General Sir John Kotelawala Defence University
Faculty of Engineering
Department of Mathematics

**Mathematics - MA 1103**
Tutorial 02 - Linear Systems

Year: 2021 Intake: 38 - 03rd Batch Semester: 01

**Learning Outcomes Covered: LO2**

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1. Solve the system of equations below:

   (a) $3x + 7y - 4z = -46$
   $5w + 4x + 8y + z = 7$
   $8w + 4y - 2z = 0$
   $-w + 6x + 2z = 13$

   (b) $-2w - 17x + 4y + 3z = 0$
   $7w + 3y - 2z = 0$
   $2x + 8y - 6z = -20$
   $5w - 13x - y + 5z = 16$

2. (a) Wendy ordered 30 T-shirts online for her three children. The small T-shirts cost \$4 each, the medium T-shirts cost \$5 each, and the large T-shirts were \$6 each. She spent \$40 more purchasing the large T-shirts than the small T-shirts, Wendy's total bill was \$154. How many T-shirts of each size did she buy?

   (b) i. $3x + 2y + z = 3$
   $2x + y + z = 0$
   $6x + 2y + 4z = 6$

   ii. $x - y + 2z = 4$
   $-x + 3y + z = -6$
   $x + y + 5z = 3$

   (c) i. $x + 2y + 3z = 10$
   $x + y + z = 7$
   $3x + 2y + z = 18$

   ii. $x + y + z = 1$
   $2x - 2y + 6z = 10$

3. (a) Solve the following homogeneous systems of linear equations.

   i. $x + 2y + 3z = 0$
   $3x + 4y + 4z = 0$
   $7x + 10y + 12z = 0$

   ii. $x + 3y - 2z = 0$
   $2x - y + 4z = 0$
   $x - 11y + 14z = 0$

   iii. $x + y - 2z = 0$
   $2x - 3y + z = 0$
   $3x - 7y + 10z = 0$
   $6x - 9y + 10z = 0$

(b) Determine the values of $\lambda$ for which the following homogeneous system of linear equations has a non-trivial solution.

$(3\lambda - 8)x + 3y + 3z = 0$

$3x + (3\lambda - 8)y + 3z = 0$

$3x + 3y + (3\lambda - 8)z = 0$

4. Consider the system of linear equations below:

$$kx + y + z = 1$$

$$x + ky + z = 1$$

$$x + y + kz = 1$$

Find suitable values for $k$ so that the system has

(a) a unique solution

(b) no solutions

(c) infinitely many solutions