# Assignment-2

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*Abstract*—This document contains solution for ICSE 2019 class 12 maths Q.16(b)

**Problem 16(b):** If $\overrightarrow{a}$ and $\overrightarrow{b}$ are non-collinear vectors, find the value of $x$ such that vectors $\overrightarrow{\alpha} = (x-2)\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{\beta} = (3+2x)\overrightarrow{a} - 2\overrightarrow{b}$ are collinear.

**Solution:** $\alpha$ and $\beta$ can be written as,

$$\alpha = \begin{pmatrix} a & b \end{pmatrix}\begin{pmatrix} x-2 \\ 1 \end{pmatrix}, \beta = \begin{pmatrix} a & b \end{pmatrix}\begin{pmatrix} 3+2x \\ -2 \end{pmatrix} \quad (1)$$

Since $\alpha$ and $\beta$ are collinear,

$$\alpha = \lambda\beta$$

$$(2)$$

$$\implies \begin{pmatrix} a & b \end{pmatrix}\left(\begin{pmatrix} x-2 \\ 1 \end{pmatrix} - \lambda\begin{pmatrix} 3+2x \\ -2 \end{pmatrix}\right) = 0 \quad (3)$$

$$\implies \begin{pmatrix} a & b \end{pmatrix}\begin{pmatrix} (1-2\lambda)\,x - (2+3\lambda) \\ 1+2\lambda \end{pmatrix} = 0 \quad (4)$$

$$\implies \begin{pmatrix} (1-2\lambda)\,x - (2+3\lambda) \\ 1+2\lambda \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$(5)$$

Comparing every element of matrix in equation (5), we get,

$$1 + 2\lambda = 0 \quad (6)$$

$$\implies \lambda = \frac{-1}{2} \quad (7)$$

$$(1 - 2\lambda)\,x - (2 + 3\lambda) = 0 \quad (8)$$

Using equation (7) in (8),

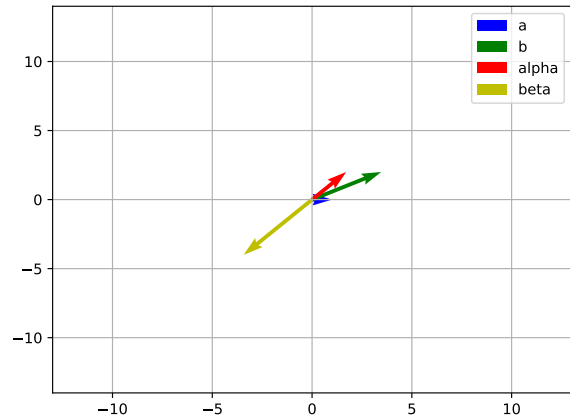$$2x - \frac{1}{2} = 0 \quad (9)$$

$$\implies x = \frac{1}{4} \quad (10)$$



Fig. 1.