

Quiz #6 : Vector and Matrix Operations, Types of Matrices

Question 1

Given the vectors:

$$\vec{w} = (0, -1, 2) \text{ and } \vec{v} = (1, 0, 7)$$

find the distance between them, $d(\vec{v}, \vec{w})$

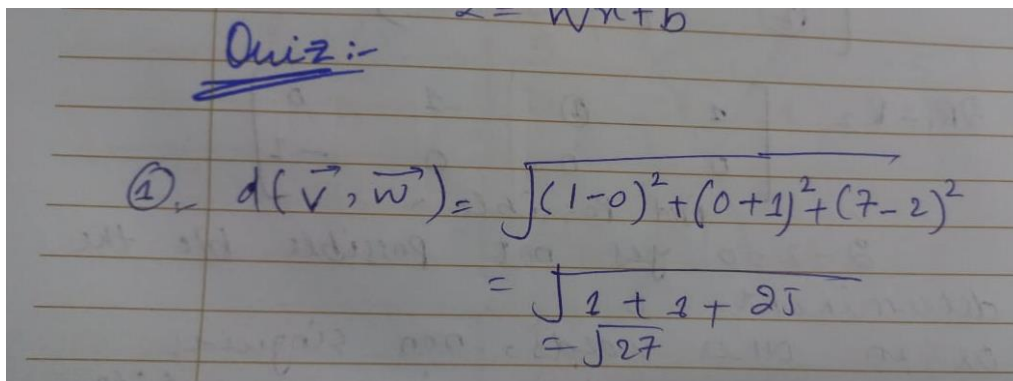
a):- -2

b):- $\sqrt{23}$

c):- $\sqrt{27}$

d):- 5

Answer:- c



Handwritten solution for Question 1:

Quiz:-

$$\textcircled{1} \quad d(\vec{v}, \vec{w}) = \sqrt{(1-0)^2 + (0+1)^2 + (7-2)^2}$$
$$= \sqrt{1 + 1 + 25}$$
$$= \sqrt{27}$$

Question 2

You are given the points P: (1, 0, -3) and Q: (-1, 0, -3). The magnitude of the vector from P to Q is:

a) 3

b) -2

c) 2

Answer:- c

$P(1, 0, -3)$ $O(-1, 0, -3)$

magnitude should be equal to distance.

$$|PO| = \sqrt{(1-(-1))^2 + (0-0)^2 + (-3-(-3))^2}$$
$$= \sqrt{2^2 + 0 + 0}$$
$$= \sqrt{4}$$
$$|PO| = 2$$

Question 3

Select the correct statements pertaining to the dot product.

- a):- The dot product of orthogonal vectors is always 0.
- b):- The dot product of two vectors is always a scalar
- c):- The dot product vector is the diagonal in a parallelogram formed by the two vectors \vec{u} and \vec{v}
- d):- The dot product of orthogonal vectors is always 1.

Answer:- a,b

Question 4

Calculate the norm $||v||$ of the vector, $\vec{v}=(1,-5,2,0,-3)$, and select the correct answer.

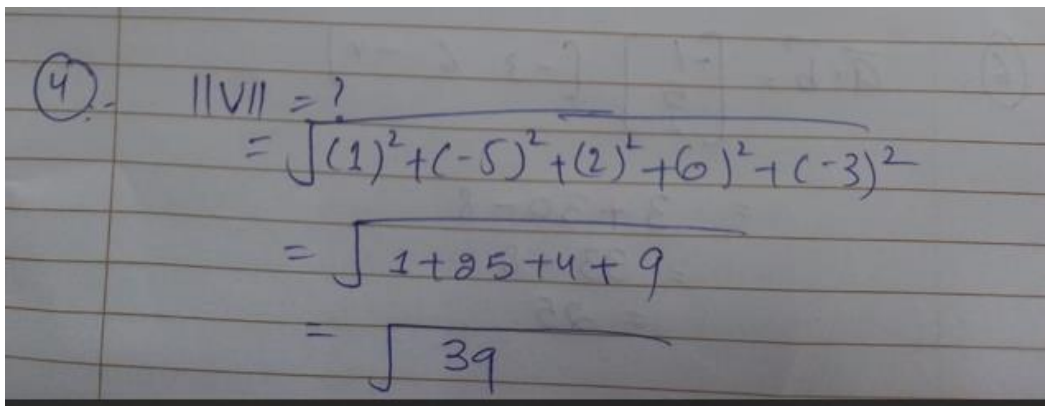
a):- $||v||=39$

b):- $||v||=\sqrt{35}$

c):- $||v||=\sqrt{39}$

d):- $||v||=5$

Answer:- c



Handwritten calculation of the norm of vector v :

$$\begin{aligned} \textcircled{4} \quad ||v|| &= ? \\ &= \sqrt{(1)^2 + (-5)^2 + (2)^2 + (0)^2 + (-3)^2} \\ &= \sqrt{1 + 25 + 4 + 9} \\ &= \sqrt{39} \end{aligned}$$

Question 5

Which of the vectors has the greatest norm?

a):-

$$\begin{bmatrix} 2 \\ 2 \\ 2 \\ 2 \end{bmatrix}$$

b):-

$$\begin{bmatrix} 1 \\ 0 \\ -2 \\ 0 \\ -1 \end{bmatrix}$$

c):-

$$\begin{bmatrix} 2 \\ 5 \end{bmatrix}$$

d):-

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

e):-

$$\begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$$

Answer:- c

⑤. for $\begin{bmatrix} 2 \\ 2 \\ 2 \\ 2 \end{bmatrix}$ Norm = $\sqrt{4+4+4+4}$
 $= \sqrt{16}$
 $= 4$

for $\begin{bmatrix} 1 \\ 0 \\ -2 \\ 0 \\ -1 \end{bmatrix}$ = $\sqrt{1+4+1} = \sqrt{6} = 2.45$

$\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ = $\sqrt{4+25} = \sqrt{29} = 5.38$

$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = 0$

$\begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix} = \sqrt{1+4+9} = \sqrt{14} = 3.74$

Question 6

Calculate the dot product $\vec{a} \cdot \vec{b}$, and select the correct answer.

$$\vec{a} = \begin{bmatrix} -1 \\ 5 \\ 2 \end{bmatrix}, \vec{b} = \begin{bmatrix} -3 \\ 6 \\ -4 \end{bmatrix}$$

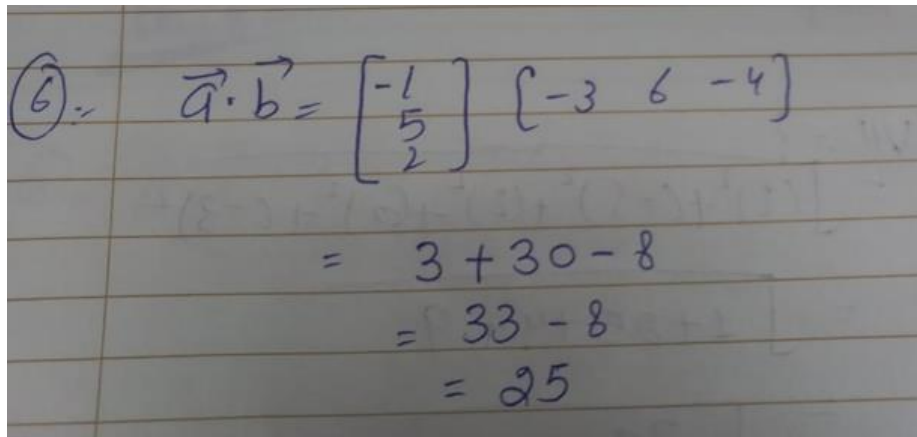
a):- $\begin{bmatrix} -3 \\ 30 \\ -8 \end{bmatrix}$

b):- 25

c):- 30

d):- $\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$

Answer:- b



Handwritten calculation showing the dot product of two vectors \vec{a} and \vec{b} . The vector \vec{a} is represented as a column matrix $\begin{bmatrix} -1 \\ 5 \\ 2 \end{bmatrix}$ and the vector \vec{b} is represented as a row matrix $\begin{bmatrix} -3 & 6 & -4 \end{bmatrix}$. The calculation proceeds as follows:

$$\begin{aligned} \textcircled{6} \therefore \vec{a} \cdot \vec{b} &= \begin{bmatrix} -1 \\ 5 \\ 2 \end{bmatrix} \begin{bmatrix} -3 & 6 & -4 \end{bmatrix} \\ &= 3 + 30 - 8 \\ &= 33 - 8 \\ &= 25 \end{aligned}$$

Question 7

Which of the following is the result of performing the multiplication $M_1 \cdot M_2$,

where $M_1 = \begin{bmatrix} 2 & -1 \\ 3 & -3 \end{bmatrix}$, $M_2 = \begin{bmatrix} 5 & -2 \\ 0 & 1 \end{bmatrix}$

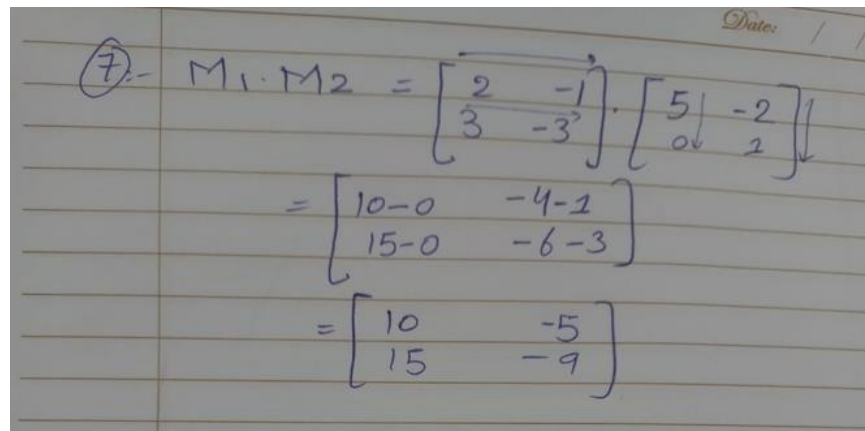
a):- $\begin{bmatrix} 10 & -5 \\ 15 & -9 \end{bmatrix}$

b):- $\begin{bmatrix} 10 & -3 & 1 \\ 15 & -4 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

c):- $\begin{bmatrix} 10 & 15 \\ -3 & -4 \end{bmatrix}$

d):- $\begin{bmatrix} 10 & 3 \\ 15 & 4 \end{bmatrix}$

Answer:- a



A photograph of a piece of lined paper with handwritten mathematical work. At the top right, there is a 'Date: / /' label. The main work shows the multiplication of two matrices, M1 and M2. M1 is a 2x2 matrix with elements 2, -1, 3, and -3. M2 is a 2x2 matrix with elements 5, -2, 0, and 1. The calculation proceeds in three steps: first, the matrices are written with an equals sign; second, the element-wise products are calculated (10, -4, 15, -6); third, the final 2x2 matrix is written with elements 10, -5, 15, and -9.

$$\textcircled{7}:- M_1 \cdot M_2 = \begin{bmatrix} 2 & -1 \\ 3 & -3 \end{bmatrix} \cdot \begin{bmatrix} 5 & -2 \\ 0 & 1 \end{bmatrix}$$
$$= \begin{bmatrix} 10-0 & -4-1 \\ 15-0 & -6-3 \end{bmatrix}$$
$$= \begin{bmatrix} 10 & -5 \\ 15 & -9 \end{bmatrix}$$

Question 8

Calculate the dot product $\vec{w} \cdot \vec{z}$, and select the correct answer.

$$\vec{w} = \begin{bmatrix} -9 \\ -1 \end{bmatrix} \quad \vec{z} = \begin{bmatrix} -3 \\ -5 \end{bmatrix}$$

a):- 35

b):- 32

c):- $\frac{27}{5}$

d):- $\frac{-27}{-5}$

Answer:- b

$$(8) \quad \vec{w} = \begin{bmatrix} -9 \\ -1 \end{bmatrix}, \quad \vec{z} = \begin{bmatrix} -3 \\ -5 \end{bmatrix}$$

$$\vec{w} \cdot \vec{z} = \begin{bmatrix} -9 \\ -1 \end{bmatrix} \cdot \begin{bmatrix} -3 & -5 \end{bmatrix}$$

$$= 27 + 5$$

$$= 32$$