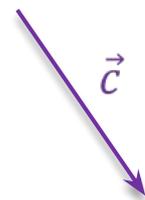
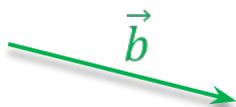
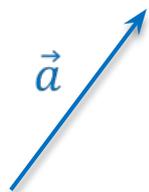
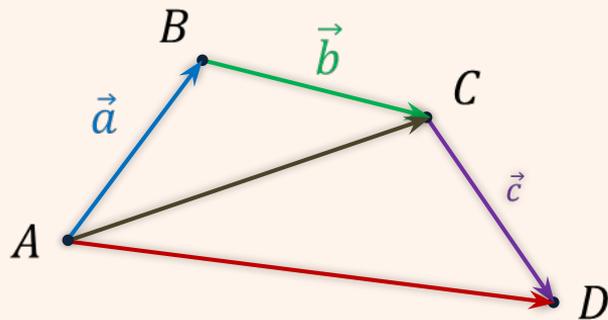


# Сумма нескольких векторов



## Правило многоугольника



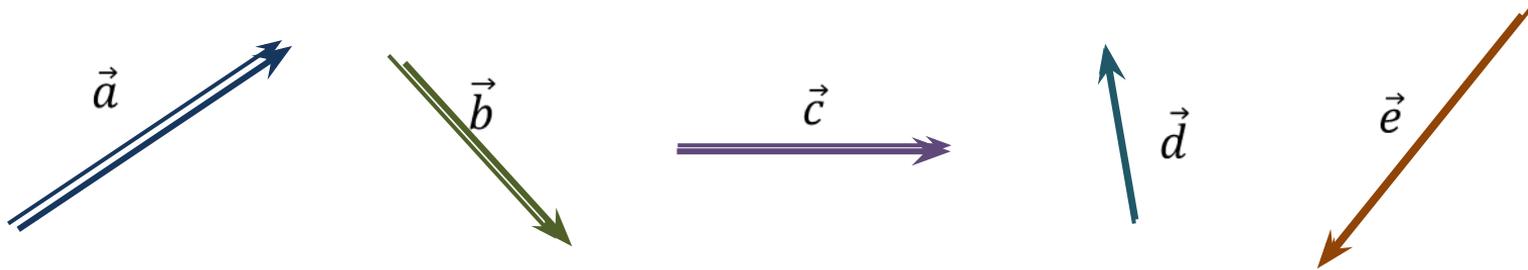
$$1. \overrightarrow{AB} = \vec{a}$$

$$2. \overrightarrow{BC} = \vec{b}$$

$$3. \overrightarrow{CD} = \vec{c}$$

$$4. \overrightarrow{AD} = \vec{a} + \vec{b} + \vec{c}$$

**Задача.** Построить вектор суммы попарно неколлинеарных векторов  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$ ,  $\vec{d}$  и  $\vec{e}$ .



**Построение.**

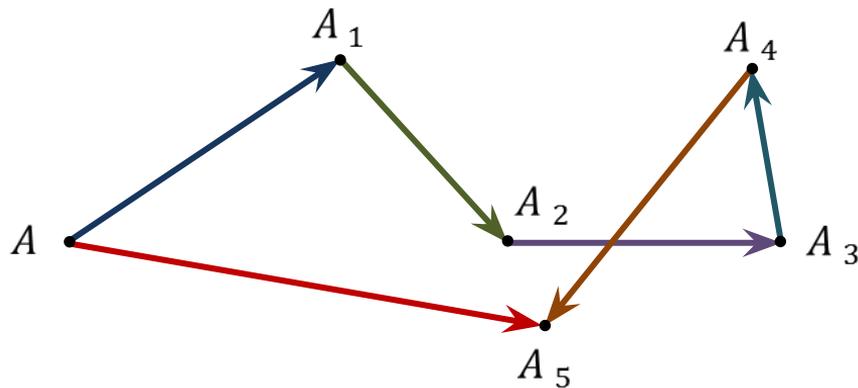
$$\overrightarrow{AA_1} = \vec{a}$$

$$\overrightarrow{A_1A_2} = \vec{b}$$

$$\overrightarrow{A_2A_3} = \vec{c}$$

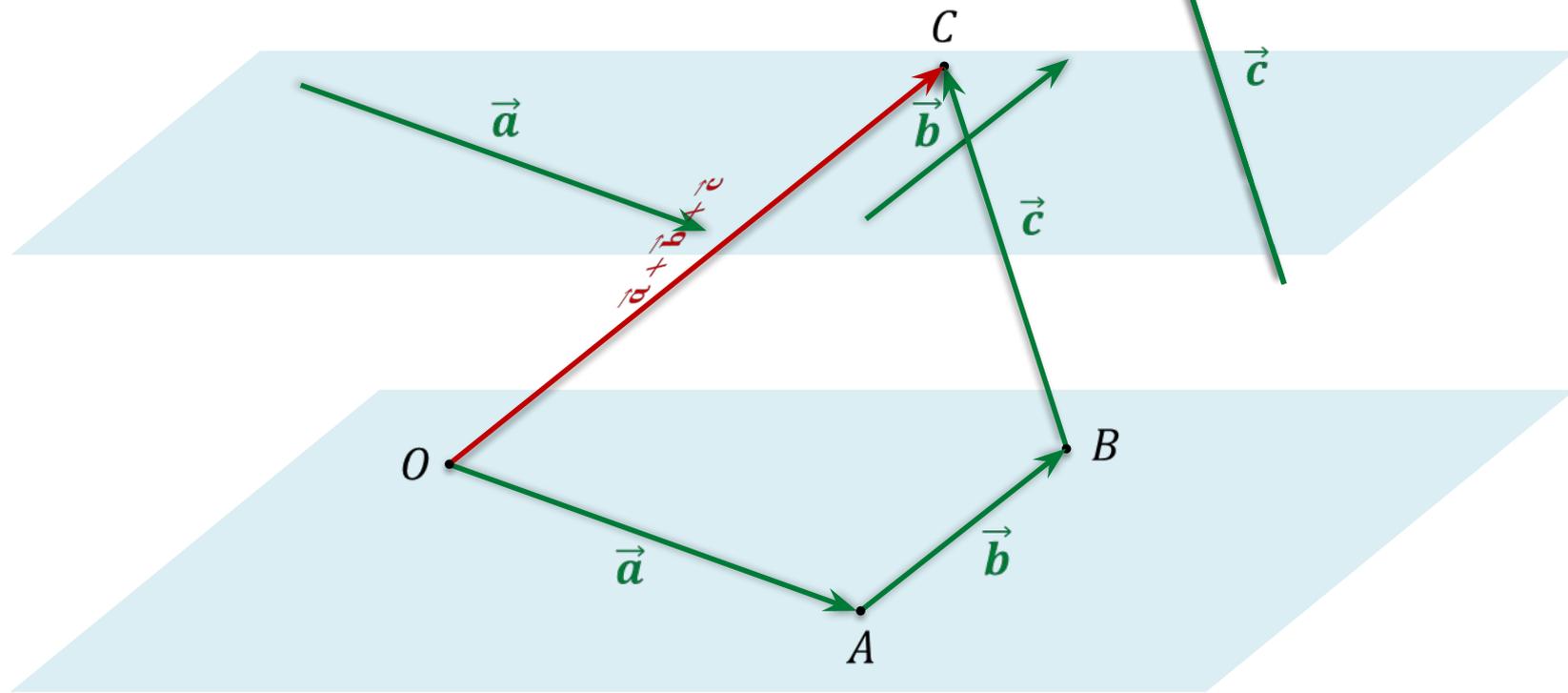
$$\overrightarrow{A_3A_4} = \vec{d}$$

$$\overrightarrow{A_4A_5} = \vec{e}$$

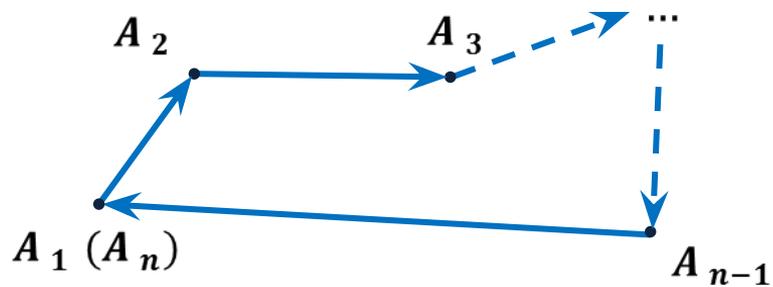
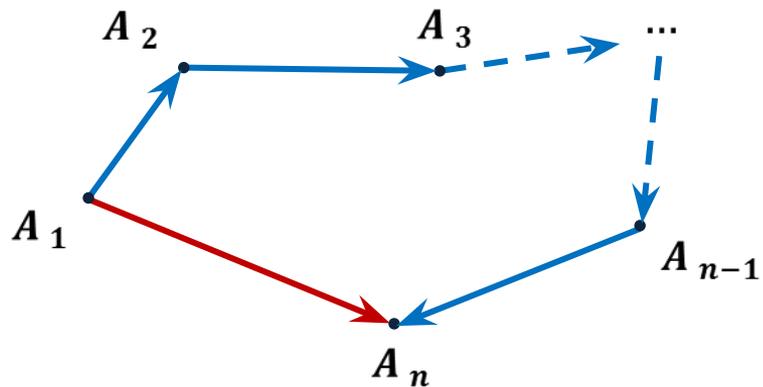


$$\overrightarrow{AA_1} + \overrightarrow{A_1A_2} + \overrightarrow{A_2A_3} + \overrightarrow{A_3A_4} + \overrightarrow{A_4A_5} = \overrightarrow{AA_5} \quad \Rightarrow \quad \vec{a} + \vec{b} + \vec{c} + \vec{d} + \vec{e} = \overrightarrow{AA_5}$$

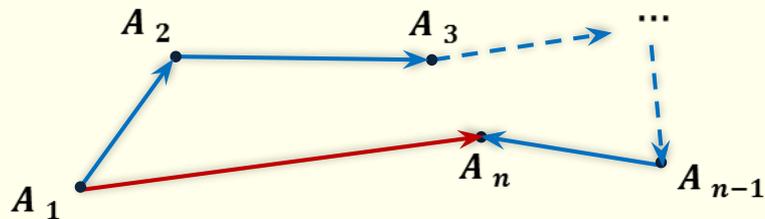
# Правило многоугольника



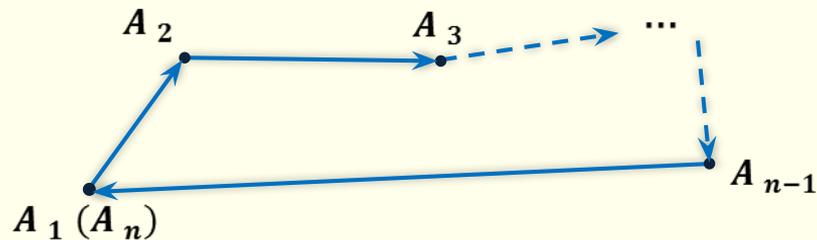
# Правило многоугольника



$$\overrightarrow{A_1A_2} + \overrightarrow{A_2A_3} + \dots + \overrightarrow{A_{n-1}A_n} = \overrightarrow{0}$$



$$\overrightarrow{A_1A_2} + \overrightarrow{A_2A_3} + \dots + \overrightarrow{A_{n-1}A_n} = \overrightarrow{A_1A_n}$$



$$\overrightarrow{A_1A_2} + \overrightarrow{A_2A_3} + \dots + \overrightarrow{A_{n-1}A_n} = \vec{0}$$

**Задача №1.** Упростить выражения.

а)  $\overrightarrow{AB} + \overrightarrow{BA} + \overrightarrow{CD} + \overrightarrow{MN} + \overrightarrow{DC} + \overrightarrow{NM} = \overrightarrow{AB} + \overrightarrow{BA} + \overrightarrow{CD} + \overrightarrow{DC} + \overrightarrow{MN} + \overrightarrow{NM} = \vec{0} + \vec{0} + \vec{0} = \vec{0}$

б)  $\overrightarrow{KM} + \overrightarrow{DF} + \overrightarrow{AC} + \overrightarrow{FK} + \overrightarrow{CD} + \overrightarrow{CA} + \overrightarrow{MP} = \overrightarrow{CD} + \overrightarrow{DF} + \overrightarrow{FK} + \overrightarrow{KM} + \overrightarrow{MP} = \overrightarrow{CP}$

в)  $\overrightarrow{OP} - \overrightarrow{EP} + \overrightarrow{KD} - \overrightarrow{KA} = \overrightarrow{OP} + (-\overrightarrow{EP}) + \overrightarrow{KD} + (-\overrightarrow{KA}) = \overrightarrow{OP} + \overrightarrow{PE} + \overrightarrow{AK} + \overrightarrow{KD} = \overrightarrow{OE} + \overrightarrow{AD}$

г)  $\overrightarrow{AC} - \overrightarrow{BC} - \overrightarrow{PM} - \overrightarrow{AP} + \overrightarrow{BM} = \overrightarrow{AC} + \overrightarrow{CB} + \overrightarrow{MP} + \overrightarrow{PA} + \overrightarrow{BM} = \overrightarrow{AC} + \overrightarrow{CB} + \overrightarrow{BM} + \overrightarrow{MP} + \overrightarrow{PA} = \vec{0}$

**Задача №2.**  $A, B, C, D$  — произвольные точки пространства.

Представить вектор  $\overrightarrow{AB}$  в виде алгебраической суммы векторов:

а)  $\overrightarrow{AC}, \overrightarrow{DC}, \overrightarrow{BD}$

б)  $\overrightarrow{DA}, \overrightarrow{DC}, \overrightarrow{CB}$

в)  $\overrightarrow{DA}, \overrightarrow{CD}, \overrightarrow{BC}$

**Решение.**

а)  $\overrightarrow{AC}, \overrightarrow{DC}, \overrightarrow{BD}$

$$\overrightarrow{AB} = \overrightarrow{AC} + \overrightarrow{CD} + \overrightarrow{DB} = \overrightarrow{AC} + (-\overrightarrow{DC}) + (-\overrightarrow{BD}) = \overrightarrow{AC} - \overrightarrow{DC} - \overrightarrow{BD}$$

б)  $\overrightarrow{DA}, \overrightarrow{DC}, \overrightarrow{CB}$

$$\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CB} = -\overrightarrow{DA} + \overrightarrow{DC} + \overrightarrow{CB}$$

в)  $\overrightarrow{DA}, \overrightarrow{CD}, \overrightarrow{BC}$

$$\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CB} = -\overrightarrow{DA} + (-\overrightarrow{CD}) + (-\overrightarrow{BC}) = -\overrightarrow{DA} - \overrightarrow{CD} - \overrightarrow{BC}$$

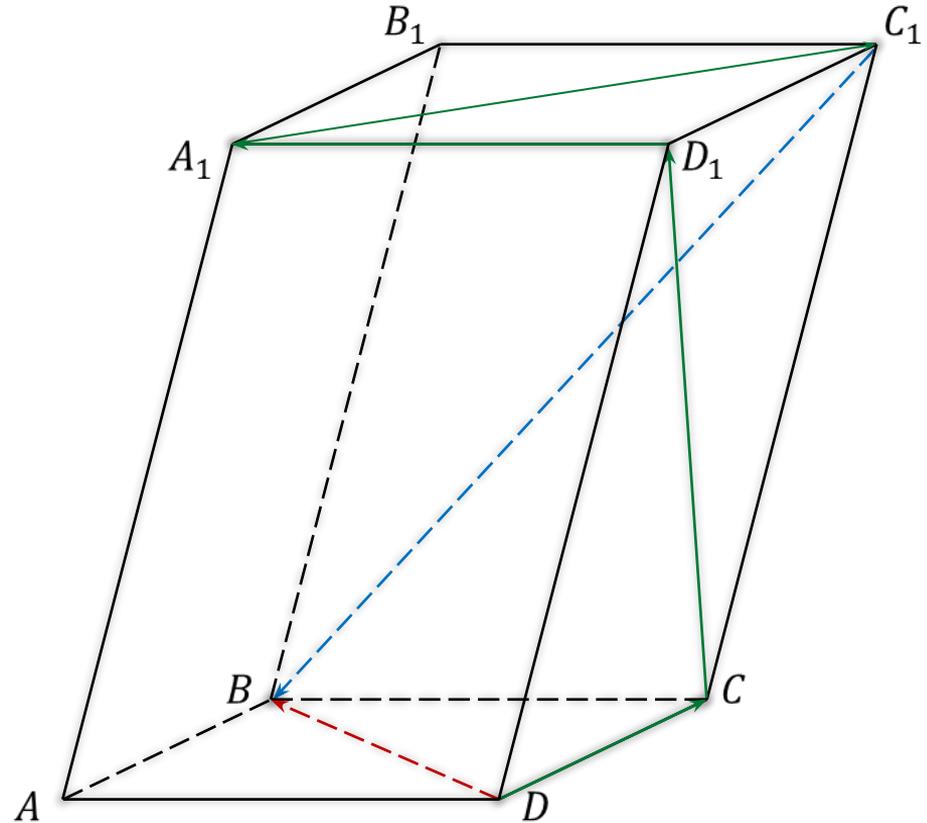
$ABCD A_1 B_1 C_1 D_1$  – параллелепипед.

а)  $\overrightarrow{DC} + \overrightarrow{D_1 A_1} + \overrightarrow{CD_1} + \vec{x} + \overrightarrow{A_1 C_1} = \overrightarrow{DB}$   
 $\vec{x} = \overrightarrow{C_1 B}$

б)  $\overrightarrow{DA} + \vec{x} + \overrightarrow{D_1 B} + \overrightarrow{AD_1} + \overrightarrow{BA} = \overrightarrow{DC}$

в)  $\overrightarrow{AA_1} + \overrightarrow{B_1 C} - \vec{x} = \overrightarrow{BA}$

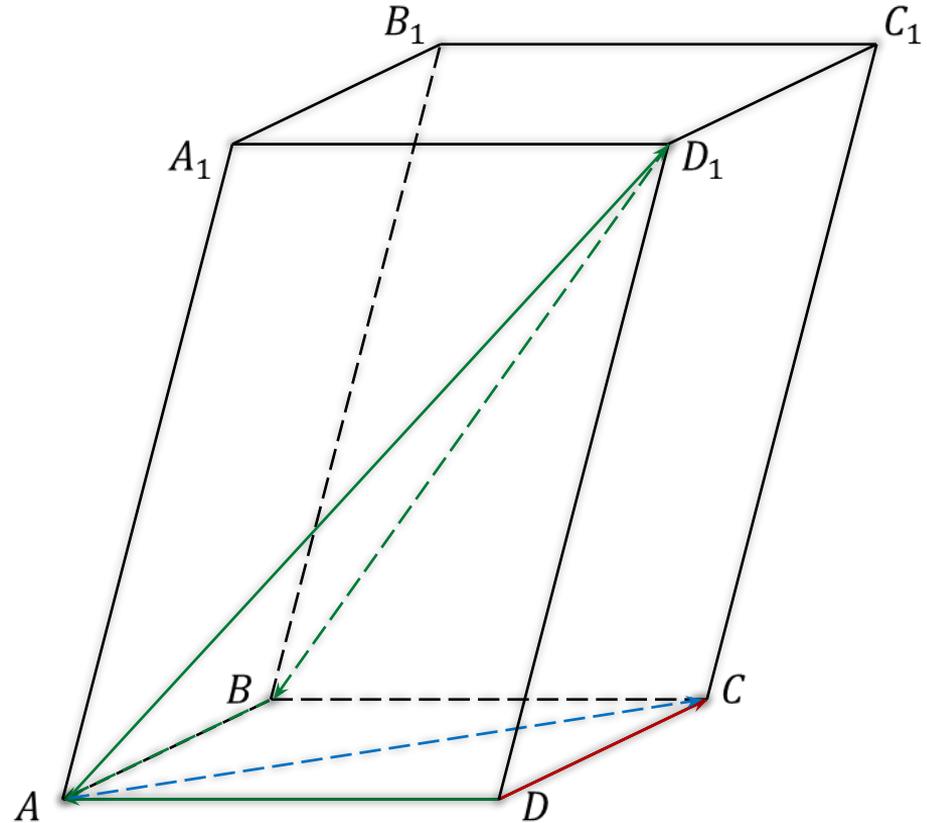
г)  $\overrightarrow{AC_1} - \overrightarrow{BB_1} + \vec{x} = \overrightarrow{AB}$



$ABCD A_1 B_1 C_1 D_1$  – параллелепипед.

$$\text{a) } \overrightarrow{DC} + \overrightarrow{D_1 A_1} + \overrightarrow{CD_1} + \vec{x} + \overrightarrow{A_1 C_1} = \overrightarrow{DB}$$
$$\vec{x} = \overrightarrow{C_1 B}$$

$$\text{б) } \overrightarrow{DA} + \vec{x} + \overrightarrow{D_1 B} + \overrightarrow{AD_1} + \overrightarrow{BA} = \overrightarrow{DC}$$
$$\vec{x} = \overrightarrow{AC}$$

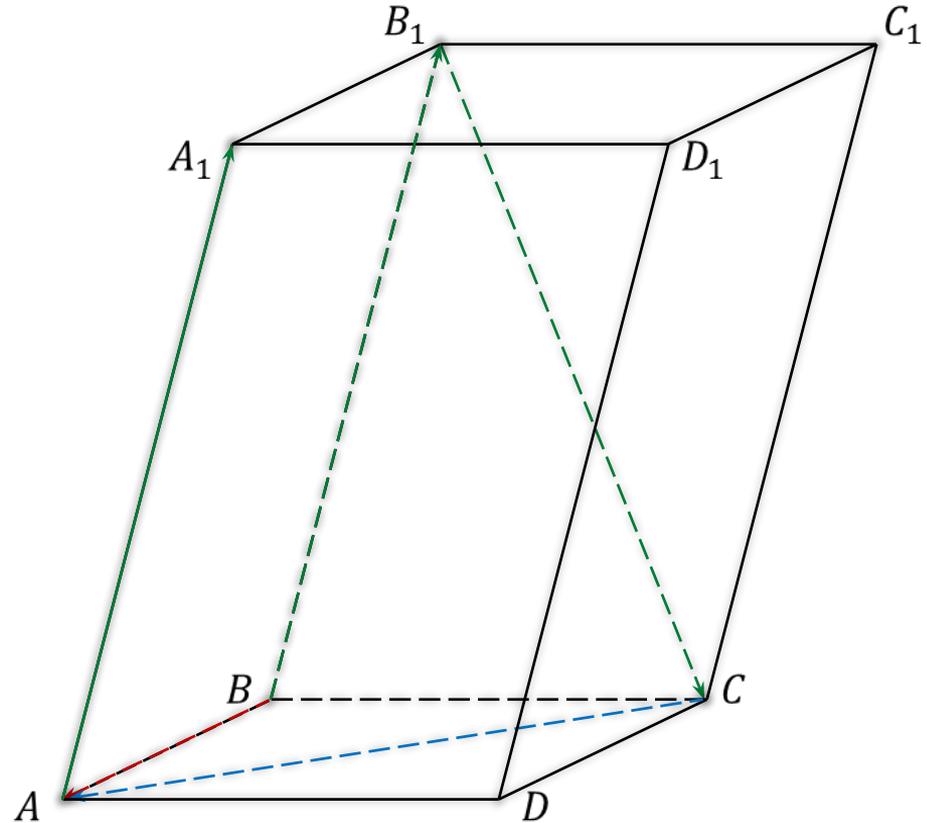


$ABCD A_1 B_1 C_1 D_1$  – параллелепипед.

$$\text{a) } \overrightarrow{DC} + \overrightarrow{D_1 A_1} + \overrightarrow{CD_1} + \vec{x} + \overrightarrow{A_1 C_1} = \overrightarrow{DB}$$
$$\vec{x} = \overrightarrow{C_1 B}$$

$$\text{б) } \overrightarrow{DA} + \vec{x} + \overrightarrow{D_1 B} + \overrightarrow{AD_1} + \overrightarrow{BA} = \overrightarrow{DC}$$
$$\vec{x} = \overrightarrow{AC}$$

$$\text{в) } \overrightarrow{AA_1} + \overrightarrow{B_1 C} - \vec{x} = \overrightarrow{BA}$$
$$\overrightarrow{BB_1} + \overrightarrow{B_1 C} - \vec{x} = \overrightarrow{BA}$$
$$-\vec{x} = \overrightarrow{CA} \Rightarrow \vec{x} = \overrightarrow{AC}$$



$ABCD A_1 B_1 C_1 D_1$  – параллелепипед.

$$\text{а) } \overrightarrow{DC} + \overrightarrow{D_1 A_1} + \overrightarrow{CD_1} + \vec{x} + \overrightarrow{A_1 C_1} = \overrightarrow{DB}$$

$$\vec{x} = \overrightarrow{C_1 B}$$

$$\text{б) } \overrightarrow{DA} + \vec{x} + \overrightarrow{D_1 B} + \overrightarrow{AD_1} + \overrightarrow{BA} = \overrightarrow{DC}$$

$$\vec{x} = \overrightarrow{DC}$$

$$\text{в) } \overrightarrow{AA_1} + \overrightarrow{B_1 C} - \vec{x} = \overrightarrow{BA}$$

$$\overrightarrow{BB_1} + \overrightarrow{B_1 C} - \vec{x} = \overrightarrow{BA}$$

$$-\vec{x} = \overrightarrow{CA} \Rightarrow \vec{x} = \overrightarrow{AC}$$

$$\text{г) } \overrightarrow{AC_1} - \overrightarrow{BB_1} + \vec{x} = \overrightarrow{AB}$$

$$\overrightarrow{AC_1} + (-\overrightarrow{BB_1}) + \vec{x} = \overrightarrow{AB}$$

$$\overrightarrow{AC_1} + \overrightarrow{B_1 B} + \vec{x} = \overrightarrow{AB}$$

$$\vec{x} = \overrightarrow{C_1 B_1}$$

