MATH 54 – HINTS TO HOMEWORK 4

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Here are a couple of hints to Homework 4. Enjoy! :)

Section 1.8: Introduction to Linear Transformations

1.8.3, 1.8.9. Just solve the equation $A\mathbf{x} = \mathbf{b}$, where in $1.8.9$, $\mathbf{b}$ is the zero vector!

1.8.15. T is just reflection across the line $y = x$.

1.8.19. Use the fact that:

$$\begin{bmatrix} 5 \\ -3 \end{bmatrix} = 5\mathbf{e_1} - 3\mathbf{e_2}$$

1.8.21.

(a) **T** (it's a function from $\mathbb{R}^n$ to $\mathbb{R}^m$ with special properties)
(b) **F** (the domain is $\mathbb{R}^5$)
(c) **T**
(d) **T** (for **NOW**; in Math 110 you'll see some linear transformations which don't have matrices)
(e) **T** (to get additivity, take $c_1 = c_2 = 1$, to get scalar multiplication, take $c_1 = c, c_2 = 0$)

1.8.33. What is $T(0, 0, 0)$?

1.8.36. $\mathbf{x} = c_1\mathbf{u} + c_2\mathbf{v}$

Section 1.9: The matrix of a linear transformation

For **all** of those questions, all you need to find is $T(\mathbf{e_1}), T(\mathbf{e_2}), \cdots$ and group the terms in a matrix!

1.9.15. The first column is given by $T(1, 0, 0)$, etc.

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1.9.23.

(a) **T** (in other words, if you know $T(\mathbf{e_1}), T(\mathbf{e_2}), \cdots, T(\mathbf{e_n})$, you know T)
(b) **T** (see example 3)
(c) **F** (the composition of two linear transformations is a linear transformation, see chapter 4)
(d) **F** (onto means every vector in $\mathbb{R}^m$ is in the image of T)
(e) **F** (let $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$, then the columns of A are linearly independent, and hence T is one-to-one by theorem $12b$)

1.9.24.

(a) **F**
(b) **T**
(c) **T**
(d) **T**
(e) **F**