

# 9th Mathematics Exercise 1.2 Notes

## Exercise 1.2

Q1. From the following matrices, identify unit matrices, row matrices, column matrices and null matrices.

$$\begin{aligned} A &= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, & B &= [2 \quad 3 \quad 4], & C &= \begin{bmatrix} 4 \\ 0 \\ 6 \end{bmatrix}, \\ D &= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, & E &= [0], & F &= \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix} \end{aligned}$$

**Solution:**

**Matrix A** is a null matrix (because all its entities are zero)

**Matrix B** is a row matrix (because it has only one row).

**Matrix C** is a column matrix (because it has only one column).

**Matrix D** is a diagonal matrix (because its diagonal entities are 1).

**Matrix E** is a null matrix (because all its entities are 0).

**Matrix F** is a column matrix (because it has only one column).

Q2. From the following matrices, identify

- |                       |                          |
|-----------------------|--------------------------|
| (a) Square matrices   | (b) Rectangular matrices |
| (c) Row matrices      | (d) Column matrices      |
| (e) Identity matrices | (f) Null matrices        |

$$\begin{aligned} \text{(i)} \quad & \begin{bmatrix} -8 & 2 & 7 \\ 12 & 0 & 4 \end{bmatrix}, & \text{(ii)} \quad & \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}, & \text{(iii)} \quad & \begin{bmatrix} 6 & -4 \\ 3 & -2 \end{bmatrix}, \\ \text{(iv)} \quad & \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, & \text{(v)} \quad & \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}, & \text{(vi)} \quad & [3 \quad 10 \quad -1], \\ \text{(vii)} \quad & \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, & \text{(viii)} \quad & \begin{bmatrix} 1 & 2 & 3 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}, & \text{(ix)} \quad & \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \end{aligned}$$

**Solution:**

- (a) (iii), (iv) and (viii) are square matrices because the number of rows are equal to number of columns.



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- (b) (i), (ii), (v), (vi) (vii), (ix) are rectangular matrices because their rows and columns are not equal.
- (c) (vi) is a row matrix because it has only one row.
- (d) (ii) and (vii) are column matrices because they have only one column.
- (e) (iv) is an identity matrix as well because its diagonal elements are "1".
- (f) (ix) is a null matrix because its each entity is zero.

**Q3. From the following matrices, identify diagonal, scalar and unit (identity) matrices.**

$$A = \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix},$$

$$B = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix},$$

$$C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix},$$

$$D = \begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix},$$

$$E = \begin{bmatrix} 5 & -3 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

**Solution:**

**Matrix A** is a scalar matrix (because its diagonal entities are same).

**Matrix B** is a diagonal matrix (because its diagonal entities are non-zero and non-diagonal entities are zero).

**Matrix C** is an identity matrix (because its diagonal entities are 1).

**Matrix D** is a diagonal matrix (because its one diagonal entity is non-zero and non-diagonal entities are zero).

**Matrix E** is a scalar matrix (because its diagonal entities are same).

**Q4. Find negative of matrices A, B, C, D and E when:**

$$A = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix},$$

$$B = \begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix},$$

$$C = \begin{bmatrix} 2 & 6 \\ 3 & 2 \end{bmatrix},$$

$$D = \begin{bmatrix} -3 & 2 \\ -4 & 5 \end{bmatrix},$$

$$E = \begin{bmatrix} 1 & -5 \\ 2 & 3 \end{bmatrix}$$

**Solution:**

Negative of a matrix is obtained by inverting (changing) the signs of all its entities.

So,

$$(i) \quad -A = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$$

$$(ii) \quad -B = \begin{bmatrix} -3 & 1 \\ -2 & -1 \end{bmatrix}$$



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$$(iii) \quad -C = \begin{bmatrix} -2 & -6 \\ -3 & -2 \end{bmatrix}$$

$$(iv) \quad -D = \begin{bmatrix} 3 & -2 \\ 4 & -5 \end{bmatrix}$$

$$(v) \quad -E = \begin{bmatrix} -1 & 5 \\ -2 & -3 \end{bmatrix}$$

**Q5. Find the transpose of each of the following matrices:**

$$A = \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix},$$

$$B = [5 \quad 1 \quad -6],$$

$$C = \begin{bmatrix} 1 & 2 \\ 2 & -1 \\ 3 & 0 \end{bmatrix},$$

$$D = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix},$$

$$E = \begin{bmatrix} 2 & 3 \\ -4 & 5 \end{bmatrix},$$

$$F = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

**Solution:**

Transpose of a matrix is obtained by converting all the columns of that matrix to the rows and all the rows to the columns.

So, according to the definition;

$$(i) \quad A^t = [0 \quad 1 \quad -2]$$

$$(ii) \quad B^t = \begin{bmatrix} 5 \\ 1 \\ -6 \end{bmatrix}$$

$$(iii) \quad C^t = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 0 \end{bmatrix}$$

$$(iv) \quad D^t = \begin{bmatrix} 2 & 0 \\ 3 & 5 \end{bmatrix}$$

$$(v) \quad E^t = \begin{bmatrix} 2 & -4 \\ 3 & 5 \end{bmatrix}$$

$$(vi) \quad F^t = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

**Q6. Verify that if  $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$  then**

$$(i) \quad (A^t)^t = A$$

$$(ii) \quad (B^t)^t = B$$

**Solution:**

$$(i) \quad \text{To prove: } (A^t)^t = A$$

$$\text{Given } A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

$$A^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$$

Taking transpose of  $A^t$ , we will get



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$$(A^t)^t = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} = A$$

Hence proved:  $(A^t)^t = A$

(ii) To prove:  $(B^t)^t = B$

$$\text{Given } B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$$

$$B^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

Taking transpose of  $B^t$ , we will get

$$(B^t)^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} = B$$

Hence proved:  $(B^t)^t = B$



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