QUIZ 4

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1 PROBLEM 1

1. If **a** *and* **b** are two collinear vectors, then which of the following are incorrect:

1) $\mathbf{b} = \lambda\mathbf{a}$ for some scalar λ
2) $\mathbf{a} = \pm\mathbf{b}$
3) the respective components of **a** *and* **b** are not proportional
4) both the vectors **a** *and* **b** have same direction, but different magnitudes.

SOLUTION: Considering each option:

1) $\mathbf{b} = \lambda\mathbf{a}$ for some scalar λ is correct, it is the condition for collinearity of two vectors. Example:
   Let, $\mathbf{a} = \begin{pmatrix}1\\1\\1\end{pmatrix}, \mathbf{b} = \begin{pmatrix}3\\3\\3\end{pmatrix} and \lambda = 3$
   we can see that $b = \lambda\mathbf{a}$
2) $\mathbf{a} = \pm\mathbf{b}$ is incorrect.The condition is not satisfied for any two collinear vectors. Example:
   Let, $\mathbf{a} = \begin{pmatrix}1\\1\\1\end{pmatrix}, \mathbf{b} = \begin{pmatrix}3\\3\\3\end{pmatrix}$ It can be seen that $\mathbf{a} = \frac{1}{3}\mathbf{b}$
   which does not satisfy the given condition.
3) the respective components of **a** *and* **b** are not proportional.This is not correct.
   Example: Let,

$$\mathbf{a} = \begin{pmatrix}a_1\\a_2\\a_3\end{pmatrix} \quad (1.0.1)$$

$$= \begin{pmatrix}1\\2\\3\end{pmatrix} \quad (1.0.2)$$

$$\mathbf{b} = \begin{pmatrix}b_1\\b_2\\b_3\end{pmatrix} \quad (1.0.3)$$

$$= \begin{pmatrix}2\\4\\6\end{pmatrix} \quad (1.0.4)$$

$$b_1 = 2a_1, b_2 = 2a_2, b_3 = 2a_3 \quad (1.0.5)$$

   Here, we can observe that the respective components of **a** *and* **b** are proportional.
4) both the vectors **a** *and* **b** have same direction, but different magnitudes.This is incorrect, because if the two vectors are collinear then they may have same directions or opposite directions, in both the areas they will be collinear. Example: Let,

$$\mathbf{a} = \begin{pmatrix}1\\1\\1\end{pmatrix} \quad (1.0.6)$$

$$\mathbf{b} = \begin{pmatrix}-1\\-1\\-1\end{pmatrix} \quad (1.0.7)$$

   Here, we can observe that the two vectors are in opposite direction but collinear.