

# Tutorial Exercises

**Qs. 1**

A transformation  $T$  is such that for the Basis vectors,

$$i = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \text{ and } j = \begin{bmatrix} 0 \\ 1 \end{bmatrix},$$

$$T(i) = 21 * i + 13 * j \text{ and } T(j) = 8 * i + 21 * j \text{ i.e.}$$

$$T\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right) = \begin{bmatrix} 21 \\ 13 \end{bmatrix} \text{ and } T\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 8 \\ 21 \end{bmatrix}.$$

$$\text{Determine } T\left(\begin{bmatrix} 3 \\ 5 \end{bmatrix}\right), \text{ i.e.}$$

where does the transformation,  $T$ , send the vector  $\begin{bmatrix} 3 \\ 5 \end{bmatrix}$  to?

## Qs. 2

Let matrix  $A = \begin{bmatrix} 1 & 2 \\ 4 & 9 \end{bmatrix}$  and matrix  $B = \begin{bmatrix} 1 & 4 \\ 2 & -1 \end{bmatrix}$

and vector  $v = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$

- ① Let  $u = A * v$ , calculate  $B * u$ .

Find  $B * A$ .

Show  $B * u = (B * A) * v$

- ② Show that  $A * B \neq B * A$ .

For matrices  $P$  and  $Q$  explain why, in general, that  $P * Q \neq Q * P$ .

- ③ Determine whether  $(A * B)^T = B^T * A^T$

Qs. 3

Let  $A = \begin{bmatrix} 1 & 2 & 4 \\ 2 & 6 & 0 \end{bmatrix}$  and  $B = \begin{bmatrix} 4 & 1 & 4 & 3 \\ 0 & -1 & 3 & 1 \\ 2 & 7 & 5 & 2 \end{bmatrix}$

and  $C = A * B$  where

$$C = \begin{bmatrix} 12 & c_{12} & 30 & 13 \\ 8 & -4 & c_{23} & 12 \end{bmatrix}$$

Calculate the values  $c_{12}$  and  $c_{23}$ .

## Box of Coins.

(Optional Question)

A box holding pennies, nickels and dimes contains thirteen coins with a total value of 83 cents.

How many coins of each type are in the box?

(These are US coins; a penny is 1 cent, a nickel is 5 cents, and a dime is 10 cents.)