

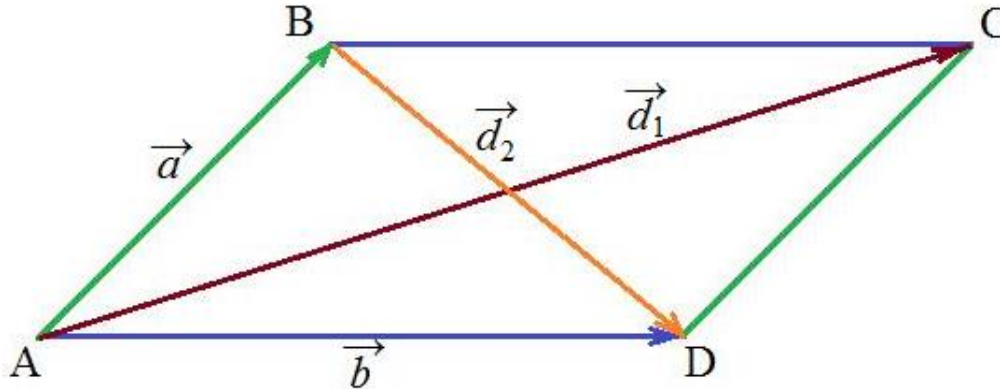
Answer on Question #70054 – Math – Calculus

Question

If \vec{a} and \vec{b} represent the non-parallel segments of a parallelogram, express the diagonal vectors in terms of \vec{a} and \vec{b} .

Solution

We have parallelogram $ABCD$.



$$\overrightarrow{AB} = \vec{a}, \overrightarrow{DC} = \vec{a}, \overrightarrow{AD} = \vec{b}, \overrightarrow{BC} = \vec{b}, \overrightarrow{AC} = \vec{d}_1, \overrightarrow{BD} = \vec{d}_2$$

Parallelogram law of vectors

$$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{AD} = \overrightarrow{AD} + \overrightarrow{AB}$$

$$\overrightarrow{BD} = \overrightarrow{BA} + \overrightarrow{BC} = \overrightarrow{BC} + \overrightarrow{BA}$$

We see that $\overrightarrow{BA} = -\overrightarrow{AB}$

Then

$$\vec{d}_1 = \overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{AD} = \overrightarrow{AD} + \overrightarrow{AB} = \vec{a} + \vec{b} = \vec{b} + \vec{a}$$

$$\begin{aligned} \vec{d}_2 = \overrightarrow{BD} &= \overrightarrow{BA} + \overrightarrow{BC} = \overrightarrow{BC} + \overrightarrow{BA} = -\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{BC} + (-\overrightarrow{AB}) = \\ &= -\vec{a} + \vec{b} = \vec{b} - \vec{a} \end{aligned}$$

$$\text{Answer: } \vec{d}_1 = \vec{a} + \vec{b} = \vec{b} + \vec{a}; \vec{d}_2 = -\vec{a} + \vec{b} = \vec{b} - \vec{a}.$$