f) $\frac{7-2y}{2} - \frac{2}{5}(2-y) = 1\frac{1}{4}$

10. Solve each of the following equations.

(a) $\frac{5x+1}{3} = 7$ (b) $\frac{2x-3}{4} = \frac{x-3}{3}$
(c) $\frac{3x-1}{5} = \frac{x-1}{3}$ (d) $\frac{1}{4}(5y+4) = \frac{1}{3}(2y-1)$
(e) $\frac{2y-1}{5} - \frac{y+3}{7} = 0$ (f) $\frac{2y+3}{4} + \frac{y-5}{6} = 0$

11. By showing your working clearly, verify if $x = \frac{19}{20}$ is the solution of the equation $2x - \frac{3}{4} = \frac{1}{3}x + \frac{5}{6}$.

12. Solve each of the following equations.

(a) $\frac{12}{x+3} = 2$ (b) $\frac{11}{2x-1} = 4$
(c) $\frac{32}{2x-5} - 3 = \frac{1}{4}$ (d) $\frac{1}{2} = \frac{1}{x+2} - 1$
(e) $\frac{y+5}{y-6} = \frac{5}{4}$ (f) $\frac{2y+1}{3y-5} = \frac{4}{7}$
(g) $\frac{2}{y-2} = \frac{3}{y+6}$ (h) $\frac{2}{7y-3} = \frac{3}{9y-5}$

13. If $4x + y = 3x + 5y$, find the value of $\frac{3x}{16y}$.

14. If $\frac{3x-5y}{7x-4y} = \frac{3}{4}$, find the value of $\frac{x}{y}$.

PAGE 132 CHAPTER 5 Linear Equations

(Source: E-Copy of Think! Mathematics New Syllabus Mathematics 1A (8th Edition) Chapter 5)

Unit 5A Part 3 Forming Linear Equations to Solve Problems

- We sometimes use linear equations to represent real life situations. By solving such linear equations, we can actually solve real life problems.

- There are some steps that we consider in solving such problems:
  1. Read the question and identify the unknown quantity.
  2. Let the unknown be represented by a letter (e.g. x)
  3. Write down the expression for other quantities in terms of x.
  4. Form an equation based on the information.
  5. Solve the equation.
  6. Write down the answer to the problem.

Does this remind you of Polya's 4 steps problem solving approach? Can you recall them?

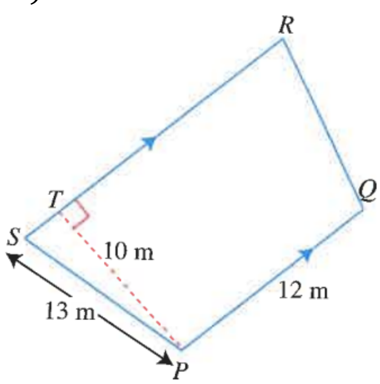
Example 4 Find 3 consecutive odd numbers whose sum is 57.

Step 1, 2	–	Let the smallest consecutive odd number be x.
Step 3	–	The two other consecutive odd numbers are $x+2$ and $x+4$.
Step 4	–	$x+x+2+x+4=57$
Step 5	–	$3x=51$ $x=17$
Step 6	–	The three consecutive numbers are **<u>17, 19 and 21</u>**.

Example 5

The figure shows a trapezium $PQRS$ where $PQ = 12\ m$ and $PS = 13\ m$. If $PT = 10\ m$, and the area of the trapezium is 150 m^2, find the length of RS.

Step 1, 2	–	Let the length of RS be x.
Step 3, 4	–	The area of the trapezium $PQRS$ is $\frac{1}{2}(x+12)\times 10$
Step 4	–	$\frac{1}{2}(x+12)\times 10$
Step 5	–	$5x+60=1$ $5x=90$ $x=18$
Step 6	–	The length of RS is **<u>18 m</u>**.



Class Work 4

1. A basketball has a surface area of 1810 cm^2. Find its volume.

   * We previously saw that when x^2 is in the equation, we will have two solutions, that is, 2 values of x that satisfy the equation. Do both solutions to the equation solve this question?

2. A man mixes 5 kg of grade B coffee powder with 4 kg of grade A coffee powder. 1kg of grade A coffee powder costs $4.50 more than 1 kg of grade B coffee powder. If the cost of the mixture is $16 per kg, find the price of 1 kg of grade B coffee powder.

3. A tank can be fully filled with water using a pipe that fills 20 litres in a minute. A bigger pipe that can fill 25 litres in a minute will take one minute less to fill the same tank. How many minutes does the smaller pipe take to fill the tank?

4. The numerator of a fraction is 1 less than the denominator. If Raj adds 1 to the numerator and adds 2 to the denominator, the fraction is $\frac{3}{4}$, when expressed in its simplest form. Find the original fraction.

Assignment 5A – Part 2

Reference: Think! Mathematics New Syllabus Mathematics 1A (8th Edition) Chapter 5

Exercise 5B (page 135)

Questions: 2, 7 and 9

Advanced | Intermediate | Basic

Exercise 5B

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Use algebra to solve the following questions.

DOC
1. When loaded with bricks, a lorry has a mass of 11 600 kg. If the mass of the bricks is three times that of the empty lorry, find the mass of the bricks.

DOC
2. The sum of 4 consecutive odd numbers is 56. Find the greatest of the 4 numbers.

DOC
3. Devi is 4 years older than Siti and Yi Hao is 2 years younger than Siti. If the sum of their ages is 47, find their respective ages.

DOC
4. If a number is tripled, it gives the same result as when 28 is added to it. Find the number.

DOC
5. A travel agency is planning a holiday for a group of people. The agency receives quotations from two coach companies, Maya Express and Great Holidays. Maya Express charges \$15 for each person while Great Holidays charges \$12 per person and a separate fee of \$84. If the total amount charged by each company is the same, find the number of people going on the holiday.

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6. The sum of two numbers, one of which is two-thirds of the other, is 45. Find the smaller number.

DOC
7. When a number, x, is multiplied by 4, then subtracted from 68, the result obtained is the same as three times the sum of x and 4. Find x.

8. In a school, the number of boys who play soccer is three times of those who play badminton. If 12 boys who play soccer play badminton instead, the number of boys who play each of these sports would be the same. Find the number of boys who play badminton.

9. A man is six times as old as his son. Twenty years later, the man will be twice as old as his son. Find the age of the man when his son was born.

10. A mooncake with two egg yolks costs \$2 more than a mooncake with one egg yolk. The cost of 6 mooncakes with two egg yolks and 5 mooncakes with one egg yolk is \$130.80. Find the cost of a mooncake with two egg yolks.

11. Albert has 12 more 10-cent coins than 20-cent coins. The total value of all his coins is \$5.40. Find the total number of coins he has.

12. Li Ting cycles the first 350 km of a 470-km journey at a certain average speed and the remaining distance at an average speed that is 15 km/h less than that for the first part of the journey. If the time taken for her to travel each part of her journey is the same, find the average speed for the second part of her journey.

13. The sum of half of a number and 49 is $2\frac{1}{4}$ times of the number. Find the number.

Linear Equations CHAPTER 5 135 PAGE

(Source: E-Copy of Think! Mathematics New Syllabus Mathematics 1A (8th Edition) Chapter 5)

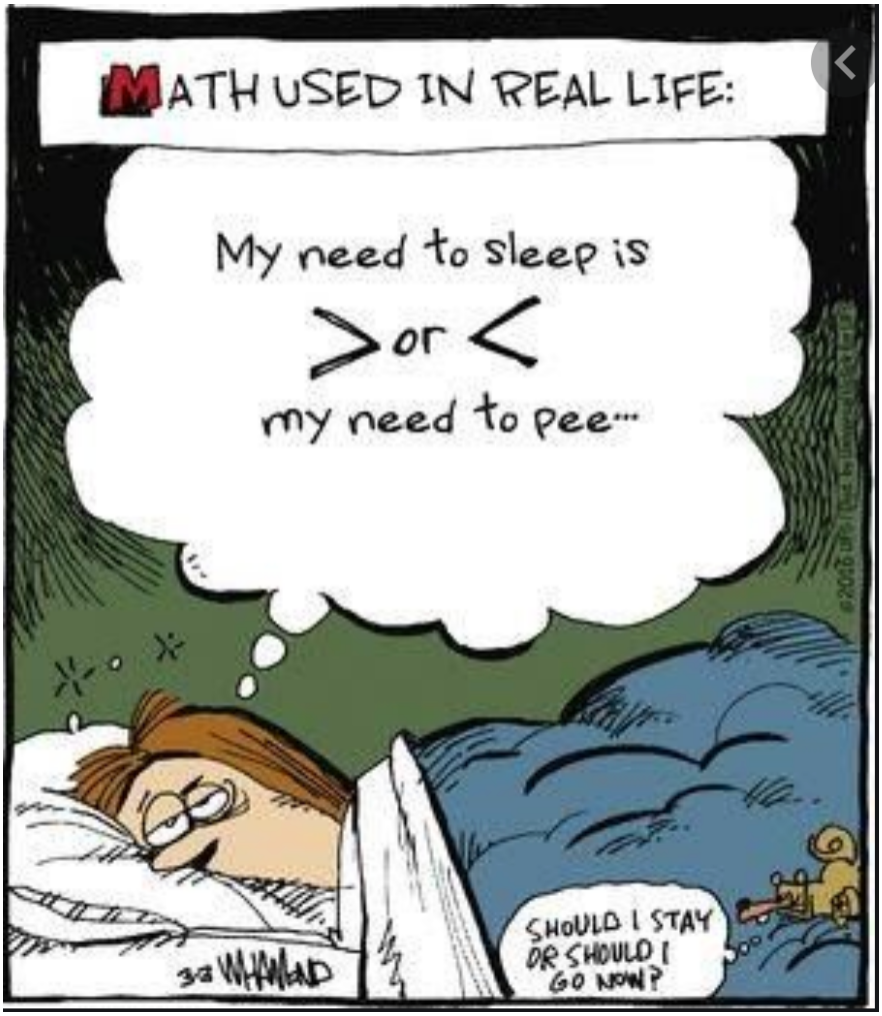
Unit 5B: Linear Inequalities

Topical Enduring Understanding

The manipulative laws that are applicable to equations have to be modified for inequalities.

Topical Essential Questions

3. How is an algebraic inequality different from an algebraic equation?
4. Why is the solution of an inequality not unique? (What does it mean to have a unique solution?)



Unit 5B Part 1 Introduction

In Mathematics, an **inequality** is a statement about the relative size or order of two objects, *or* about whether they are the same or not.

Notation	Meaning
$a < b$	a is less than b
$a \leq b$	a is less than or equal to b
$a > b$	a is more than b
$a \geq b$	a is more than or equal to b
$a \neq b$	a is not equal to b

Unit 5B Part 2 Properties of Inequalities

The world of INEQUALITIES is governed by several rules and properties.

1 **TRANSITIVE PROPERTY** – For any REAL NUMBERS *a, b* and *c*, the transitive property of inequalities states that

Property	Example
a) if $a > b$ & $b > c$, then $\underline{a > c}$	
b) if $a < b$ & $b < c$, then $\underline{a < c}$	
c) if $a > b$ & $b = c$, then $\underline{a > c}$	
d) if $a < b$ & $b = c$, then $\underline{a < c}$	

2 For any real numbers a, b and c,

Property	Example
a) $a > b \Rightarrow a + c > b + c$ $a < b \Rightarrow a + c < b + c$	
b) $a > b \Rightarrow a - c > b - c$ $a < b \Rightarrow a - c < b - c$	
c) If $c > 0$, $a > b \Rightarrow ac > bc$ $a > b \Rightarrow \frac{a}{c} > \frac{b}{c}$	
d) If c < 0, $a > b \Rightarrow ac < bc$ $a > b \Rightarrow \frac{a}{c} < \frac{b}{c}$	

Important Note

If we multiply or divide both sides of an inequality by a ***negative*** number, we will have to ***reverse*** the inequality sign.

Why is does this happen?

Activity 1
Complete the following table.
Fill the ‘solutions’ column in your table using the numbers

$$-4, 0, 2, 8.3, 9, 7\frac{1}{4}, 11, 14, 7.$$

Inequality	Read as	Solutions
$x \le 7$	x is less than or equal to 7	
$x < 7$	x is less than 7	
$x \ge 7$	x is more than or equal to 7	
$x > 7$	x is more than 7	

Activity 2

In the following Activity, add, subtract, multiply and divide both sides of the inequality by any positive and negative numbers. Fill in the “Inequality Sign” column with the correct sign. Record your observation on what has happened for each action you have performed.

Actions	L.H.S.	Inequality Sign	R.H.S.	Your observations
	3	**<**	**6**	
Add 1 to both sides	4		7	
Add –6 to both sides	–2		1	
Subtract 1 from both sides	–3		0	
Subtract –10 from both sides	7		10	
Multiply 2 to both sides	14		20	
Multiply –2 to both sides	–28		–40	
Divide both sides by 2	–14		–20	
Divide both sides by -2	7		10	

What conclusion can you draw from **Activity 2** above?

Example 1:
Solve the following inequality and illustrate the solutions on a number line.

(a) $x+1 < 24$	(b) $x-3<17$
(c) $3x < 24$	(d) $-3x<24$
(e) $\frac{1}{2}x < 16$	(f) $-\frac{1}{2}x<16$

<u>Exercise 1: Tier A</u>

1. Solve the following inequality and illustrate the solutions on a number line.

(a) $6x>-48$	(b) $\frac{2x}{3}\geq 6$
(c) $\frac{3x}{10}\leq\frac{6}{5}$	(d) $\frac{5x}{9}\geq -\frac{10}{3}$
(e) $2(2+x)>-13$	(f) $2x+7\geq -3(x+1)$

2.

(a) Find the **greatest** integer x that satisfy each inequality. $\frac{1}{2}x + \frac{1}{3}x > -10$	(b) Find the **greatest** integer y that satisfy each inequality. $\frac{2}{3}y + \frac{y}{4} < 7$

Unit 5B Part 3 Problem Solving Involving Inequalities

Note: consider the **context** of each question to give a **complete and accurate** range as the final answer.

Example 2

Billy and Carol decide to buy a present for their parents' wedding anniversary. Billy has agrees to pay \$40 more than Carol. The present they are buying together is to cost **not more than** \$180. Form an inequality and solve it to find the possible amount Billy has to pay.

Example 3

A fruit-seller bought a case of 136 oranges for \$25.40. If he sells each orange for 35 cents. He aims to make a profit of **at least** \$8 by selling the oranges.

(a) Form an inequality and solve it to find the possible number of oranges that he must sell to meet his target.

(b) Hence, state the least number of oranges that he must sell to meet his target.

Exercise 2 (Tier B)

1. Water at 24°C is poured into a boiler. The temperature of the water in the boiler increases by 7°C per minute. Find the time range at which the temperature of the water in the boiler is greater than 52°C but not greater than 73°C.

2. A rectangular box is $(2x-1)$ cm long and $(x+3)$ cm wide. If the perimeter of the frame is greater than 38 cm and not greater than 80 cm, find the range of possible values of x.

<u>[Extension]</u> IT Exploration

Instructions

1. In Desmos, enter the equation $y = x + 4$.
2. Sketch your graph in the space below.
3. Give an example of two pairs of coordinate values that satisfy the equation. Show on your sketch where the point with these coordinates lies.
   Ans: (,) and (,)
4. Give an example of two pairs of coordinate values that satisfy the inequality $y > x + 4$. Show on your sketch where the point with these coordinates lies.
   Ans: (,) and (,)
5. Hence shade the region of the graph where $y > x + 4$. Label the region with this inequality.
6. Give an example of two pairs of coordinate values that satisfy the inequality $y < x + 4$. Show on your sketch where the point with these coordinates lies.
   Ans: (,) and (,)
7. Hence shade the region of the graph where $y < x + 4$. Label the region with this inequality.
8. **Challenge:** Can you identify the region where $y < x + 4$ **and** $x < 0$?

Sketch your graph here.

Assignment 5B Part 1

Tier A

Q1 Solve each of the following inequalities and illustrate the solutions on a number line.

(a) $3x \leq 18$

(b) $5y > -24$

(c) $-4x < 28$

(d) $-12x \geq 126$

Q2 Find the smallest rational value of y that satisfies the inequality $8 \leq 7y$.

Q3 Find the greatest odd integer value of x that satisfies the inequality $-3x > -105$.

Tier B

Q4 Solve each of the following inequalities.

(a) $3x + 2 < 8$

(b) $6x - 5 < -2$

(c) $3x - 2x > 5 + 7$

(d) $5x - 2x \leq 3 + 9$

Q5 Solve each of the following inequalities.

(a) $\frac{1}{2}x > 3$

(b) $\frac{3}{4}x \leq \frac{3}{8}$

(c) $0.4x < 3.2$

Q6 Solve each of the following inequalities.

(a) $\frac{x}{2} + \frac{x}{4} \leq 15 - 24$

(b) $\frac{3x}{4} - \frac{x}{8} \geq 1\frac{1}{2} + 3\frac{3}{4}$

Q7 Find the largest rational number that satisfies the inequality

$\frac{2x}{3} - \frac{x}{6} \leq \frac{1}{2} + 3\frac{1}{4}$.

Tier C

Q8 If y is an integer, and it satisfies the inequalities $5y < 35$ and $-2y \leq -6$, find all the possible value of y.

Assignment 5B Part 2

Instructions: ***Apply the Problem Solving Strategy:***

1. Read the question carefully. Identify the unknown quantity.
2. Use a letter, say x, to represent the unknown. State this clearly at the start of your solutions.
3. Express some other quantities in the question in terms of x.
4. Set up an inequality using the given information.
5. Solve the inequality.
6. Consider the context of the question and write down the solution of the problem in words or as required.

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1. A mini bus can take a maximum of 28 primary school students to school. By setting up an inequality, find the minimum number of mini buses that are needed to take 194 students to school.

2. For any school excursion to any place in Singapore, the school requires **at least** 1 teacher to accompany 20 students**.** 155 students are going for a school excursion to the Science Centre.
(i) Form an inequality in x to find the acceptable number of teachers in this excursion,
(ii) Solve the inequality,
(iii) State the minimum number of teachers required for this trip.

3. The price of a concert ticket is \$50.
(a) Find the total price of x tickets.
(b) Harry has \$200 to spend on tickets.
(i) Form an inequality in x and solve it.
(ii) List the possible number of concert tickets he can buy.

4. The mass of a book is 0.5 kg.
(a) Find the total mass of x such books.
(b) The mass of a pile of the books is more than 11 kg.
(i) Form an inequality in x and solve it to find the possible number of books in the pile,
(ii) State the minimum number of books in the pile.
