A LEVEL
H2 MATHEMATICS
EQUATIONS & INEQUALITIES

CHAPTER ANALYSIS

MASTERY

- Formulate equations and inequalities to solve problems
- Solve equations using G.C.
- Solve inequalities algebraically and graphically
- Inequalities with modulus

EXAM

- Not a prerequisite for other chapters, but is useful for sequences and series

WEIGHTAGE

- Does not appear every year
- When it appears it's usually 1 small question
- Typically constitutes 3% of final grade

System of Linear Equations

A theme park charges entrance fees for children, adults and senior citizens at 3 different prices. Three groups of people, X, Y and Z, go on the same day. The table below summarises the number of people for each category and the total cost for each group.

Group	Children	Adults	Senior Citizens	Total Cost
X	8	3	1	$140.90
Y	5	7	4	$215.80
Z	11	6	2	$237.30

Create equations to find the cost of each ticket for the different categories.

To solve a linear equations questions such as the one on the left:

Step 1: Define variables for each category
Let the price of a ticket for a child, adult and senior citizen be $$c$, $$a$ and $$s$ respectively.

Step 2: Form linear equations from information from the question
$8c + 3a + s = 140.90$
$5c + 7a + 4s = 215.80$
$11c + 6a + 2s = 237.30$

Step 3: Use G.C. to solve simultaneous equations

Step 4: Conclude the value of the variables
The price of a ticket for a child, adult and senior citizen are $8.90, $21.50 and $5.20 respectively.

Note:
Questions vary. Sometimes there may be 3 unknowns even though only 2 equations can be formed. Your G.C. can still be used. In this case, there may be multiple possible solutions. Look at the conditions of the question, and think about the validity of your answer.

Inequalities

For simultaneous inequalities:

Split both sides and solve separately, then determine the solution by finding

overlaps in the number line later

$$-3 \leq \frac{x}{x+1} \leq 5$$

$$-3 \leq \frac{x}{x+1} \quad \text{or} \quad \frac{x}{x+1} \leq 5$$

For modulus inequalities:

Square both sides and solve accordingly OR bring modulus to one side

and solve both + and -

$$\frac{3}{|2x-1|} > \frac{2}{|x+3|}$$

$$\frac{9}{(2x-1)^2} > \frac{4}{(x+3)^2}$$

$$\frac{9}{(2x-1)^2} - \frac{4}{(x+3)^2} > 0$$

$$9(x+3)^2 - 4(2x-1)^2 > 0$$

Recall: The inequality sign is reversed if a negative constant is multiplied or divided throughout the inequality

In general, there are 2 ways to solve inequality questions:

1. **Use G.C. to solve graphically:**
    1. Plot all equations of the inequality on the G.C. OR move all equations to one side, sketch that and the line y = 0
    2. Find the points of intersections using G.C.
    3. Determine the solution:
       LHS < RHS : values of x for which the LHS graph is below the RHS
       LHS > RHS : values of x for which the LHS graph is above the RHS

2. **Manipulate the inequality to solve algebraically:**
    1. Move all variables to one side of the inequality
    2. Manipulate by:
        a) Factorising polynomials
        b) Combining algebraic fractions and factorising
    3. Find the critical values by equating factors to be 0
    4. Use a number line to mark critical values and determine the signs for each interval
    5. State the final solution from the sign test:
       < : values for x for which interval has - sign
       > : values for x for which interval has + sign

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