Quiz #5 : Vector operations Sum, difference, multiplication, dot product

Question 1

Which of the following options is true for a vector?

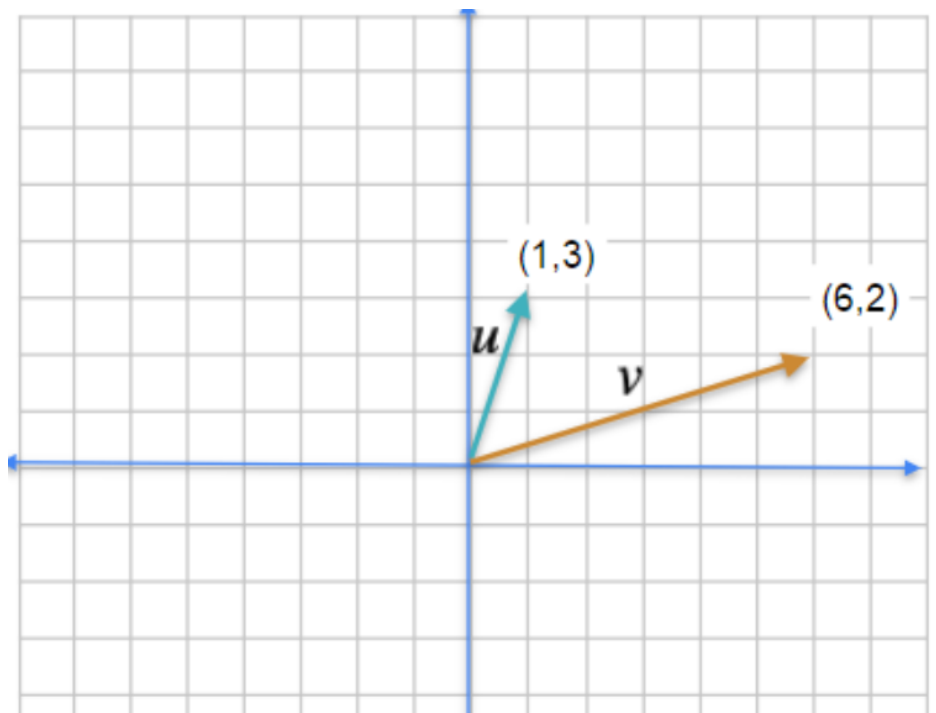**a):- A vector has a magnitude and direction.**

b):- A vector has only direction.

c):- A vector has only a magnitude

d):- A vector has a shape and weight

Answer:- a

Question 2

Compute the sum of the vectors $\vec{u}$ and $\vec{v}$.

Hint:- The sum vector is the diagonal in a parallelogram formed by the two vectors, $\vec{u} = (1,3)$ and $\vec{v}=(6,2)$.
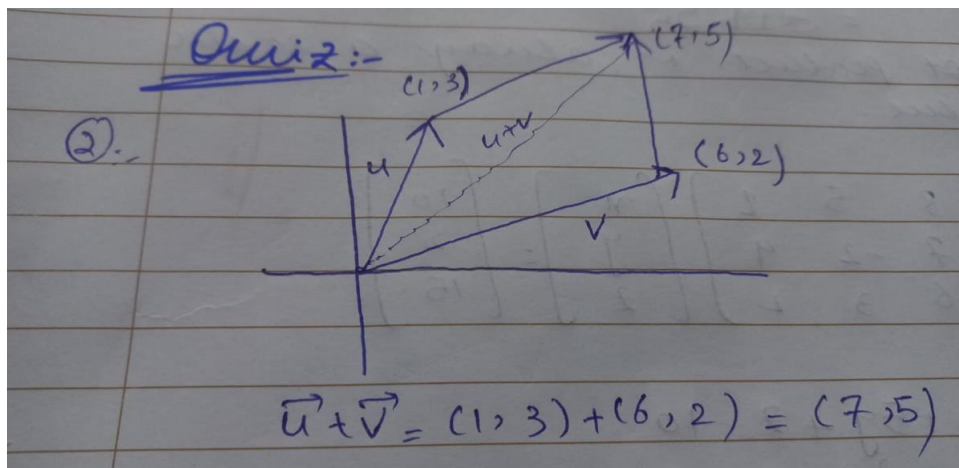
a):- $\vec{u} + \vec{v}$

b):- $\vec{u} + \vec{v} = (7,5)$

c):- $\vec{u} + \vec{v} = (6,3)$

d):- $\vec{u} + \vec{v} = 3$

Answer:- b

Question 3

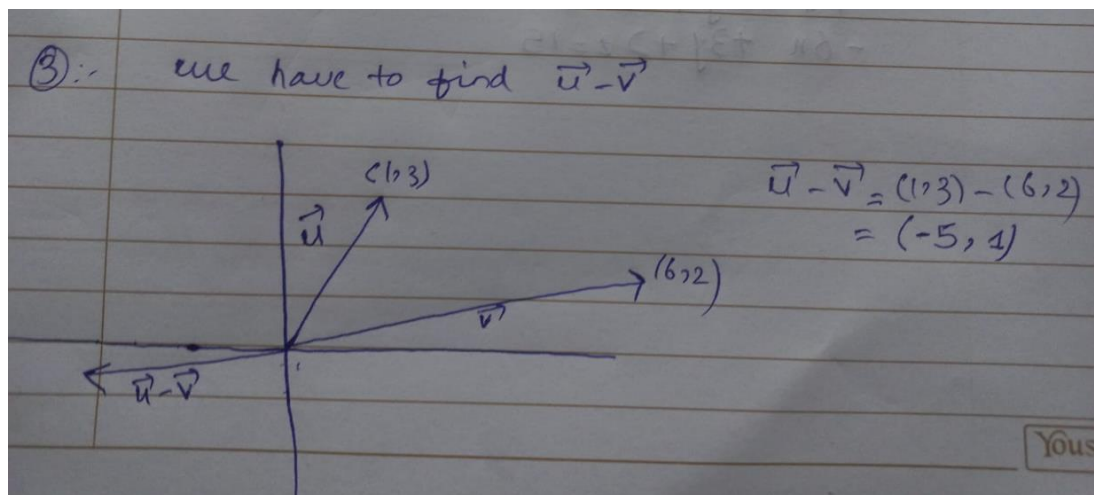Compute the difference of the vectors $\vec{u}$ and $\vec{v}$

a):- $\vec{u} - \vec{v} = (-1,5)$

b):- $\vec{u} - \vec{v} = (5,1)$

c):- $\vec{u} - \vec{v} = 3$

d):- $\vec{u} - \vec{v} = (-5,1)$

Answer:- d

(3):- we have to find $\vec{u} - \vec{v}$

C(1,3)

$\vec{u} - \vec{v} = (1,3) - (6,2)$
$= (-5, 1)$

(6,2)

Question 4

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

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

a):- $\begin{matrix} 1 \\ 0 \\ 1 \end{matrix}$

b):- **30**

c):- **25**

d):- $\begin{matrix} -3 \\ 30 \\ 8 \end{matrix}$

Answer:- c

(4).

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

$$\vec{a} \cdot \vec{b} = ab^t$$

$$= \begin{bmatrix} -1 \\ 5 \\ 2 \end{bmatrix} \begin{bmatrix} -3 & 6 & -4 \end{bmatrix}$$

$$= 3 + 30 - 8$$

$$= 3 + 22$$

$$= 25$$

dot product is always a scalar value.

Question 5

Which of the following is true, if $\vec{a} \cdot a = 0$ and $\vec{a} \cdot \vec{b} = 0$?

a):- $\vec{a} = 0$, $\vec{b} = 0$

b):- $\vec{a} \cdot \vec{a} = 1$

c):- $\vec{a} \neq 0$, $\vec{b} = 0$

d):- $\vec{a} = 0$, $\vec{b} =$ any vector

Answer:- d

Although c option is also true but d is more generic, because as vector , $\vec{a} = 0$, it will make vector product with $\vec{b}$ to be 0, no matter whichever actual value of , $\vec{b}$ was.

Question 6

Which of the following is the correct representative system of equation for the given dot product:

$$\begin{bmatrix} 3 & 5 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 10$$

$$\begin{bmatrix} 7 & -2 & 4 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 2$$

$$\begin{bmatrix} -6 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 15$$

The image above represents the following:

$$\begin{bmatrix} 3 & 5 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 10$$

$$\begin{bmatrix} 7 & -2 & 4 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 2$$

$$\begin{bmatrix} -6 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = 15$$

a):-

$$\begin{cases} 3x + 5y + z = 2 \\ 7x{-}2y + 4z = 1 \\ -6x + 3y + 2z = 20 \end{cases}$$
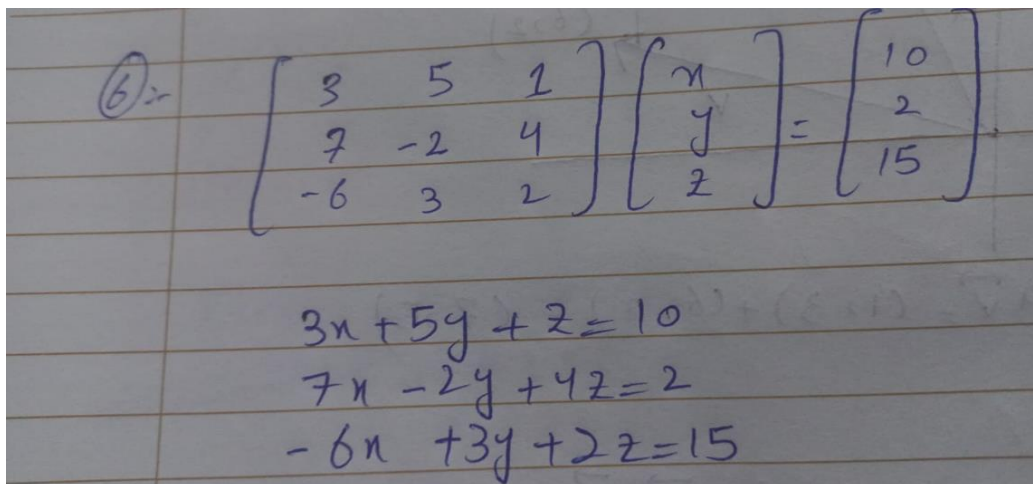
b):-

$$\begin{cases} 3x + 5y + z = 10 \\ 7x{-}2y + 4z = 2 \\ -6x + 3y + 2z = 15 \end{cases}$$

c):-

$$\begin{cases} 3x - 2y + 4z = 10 \\ 7x{-}2y + 4z = 2 \\ -6x + 3y + 2z = 15 \end{cases}$$

Answer:- c

$$\begin{bmatrix} 3 & 5 & 1 \\ 7 & -2 & 4 \\ -6 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 10 \\ 2 \\ 15 \end{bmatrix}$$

$3x + 5y + z = 10$

$7x - 2y + 4z = 2$

$-6x + 3y + 2z = 15$