MST 204 TMA03

1)a) $x_1 + x_2 + x_3 = 2$ E_1
$4x_1 + x_2 + 3x_3 = -3$ E_2
$2x_1 - x_2 + 2x_3 = -8$ E_3

It is far more convenient to write coefficients and constants into an augmented matrix form

$$\left[\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 4 & 1 & 3 & -3 \\ 2 & -1 & 2 & -8 \end{array}\right]$$

Refer to UNIT 9 for reference (P.14)

Eliminate x_1 from E_2 and E_3

$E_{2a}: E_2 - 4\times E_1$ ✓ $E_{3a}: E_3 - 2\times E_1$ ✓
$E_{2a}: -3x_2 - x_3 = -11$ $-3x_2 = -12$

We now have

$x_1 + x_2 + x_3 = 2$ E_1
$-3x_2 - x_3 = -11$ E_{2a}
$-3x_2 = -12$ E_{3a}

4/4

0/2

From E_{3a}, $x_2 = 4$
From E_{2a}, $x_3 = -3x_2 + 11$
$x_3 = -3\times 4 + 11 = -1$

✗ I realise that this will give you an unique solution, ~~although~~. The problem is that the Elimination Method [illegible] is quite systematic and says that the matrix must be turned into one of upper triangular form [With a very large matrix you might have had another equation such as $-3x_2 = -11$ what then?]

Sub for x_2 and x_3 in E_1

$x_1 + x_2 + x_3 = 2$
$x_1 = 2 - x_2 - x_3$
$x_1 = 2 - 4 - -1 = 2 - 4 + 1 = -1$

Hence there is a unique solution, which is
$x_1 = -1$ ✓, $x_2 = 4$ ✓, $x_3 = -1$ ✓

4/5

(b) $x_1 + x_2 + x_3 = 2$ E_1
$4x_1 + x_2 + 3x_3 = -3$ E_2
$2x_1 - x_2 + x_3 = -8$ E_3

Eliminate x_1 from E_2 and E_3

2/2

$E_{2a}: E_2 - 4\times E_1$ $E_{3a}: E_3 - 2\times E_1$
$E_{2a}: -3x_2 - x_1 = -11$ ✓ $E_{3a}: -3x_2 - x_1 = -12$ ✓

Eliminate x_2 from E_{3a}

$E_{3b}: E_{3a} - E_{2a}$
$E_{3b}: 0 = -1$ ✓

Again you were asked to use Gaussian Elimination 0/1

We have a contradiction, hence this set of linear equations has no solution. ✓

2/2

$0x_1 + 0x_2 + 0x_3 = -1$