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A. Let $A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$; $B = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$; $C = \begin{bmatrix} -1 \\ 1 \\ 3 \end{bmatrix}$, find :-

1] $2A - B$

$$= 2\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} - \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix} - \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = \begin{bmatrix} -2 \\ -1 \\ 0 \end{bmatrix}$$

2] $\|A\| = \sqrt{1^2+2^2+3^2} = \sqrt{1+4+9} = \sqrt{14}$

$\|A\|$ and the angle of A relative to the

3] positive X-axis.

Angle of A relative to the positive X-axis :-

Hence, Positive X-axis $= \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

Angle between $\|A\|$ & X is $\cos\theta = \frac{A \cdot X}{\|A\| \, |X|}$

$$= \cos^{-1}\left(\frac{(1,2,3)\cdot(1,0,0)}{(\sqrt{14})\cdot 1}\right)$$

$$= \cos^{-1}\left(\frac{1}{\sqrt{14}}\right)$$

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3) $\hat{A}$; a unit vector in direction of A.

$$\hat{A} = \frac{A}{|A|} = \frac{1}{\sqrt{14}} \times \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 1/\sqrt{14} \\ 2/\sqrt{14} \\ 3/\sqrt{14} \end{bmatrix}$$

4) The direction cosines of A.

$$\cos(\alpha) = \frac{A_x}{|A|} = \frac{1}{\sqrt{14}}$$

$$\cos \text{ of } (\beta) = \frac{A_y}{|A|} = \frac{2}{\sqrt{14}}$$

$$\cos \text{ of } (\gamma) = \frac{A_c}{|A|} = \frac{3}{\sqrt{14}}$$

5) A.B and B.A

$$A \cdot B = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = 1\times4 + 2\times5 + 3\times6$$
$$= 4 + 10 + 18 = \underline{\underline{32}}.$$

$$B \cdot A = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = 4\times1 + 5\times2 + 6\times3.$$
$$4 + 10 + 18 = \underline{\underline{32}}$$

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6) the angle between A and B

$\cos\theta = \frac{A \cdot B}{|A||B|} = (A \cdot B)$ from previous problem. ↳ I

$|A| = \sqrt{1^2+2^2+3^2}$; $|B| = \sqrt{4^2+5^2+6^2}$.

$|A| = \sqrt{14}$ ↳ II ; $|B| = \sqrt{77}$. ↳ III

∴ ~~to~~

$\therefore \cos\theta = \frac{32}{(\sqrt{14})(\sqrt{77})} = \frac{32}{\sqrt{1078}}$.

$\therefore \cancel{\cos}\ \theta = \cos^{-1}\left(\frac{32}{\sqrt{1078}}\right)$

$$\boxed{\theta = 12.93}$$

7) A vector which is perpendicular to A.

Consider y be the vector perpendicular to A.
↳ Also, a vector which is perpendicular to A the dot product will be 0.

$\therefore A \cdot x = 0.$

$= 1x_1 + 2 \cdot x_2 + 3 \cdot x_3 = 0$

$A = [\ ]$

Hence, choose values of x_1, x_2, and x_3 such that it satisfies condition $\boxed{A \cdot x = 0}$.

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Hence possible values could be :-

$(1)(2) + (2)(2) + (3)(-2) = 0.$ or

$(1)(-1) + (2)(-4) + (3)(3) = 0.$

$$\therefore \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \\ -2 \end{bmatrix} \quad \text{OR} \quad \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -1 \\ -4 \\ 3 \end{bmatrix}$$

8) $A \times B$ and $B \times A$

$$A \times B = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \times \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = \begin{bmatrix} 2(6) - 3(5) \\ 1(6) - (4)(3) \\ 1(5) - 2(4) \end{bmatrix}$$

$$= \begin{bmatrix} 12-15 \\ 6-12 \\ 5-18 \end{bmatrix} = \begin{bmatrix} -3 \\ -6 \\ -3 \end{bmatrix}$$

$$B \times A = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} \times \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 5(3) - 6(2) \\ 4(3) - 6(1) \\ 4(2) - 5(1) \end{bmatrix} = \begin{bmatrix} 3 \\ 6 \\ 3 \end{bmatrix}$$

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9) a vector which is perpendicular to both A and B such that

$$\vec{V} = \begin{vmatrix} a & b & c \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix} = \cancel{-6\hat{a} + 9\hat{b}}$$

-3
$+12$
-9

$-6 + 9 \cdot 6$
$3 \quad -6$

$-6\hat{a} + 9\hat{b} - 6\hat{c}$

Now :- $A \cdot V = -6 \times 4 + 5 \times 9 - 6 \times 6$

-24
$+45$
-36

24
36
-60

$$\vec{V} = \begin{vmatrix} a & b & c \\ 1 & 2 & 3 \\ 4 & 5 & 6 \end{vmatrix} = -3\hat{a} + 6\hat{b} - 3\hat{c}$$

$= -3\hat{a} + 6\hat{b} - 3\hat{c}$

Now, $A \cdot V = 1 \times (-3) + 2 \times 6 + 3 \times (-3) = 0$

$B \cdot V = 4 \times (-3) + 5 \times 6 + 6 \times (-3) = 0$

$\therefore$ $\vec{V}(-3, 6, -3)$ is perpendicular to A and B

10) The linear dependency between A, B, C

11) $A^T B = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$

$= \begin{bmatrix} 4 \times 1 + 5 \times 2 + 6 \times 3 \end{bmatrix}$

$= 4 + 10 + 18 = 32$

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$$AB^T = \begin{bmatrix}1\\2\\3\end{bmatrix}\begin{bmatrix}4 & 5 & 6\end{bmatrix}$$

$$= 4 + 10 + 18$$

$$= \underline{\underline{32}}$$

$$= \cancel{\begin{bmatrix}4 & 5 & 6\\8 & 10 & 12\\12 & 15 & 18\end{bmatrix}}$$

Q B) $A = \begin{bmatrix}1 & 2 & 3\\4 & -2 & 3\\0 & 5 & 1\end{bmatrix}$; $B = \begin{bmatrix}1 & 2 & 1\\2 & 1 & -4\\3 & -2 & 1\end{bmatrix}$;

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

1) $2A - B = \begin{bmatrix}2 & 4 & 6\\8 & -4 & 6\\0 & 10 & 2\end{bmatrix} - \begin{bmatrix}1 & 2 & 1\\2 & 1 & -4\\3 & -2 & 1\end{bmatrix}$

$$= \begin{bmatrix}1 & 2 & 5\\6 & -5 & 10\\-3 & 12 & 1\end{bmatrix}$$

2) $AB = \begin{bmatrix}1 & 2 & 3\\4 & -2 & 3\\0 & 5 & 1\end{bmatrix}\begin{bmatrix}1 & 2 & 1\\2 & 1 & -4\\3 & -2 & 1\end{bmatrix}$

$$= \begin{bmatrix}1+4+9 & \cancel{2+3+6}\ 2+4+6 & 1+(-8)+3\\4-4+9 & 8-2-6 & 4+8-3\\0+10-3 & 0+5+2 & 0-20-1\end{bmatrix} = \begin{bmatrix}14 & 12 & -4\\9 & 0 & 15\\7 & 7 & -21\end{bmatrix}$$

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$$BA = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & -4 \\ 3 & -2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 4 & -2 & 3 \\ 0 & 5 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} 1+8+0 & 2-4+5 & 3+6+1 \\ 2+4+0 & 4-2-20 & 6+3+4 \\ 3-8+0 & 6+4+5 & 9+6+1 \end{bmatrix}$$

$$= \begin{bmatrix} 9 & 3 & 10 \\ 6 & -18 & 13 \\ -5 & 15 & 16 \end{bmatrix}$$

3) $(AB)^T$ and :-

$$(AB) = \begin{bmatrix} 14 & 12 & -4 \\ 9 & 0 & 15 \\ 7 & 7 & -21 \end{bmatrix} = \begin{bmatrix} 14 & 9 & 7 \\ 12 & 0 & 7 \\ -4 & 15 & -21 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & -4 \\ 3 & -2 & 1 \end{bmatrix} \Rightarrow B^T = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -2 \\ 1 & -4 & 1 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & -2 & 3 \\ 0 & 5 & -1 \end{bmatrix} \Rightarrow A^T = \begin{bmatrix} 1 & 4 & 0 \\ 2 & -2 & 5 \\ 3 & 3 & -1 \end{bmatrix}$$

$$B^TA^T = \begin{bmatrix} 1+4+9 & 4+4+9 & 0+10+3 \\ 2+2-6 & \overset{8-2-6}{8+2+6} & 0+5+2 \\ 1-8+3 & 4+8+3 & 0-20-1 \end{bmatrix}$$

$$B^T A^T = \begin{bmatrix} 1\times1+2\times2+3\times3 & 4\times1-2\times(-2)+3\times3 & 0\times1+2\times5+3\times(-1) \\ 2\times1+2\times2+3\times-2 & 4\times2-2\times1+3\times(-2) & 0\times2+5\times1+-2\times1 \\ 1\times1+2\times4+3\times1 & 4\times1-2\times-4+3\times1 & 0\times2-4\times5-1\times1 \end{bmatrix}$$

$$= \begin{bmatrix} 1+4+9 & 4-4+9 & 0+10-3 \\ 2+2-6 & 8-2-6 & 0+5+2 \\ 1-8+3 & 4+8+3 & 0-20-1 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 9 & 7 \\ -2 & 0 & 7 \\ -4 & 15 & -21 \end{bmatrix}$$

4) $|A| = \begin{vmatrix} 1 & 2 & 3 \\ 4 & -2 & 3 \\ 0 & 5 & 1 \end{vmatrix} = 1(2-15) - 2(-4+0) + 3(20-0)$

$= -13 + 18 + 60 = 55$

$|C| = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ -1 & 1 & 3 \end{vmatrix} = 1(15-6) - 2(12-6) + 3(4+5)$

$= 9 - 2(6) + 3(9)$

$\Rightarrow 9 - 12 + 18 = \underline{\underline{15}}$

5) the matrix (A, B, or C) in which the row vectors form an orthogonal set.

<u>Condition of orthogonality</u> :-

$\Rightarrow$ Dot product of rows should be zero.

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for A,

$(1,2,3)\cdot(4,2,3) = 1\times4 - 2\times2 + 3\times3 = \boxed{9 \neq 0}$

$(4,-2,3)\cdot(0,5,-1) = (0\times4 - 2\times5 - 3\times1) =$

$= 0 - 10 - 3 = \boxed{-13 \neq 0}$

Hence A is not orthogonal

B] $(1,2,1)\cdot(2,1,-4) =$

$2\times1 + 2\times1 - 4\times1 = 0$

$2+2-4 = 0 \Rightarrow \boxed{0 = 0}$

$(2,1,-4)(3,-2,1)$

$= 2\times3 + (-2)\times(1) - 4\times1$

$= 6 - 2 - 4$

$= \boxed{0 = 0}$

$\therefore$ B is orthogonal.

C] $(1,2,3)(4,5,6) \neq 0$

$1\times4 + 2\times5 + 3\times6 \neq 0$

$(4,3,6)\cdot(-1,1,3)$

$4\times(-1) + 3\times1 + 6\times3$

$-4+3+18 = \boxed{19 \neq 0}$

C is not orthogonal.

6). $A^{-1} = \frac{Adj(A)}{|A|}$ | $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & -3 & 3 \\ 6 & 5 & -1 \end{bmatrix}$

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$B^{-1} = \frac{Adj(B)}{|B|}$ | $B = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & -4 \\ -3 & 2 & 1 \end{bmatrix}$

$$Adj\ A \Rightarrow \begin{bmatrix} 2-15 & -(-4-0) & 20-0 \\ 2+15 & -1-0 & -5 \\ 12 & 9 & -10 \end{bmatrix}$$

$$= \begin{bmatrix} -13 & 4 & 20 \\ 17 & -1 & -5 \\ 2 & 9 & -10 \end{bmatrix} \Rightarrow \begin{bmatrix} 13 & 17 & 12 \\ 4 & -1 & 9 \\ 20 & -5 & -10 \end{bmatrix}$$

$$|A| = 1(2-15) - 2(-4-0) + 3(20-0)$$
$$= -13 + 8 + 6 = 55$$

$$\underline{\underline{A^{-1}}} \Rightarrow \frac{1}{\cancel{55}} \frac{\begin{bmatrix} -13 & 17 & 12 \\ 4 & -1 & 9 \\ 20 & -5 & -10 \end{bmatrix}}{55}$$

$$B^{-1} = \frac{Adj(B)}{|B|} = \begin{bmatrix} 1-8 & -2-12 & -7 \\ -2-2 & 1-3 & 8 \\ 8-1 & 4+2 & -3 \end{bmatrix}$$

$$= \begin{bmatrix} -7 & -14 & -7 \\ -4 & -2 & 8 \\ -9 & 6 & -3 \end{bmatrix}$$

$$Adj(B) = \begin{bmatrix} -7 & -4 & -9 \\ -14 & -2 & 6 \\ -7 & 8 & -3 \end{bmatrix} \Rightarrow |B| \Rightarrow 1(-7) - 28 + 11$$

$$= -7-12 - 42$$
$$= 4$$

$$B^{-1} = \frac{1}{42}\begin{bmatrix} -7 & -4 & -9 \\ -14 & -2 & 6 \\ -7 & 8 & -3 \end{bmatrix}$$

Q C] $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -2 \\ -2 & 5 \end{bmatrix}$, find

I] Eigen Values and corresponding Eigen Vectors

formula:- $|A - I\lambda| = 0$ I = Identity matrix $= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$\therefore \left| \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \right| = 0.$

$= \begin{vmatrix} 1-\lambda & 2-0 \\ 3-0 & 2-\lambda \end{vmatrix} = 0$

$\Rightarrow (1-\lambda)(2-\lambda) - 3(2) = 0$

$= 1(2-\lambda) - \lambda(2-\lambda) - 3(2) = 0$

$= 2 - \lambda - 2\lambda + \lambda^2 - 6 = 0$

$= 2 - 3\lambda + \lambda^2 - 6 = 0$

$\lambda^2 - 3\lambda - 4 = 0$

$\Rightarrow \therefore (\lambda - 4)(\lambda + 1) = 0$

-3

$-4 \quad +1$

-4

$\therefore \lambda = 4$ or $\lambda = -1$

Case 1: $\lambda = 4$ $\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = 4 \begin{bmatrix} x \\ y \end{bmatrix}$

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$$\Rightarrow \begin{bmatrix} x \times 1 + 2 \times y \\ 3 \times x + 2 \times y \end{bmatrix} = \begin{bmatrix} 4x \\ 4y \end{bmatrix}$$

$$= \begin{bmatrix} x + 2y \\ 3x + 2y \end{bmatrix} = \begin{bmatrix} 4x \\ 4y \end{bmatrix}$$

$\therefore\ x + 2y = 4x \Rightarrow 2y = 4x - x \therefore 2y = 3x$

$\Rightarrow \boxed{x = \frac{2y}{3}}$

$\therefore\ 3x + 2y = 4y \Rightarrow 3x + 2y - 4y = 0$

$= 3x - 2y = 0$

$= \boxed{x = \frac{2y}{3}}$

$\Rightarrow$ Eigenvector $= \begin{bmatrix} 2/3 \\ 1 \end{bmatrix}$

Case 2) $\lambda = -1 \Rightarrow \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = -1 \begin{bmatrix} x \\ y \end{bmatrix}$

$$\Rightarrow \begin{bmatrix} x \times 1 + 2 \times y \\ 3 \times x + 2 \times y \end{bmatrix} = \begin{bmatrix} -x \\ -y \end{bmatrix} \Rightarrow \begin{bmatrix} x + 2y \\ 3x + 2y \end{bmatrix} = \begin{bmatrix} -x \\ -y \end{bmatrix}$$

$\Rightarrow x + 2y = -x \Rightarrow 2x + 2y = 0;\ x + y = 0\ \boxed{x = -y}$

$\Rightarrow 3x + 2y = -y \Rightarrow 3x + 3y = 0 \therefore \boxed{x = -y}$

Eigenvector $= \begin{bmatrix} -1 \\ -1 \end{bmatrix}$

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2] The matrix $V^{-1}AV$ where V is composed of eigen vector of A

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \Rightarrow V = \begin{bmatrix} -1 & 2/3 \\ -1 & 1 \end{bmatrix}$$

$$1 - \frac{2}{3} = \frac{1}{3}$$

$$= \frac{1}{\frac{1}{3}} = 3$$

$$\therefore V^{-1} = \frac{1}{1 - 2/3} \times \begin{bmatrix} 1 & 2/3 \\ -1 & -1 \end{bmatrix}$$

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

$$V^{-1} = \begin{bmatrix} 3 & 2 \\ -3 & -3 \end{bmatrix}$$

$$V^{-1}(A) = \begin{bmatrix} 3 & 2 \\ -3 & -3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 3 \times 1 + 2 \times 3 & 3 \times 2 + 2 \times 2 \\ -3 \times 1 + -3 \times 3 & 2 \times 2 + (-3) \times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 3+6 & 6+4 \\ -3-9 & 4-6 \end{bmatrix} = \begin{bmatrix} 9 & 10 \\ -12 & -2 \end{bmatrix}$$

$$\therefore V^{-1}(A) = \begin{bmatrix} 9 & 10 \\ -12 & -2 \end{bmatrix}$$

3) Dot product of Eigen Vectors of A

$$\begin{bmatrix}-1 & -1\end{bmatrix}\begin{bmatrix}2/3 \\ 1\end{bmatrix} = \frac{-1\times 2}{3} + (-1)(1)$$

$$= \frac{-2}{3} - 1 = \frac{-2}{3} - \frac{1\times 3}{1\times 3} = \frac{-2-3}{3}$$

$$\boxed{= \frac{-5}{3}}$$

4) Dot product of Eigenvectors of B.

$$|B - \lambda I| = 0 \qquad I = \begin{bmatrix}1 & 0 \\ 0 & 1\end{bmatrix}$$

$$\therefore \left|\begin{bmatrix}2 & -2 \\ -2 & 5\end{bmatrix} - \lambda\begin{bmatrix}1 & 0 \\ 0 & 1\end{bmatrix}\right| = 0$$

$$\therefore \begin{vmatrix}2-\lambda & -2 \\ -2 & 5-\lambda\end{vmatrix} = 0$$

$$\Rightarrow (2-\lambda)(5-\lambda) - (-2)(-2) = 0$$

$$\therefore 10 - 7\lambda + \lambda^2 - 4 = 0$$

$$\lambda^2 - 7\lambda + 6 = 0$$

$$(\lambda-1)(\lambda-6) = 0$$

$$\therefore \boxed{\lambda = 1} \text{ or } \boxed{\lambda = 6}$$

Case 1

For $\lambda = 1$.

$$\begin{bmatrix}2 & -2 \\ -2 & 5\end{bmatrix}\begin{bmatrix}x \\ y\end{bmatrix} = 1\begin{bmatrix}x \\ y\end{bmatrix} \Rightarrow \begin{bmatrix}2\times x & -2\times y \\ -2\times x & 5\times y\end{bmatrix} = \begin{bmatrix}x \\ y\end{bmatrix}$$

$$\hookrightarrow \begin{bmatrix}2x - 2y \\ -2x + 5y\end{bmatrix} = \begin{bmatrix}x \\ y\end{bmatrix}$$

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$2x - 2y = x$

$2x - x - 2y = 0$

$x - 2y = 0$

$\boxed{x = 2y}$

$-2x + 5y = y$

$-2x + 5y - y = 0$

$-2x + 4y = 0$

$\therefore \boxed{x = 2y}$

Eigen Vector $= \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Case 2) $\lambda = 6$

$$\begin{bmatrix} 2 & -2 \\ -2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = 6 \begin{bmatrix} x \\ y \end{bmatrix}$$

$$= \begin{bmatrix} 2\times x - 2\times y \\ -2\times x + 5\times y \end{bmatrix} = \begin{bmatrix} 6x \\ 6y \end{bmatrix} \Rightarrow \begin{bmatrix} 2x - 2y \\ -2x + 5y \end{bmatrix} = \begin{bmatrix} 6x \\ 6y \end{bmatrix}$$

$\therefore 2x - 2y = 6x$

$\Rightarrow +2x - 6x - 2y = 0$

$-4x - 2y = 0$

$= -2x - y = 0$

$\therefore \cancel{-2x} + y$

$= -2x = y$

$\therefore \boxed{x = \frac{-y}{2}}$

$-2x + 5y = 6y$

$-2x + 5y - 6y = 0$

$-2x - y = 0$

$-2x = y$

$x \Rightarrow \boxed{x = -\frac{y}{2}}$

Dot Product :- $\begin{bmatrix} 2 & 1 \end{bmatrix} \begin{bmatrix} -1/2 \\ 1 \end{bmatrix}$

$\cancel{1\times}$ $2\times \frac{-1}{2} + 1\times 1 = [-1 + 1]$

$= \underline{\underline{0}}$

All ~~Eigen Vectors of B are~~

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5) ~~The property of eigenvectors of B:-~~

~~⇒ The property is that the eigenvector of B have dot product as zero, hence they the real~~

⇒ The dot product of Eigenvector is zero ~~be~~ hence eigenvectors are perpendicular.

Q 2] Let $f(x) = x^2+3$; $g(x,y) = x^2+y^2$

1]. The first and second derivatives of $f(x)$ with respect to x:

$f'(x)$, and $f''(x)$.

i) $\frac{d(x)}{dx} = \frac{d}{dx}(x^2+3)$

$\boxed{\frac{d(x)}{dx} = 2x}$ → first derivative.

ii) $\frac{d}{dx}\left[\frac{d(x)}{dx}\right] = \frac{d}{dx}(2x)$

$= 2$ → 2nd derivativede.

2) Partial Derivatives:-

$\frac{\partial g}{\partial x} = \frac{\partial}{\partial x}(x^2+y^2)$

$\boxed{\frac{\partial(g)}{\partial x} = 2x.}$

$\frac{\partial g}{\partial y} = \frac{\partial}{\partial y}(x^2+y^2)$

$\therefore \boxed{\frac{\partial(g)}{\partial y} = 2y}$

Now!- $\frac{\partial g}{\partial y} =$

3. The Gradient Vector $\nabla g(x, y)$

$$\nabla g(x,y) = \left(\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y} \right) = (2x, 2y)$$

4. The probability density function (pdf) of a univariate Gaussian (normal) distribution.

$$= \frac{1}{\sqrt{2\pi\sigma^2}} \cdot e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Substitute values:- $\sigma = 1$; $t = 0$; $\mu = 0$.

$$\therefore = \frac{1}{\sqrt{2\pi\sigma^2}}$$

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