Chapter 2 Section 1

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Problem 1. *Imagine yourself cruising in the Mediterranean as a crew member on a French coast goard boat, looking for evildoers. Periodically, your boat radios its position to headquarters in Marseille. You expect that communications will be intercepted. So, before you broadcast anything, you have to transform the actual position of the boat,*

$$\begin{bmatrix} x1 \\ x2 \end{bmatrix}$$

(x_1 for Eastern longitude, x_2 for Northern latitude), into an encoded position

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$

You use the following code:

$$\begin{aligned} y_1 &= x_1 + 3x_2 \\ y_2 &= 2x_2 + 5x_2 \end{aligned}$$

For example, when the actual position of your boat is $5°E$, $42°N$, or

$$\vec{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 5 \\ 42 \end{bmatrix}$$

your encoded position will be

$$\begin{aligned} \vec{y} &= \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} \\ &= \begin{bmatrix} x_1 + 3x_2 \\ 2x_1 + 5x_2 \end{bmatrix} \\ &= \begin{bmatrix} 5 + 3 * 42 \\ 2 * 5 + 5 * 42 \end{bmatrix} \\ &= \begin{bmatrix} 131 \\ 220 \end{bmatrix} \end{aligned}$$

The coding transformation can be represented as

$$\begin{aligned}\vec{y} &= \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix} \\ &= \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\end{aligned}$$

Figure 1

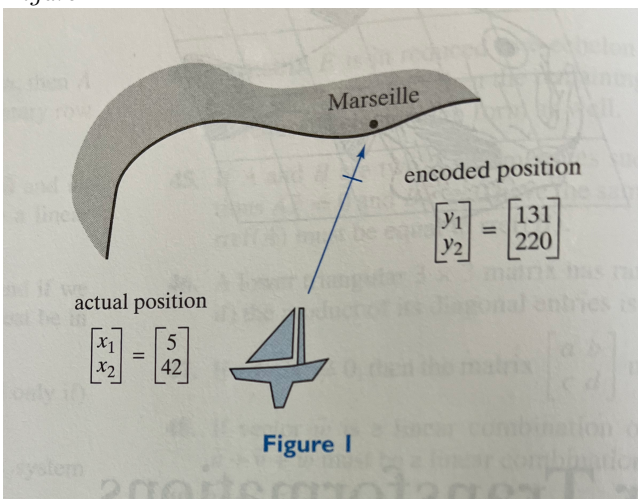

Figure 1