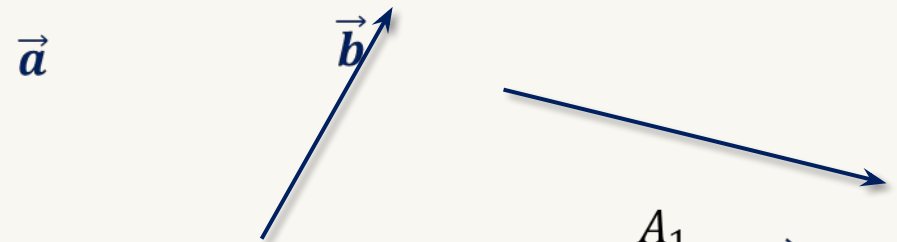


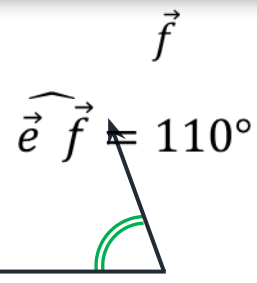
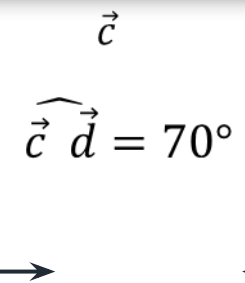
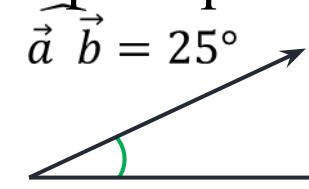
# Угол между векторами

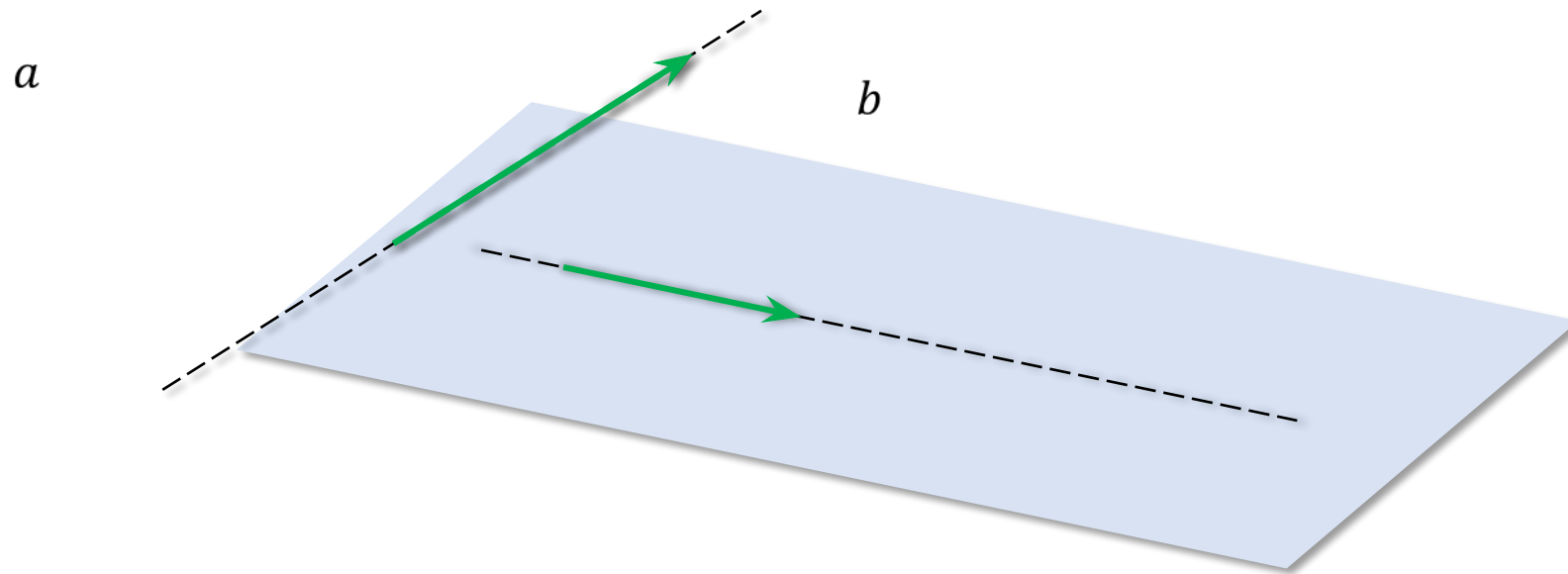
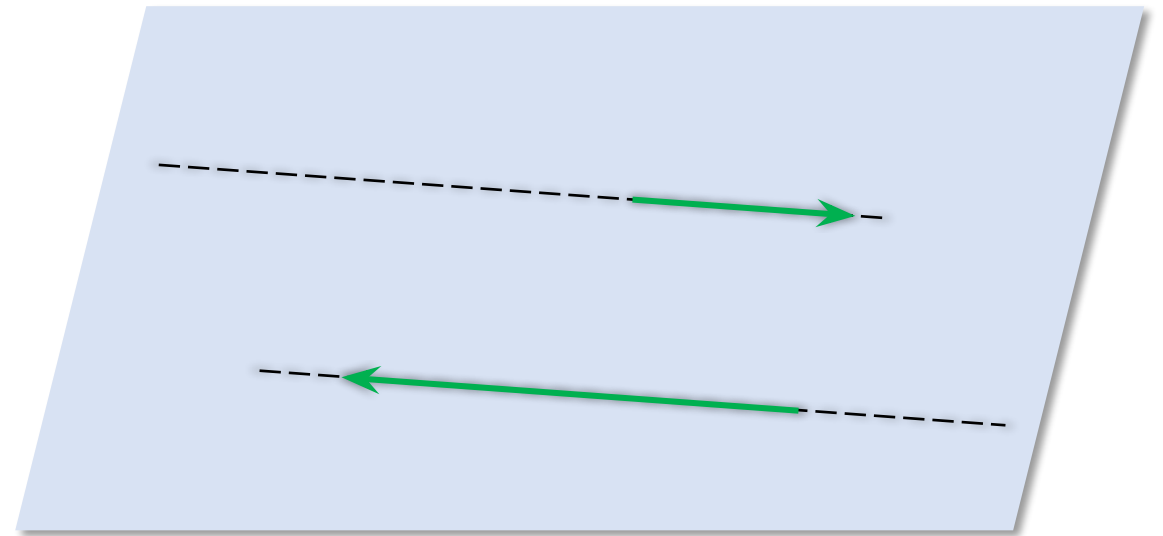
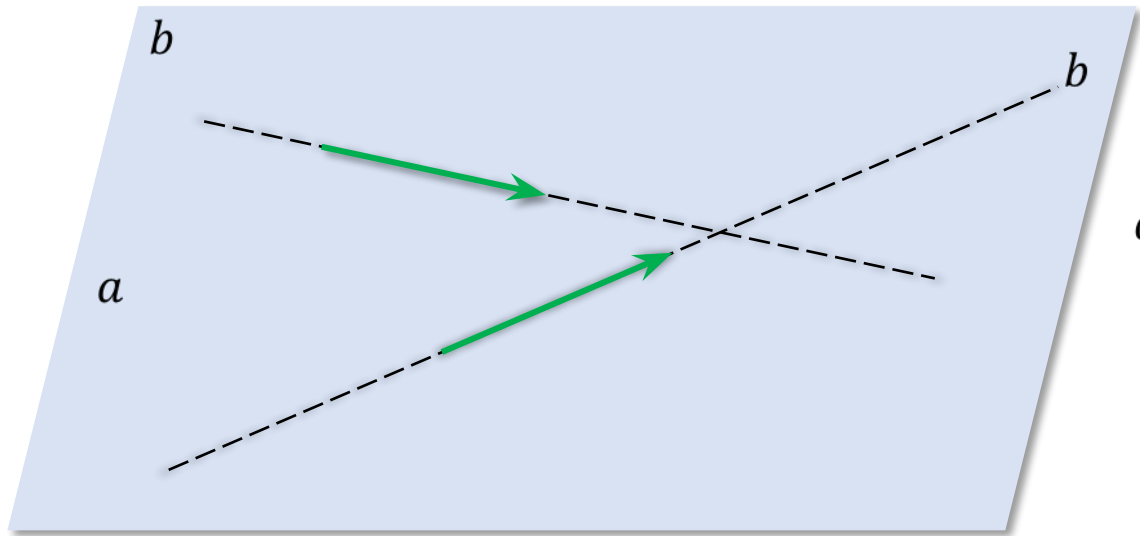


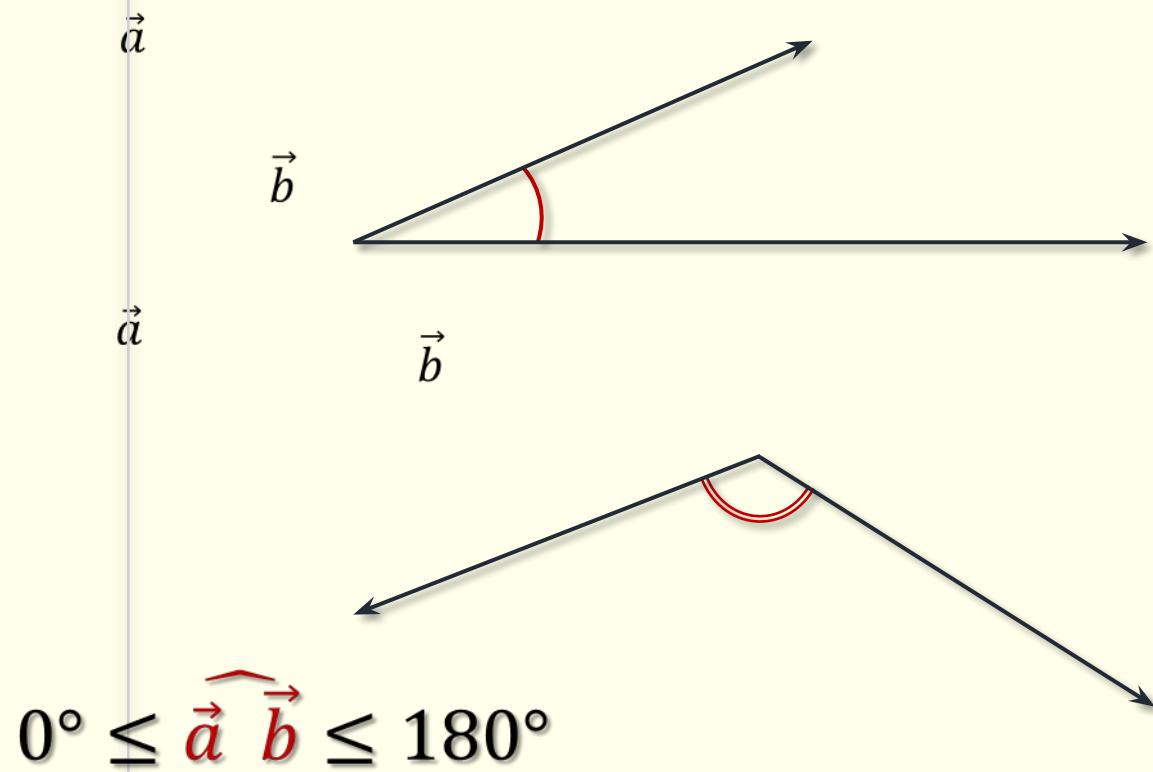
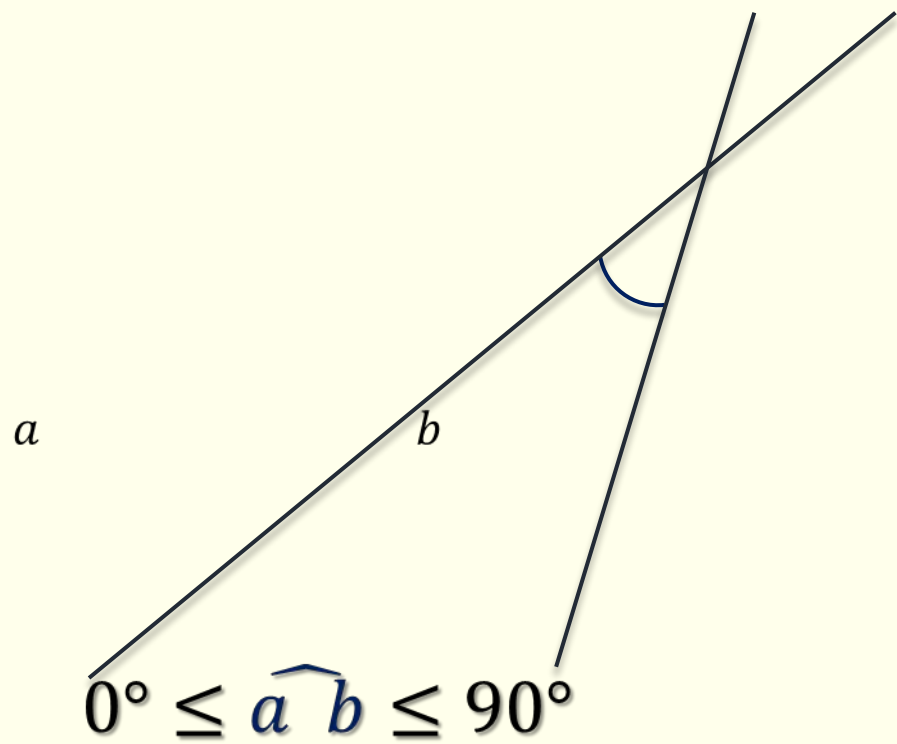
«Угол между векторами  $\vec{a}$  и  $\vec{b}$  равен  $\alpha$ »

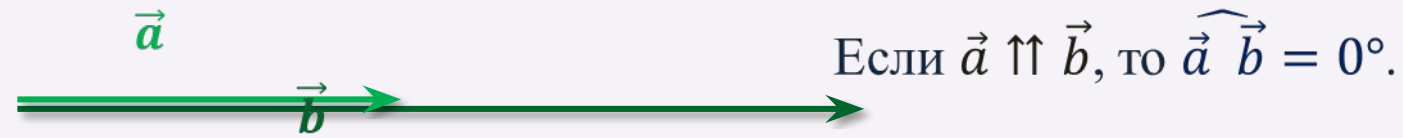
$\widehat{\vec{a} \vec{b}} = \alpha$

Пример:









$\vec{a}$

$\vec{b}$

$\vec{a}$

$\vec{b}$

$\vec{b}$

.

$\vec{a}$

.

.

.

Если  $\vec{a} = \vec{0}$ , то  $\widehat{\vec{a} \vec{b}} = 0^\circ$ .    Если  $\vec{b} = \vec{0}$ , то  $\widehat{\vec{a} \vec{b}} = 0^\circ$ .    Если  $\vec{a} = \vec{b} = \vec{0}$ , то  $\widehat{\vec{a} \vec{b}} = 0^\circ$ .

$\vec{a}$

$\vec{a}$

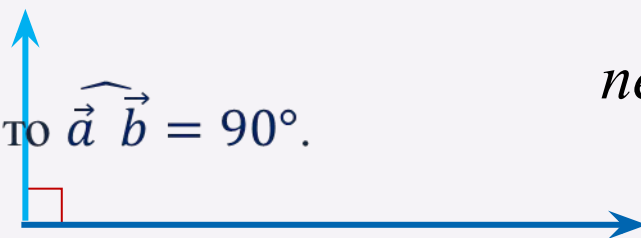
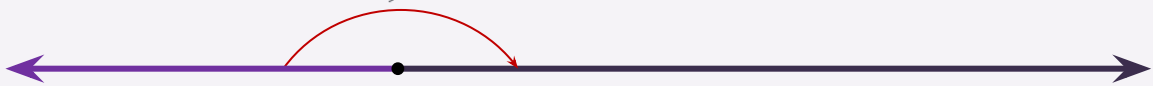
$\vec{b}$

$\vec{b}$

Если  $\vec{a} \uparrow\downarrow \vec{b}$ , то  $\widehat{\vec{a} \vec{b}} = 180^\circ$ .

Если  $\vec{a} \perp \vec{b}$ , то  $\widehat{\vec{a} \vec{b}} = 90^\circ$ .

*перпендикулярные  
векторы*



Найти углы между векторами (с

объяснением)

а)  $\widehat{B_1B} \widehat{B_1C} = \angle BB_1C = 45^\circ$  ( $\triangle BB_1C$  – прямоугольный, равнобедренный).

б)  $\widehat{DA} \widehat{B_1D_1}$

в)  $\widehat{A_1C_1} \widehat{A_1B_1}$

г)  $\widehat{BC} \widehat{AC}$

д)  $\widehat{BB_1} \widehat{AC}$

е)  $\widehat{B_1C} \widehat{AD_1}$

ж)  $\widehat{A_1D_1} \widehat{BC}$

з)  $\widehat{AA_1} \widehat{C_1C}$

$A_1$

$45^\circ$

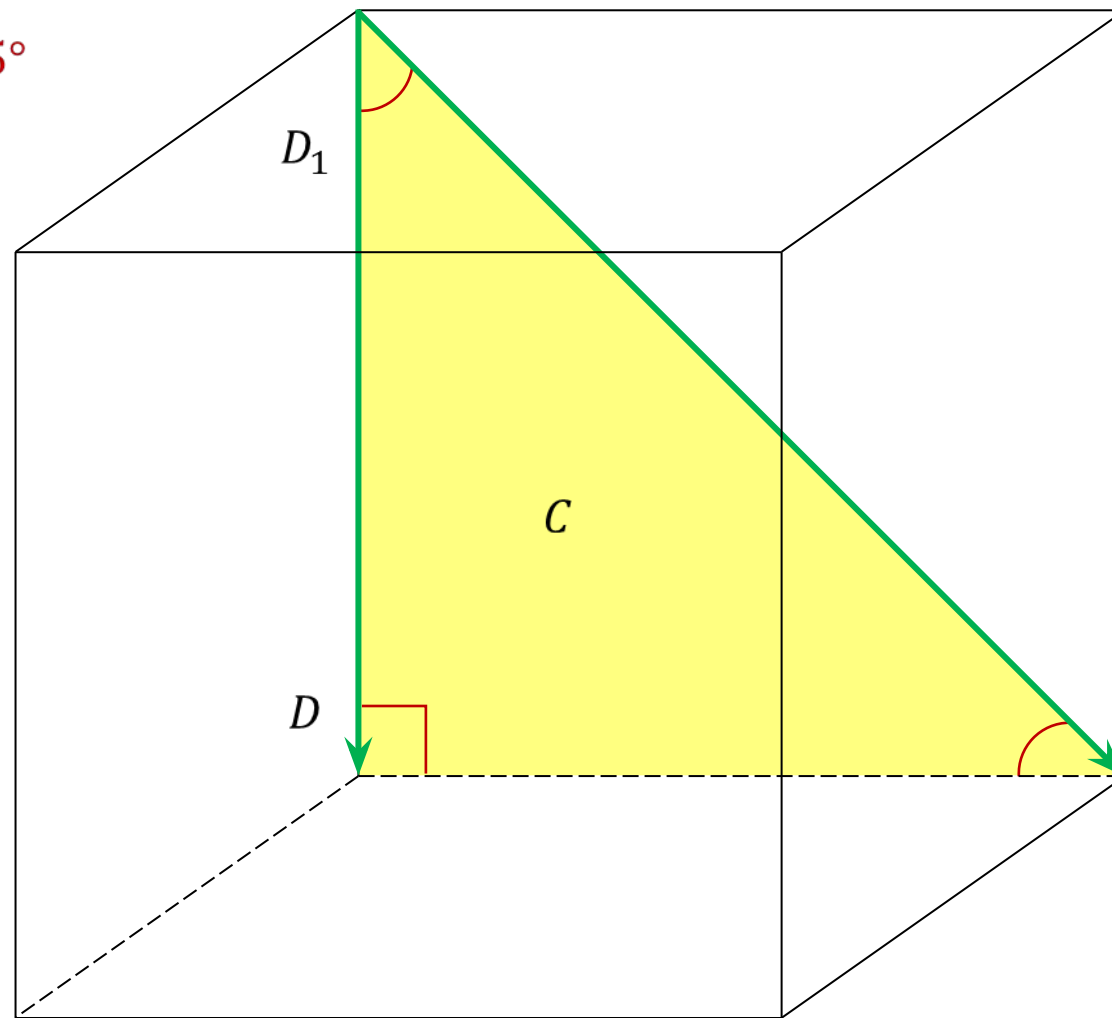
$D_1$

$B$

$C$

$A$

$D$

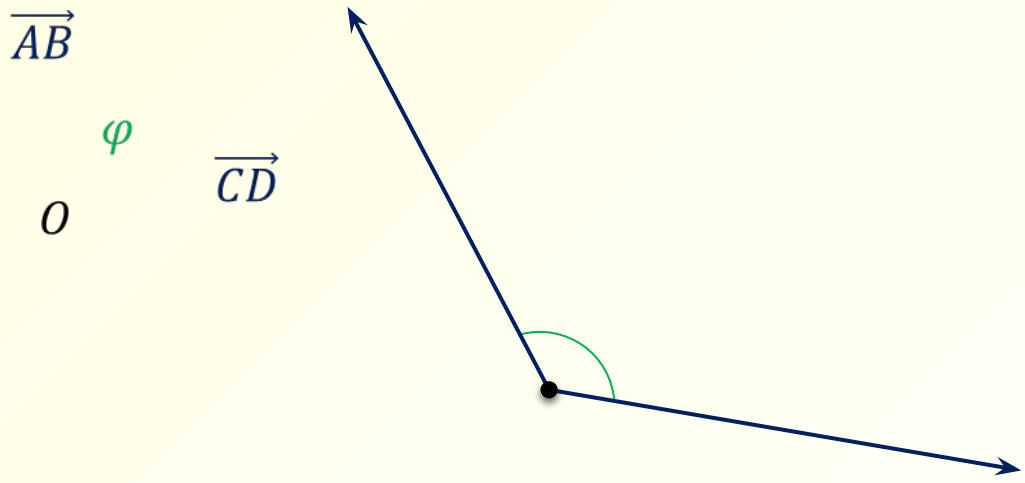
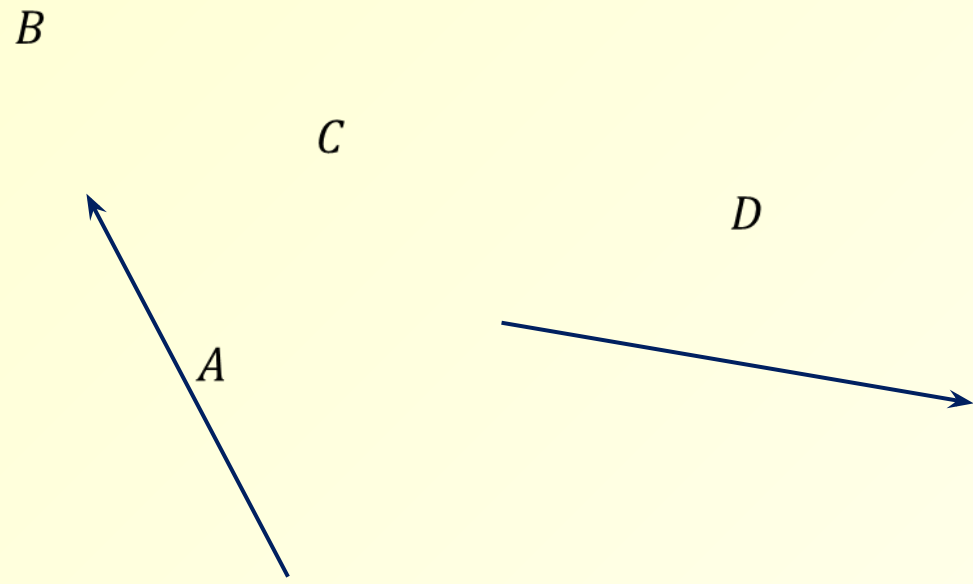


$$\overrightarrow{AB} \overrightarrow{CD} = \varphi$$

$$\overrightarrow{BA} \overrightarrow{DC}$$

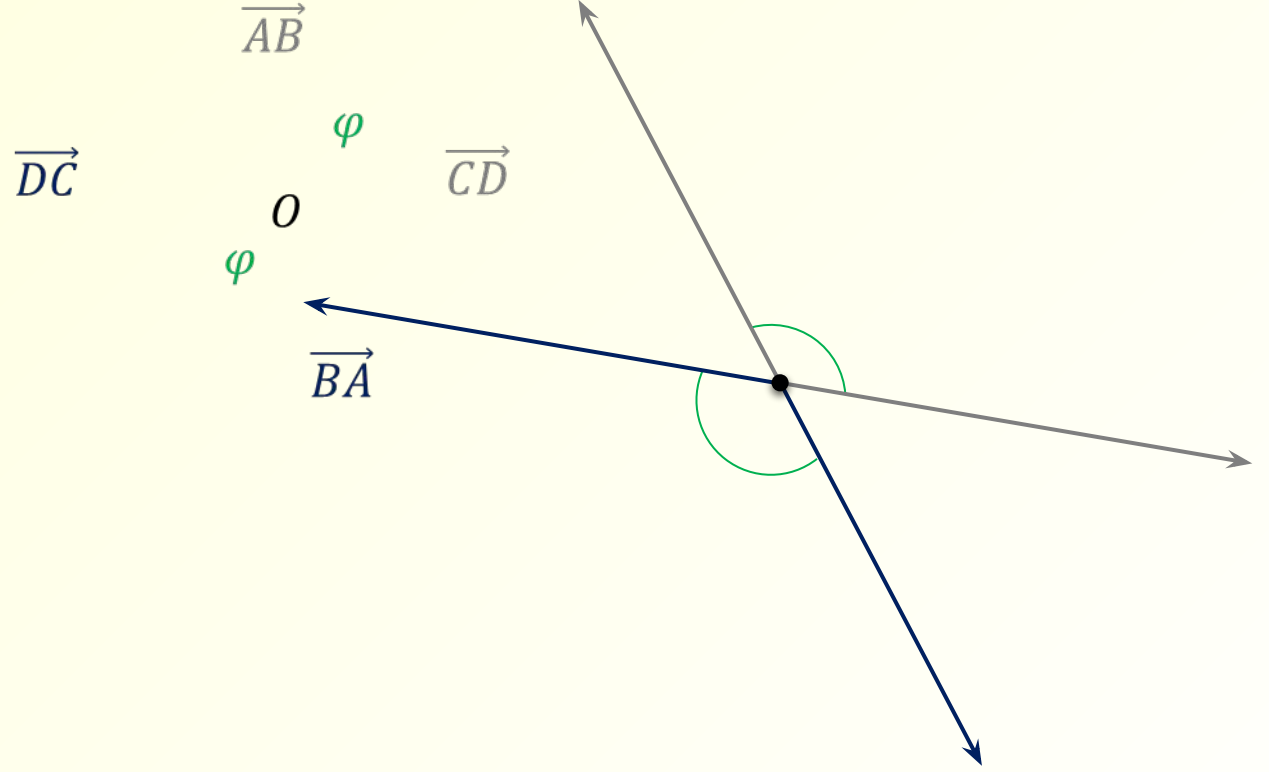
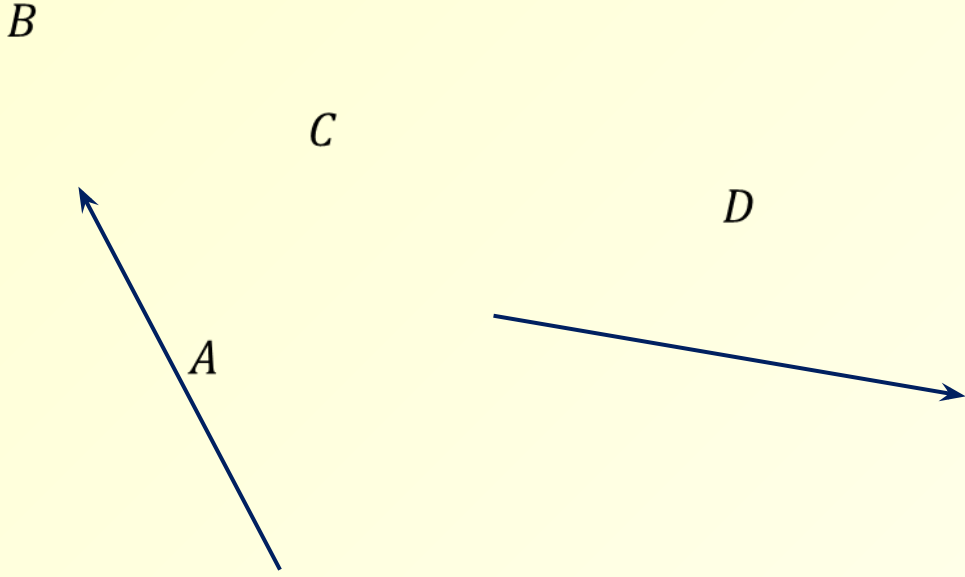
$$\overrightarrow{BA} \overrightarrow{CD}$$

$$\overrightarrow{AB} \overrightarrow{DC}$$



$$\overrightarrow{AB} \overleftarrow{CD} = \varphi$$

$$\overrightarrow{BA} \overleftarrow{DC} = \varphi$$

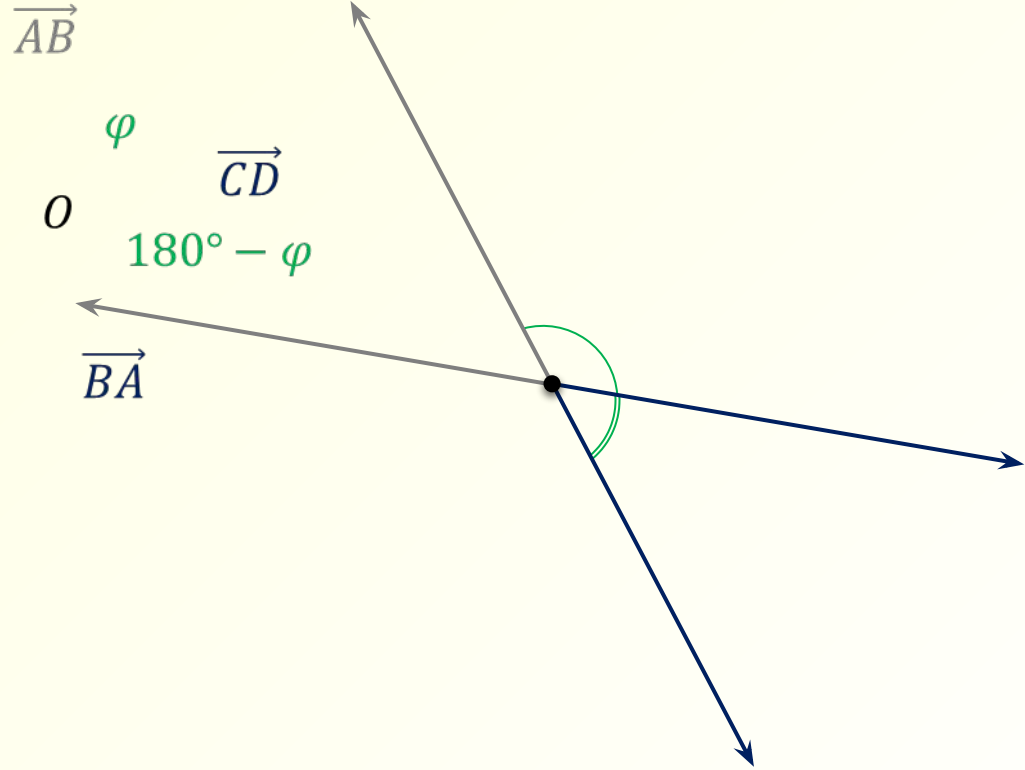
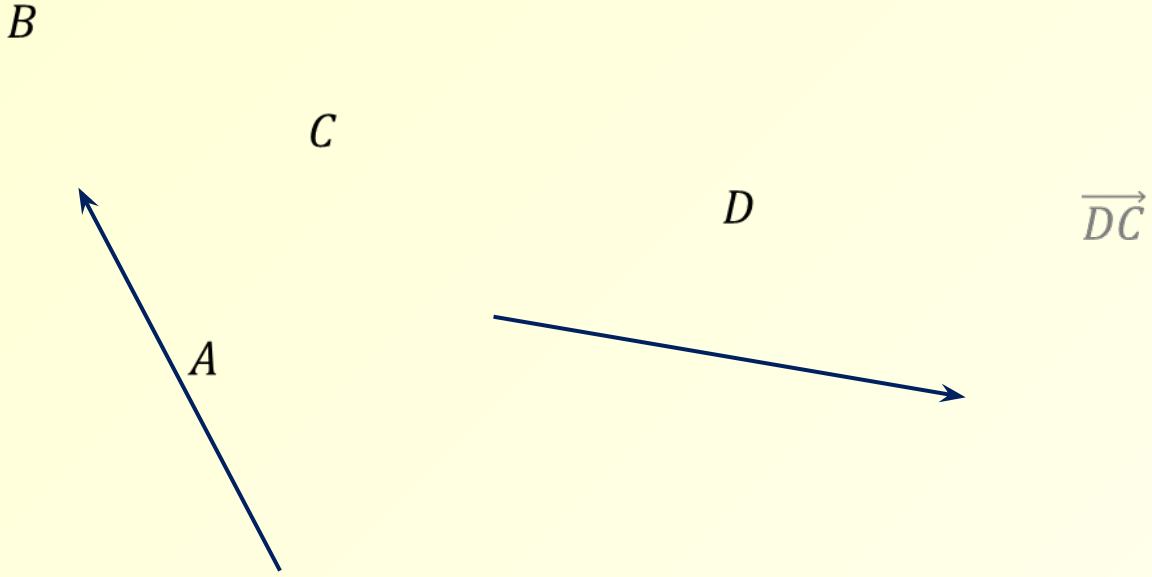




$$\widehat{\overrightarrow{AB} \overrightarrow{CD}} = \varphi$$

$$\widehat{\overrightarrow{BA} \overrightarrow{DC}} = \varphi$$

$$\widehat{\overrightarrow{BA} \overrightarrow{CD}} = 180^\circ - \varphi$$

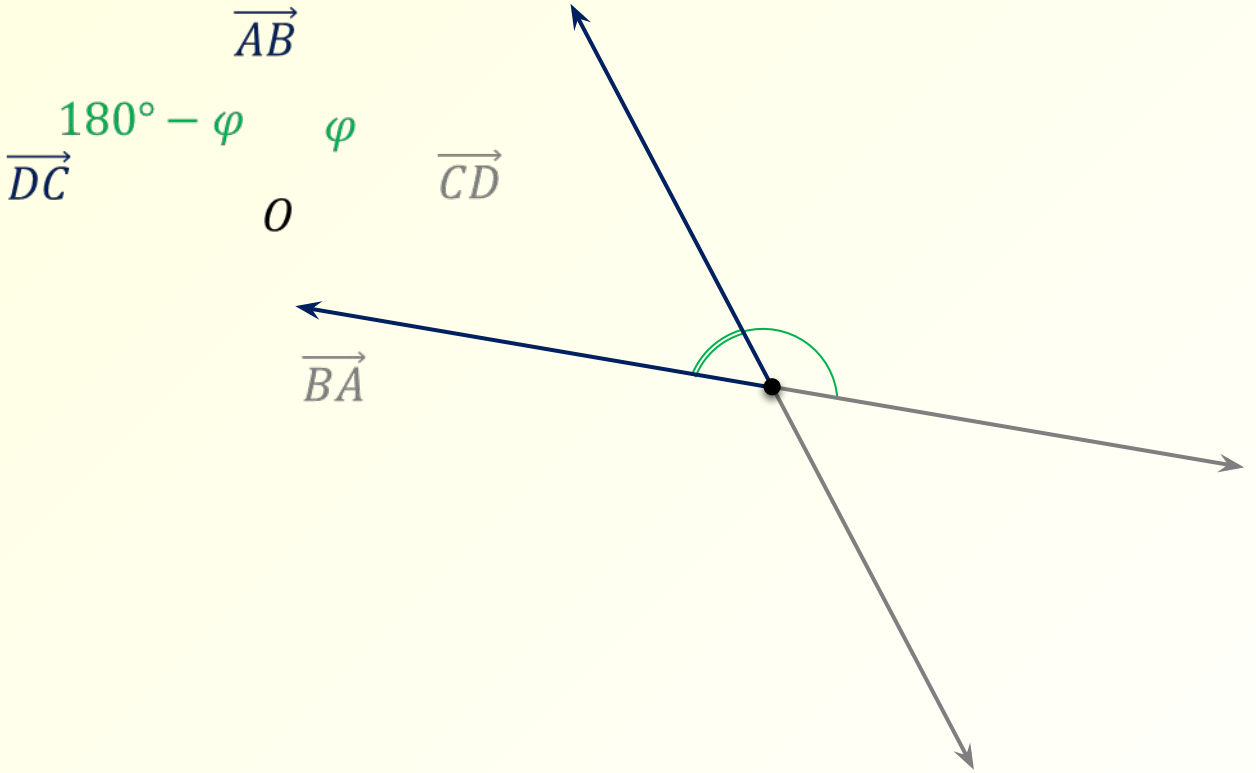
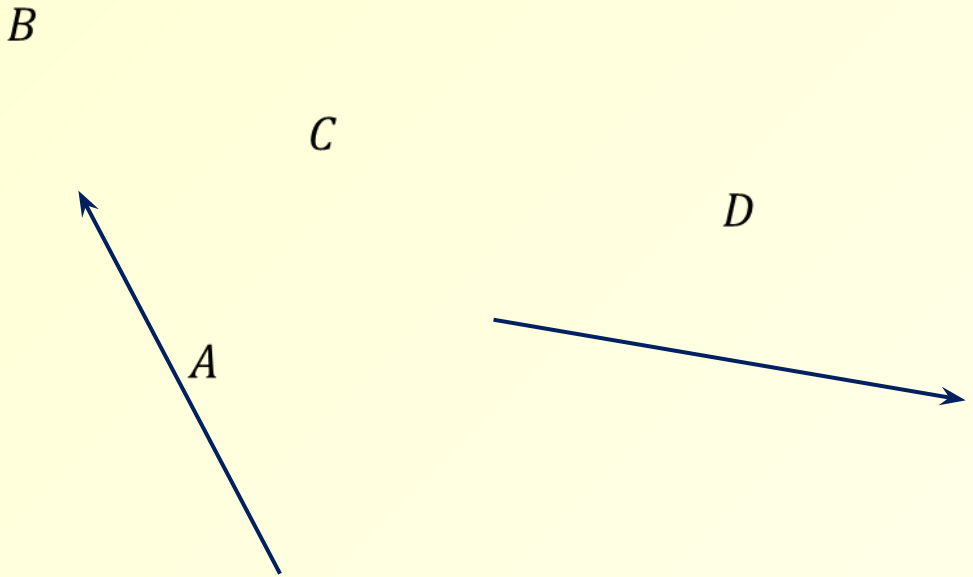


$$\widehat{\overrightarrow{AB} \overrightarrow{CD}} = \varphi$$

$$\widehat{\overrightarrow{BA} \overrightarrow{DC}} = \varphi$$

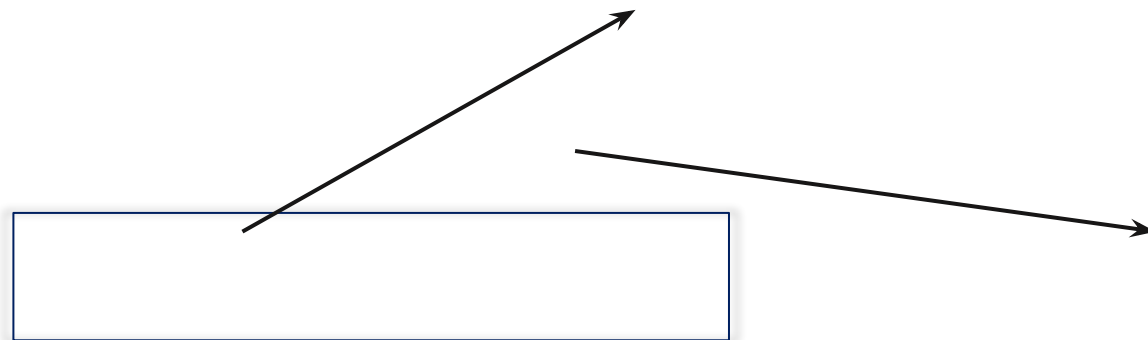
$$\widehat{\overrightarrow{BA} \overrightarrow{CD}} = 180^\circ - \varphi$$

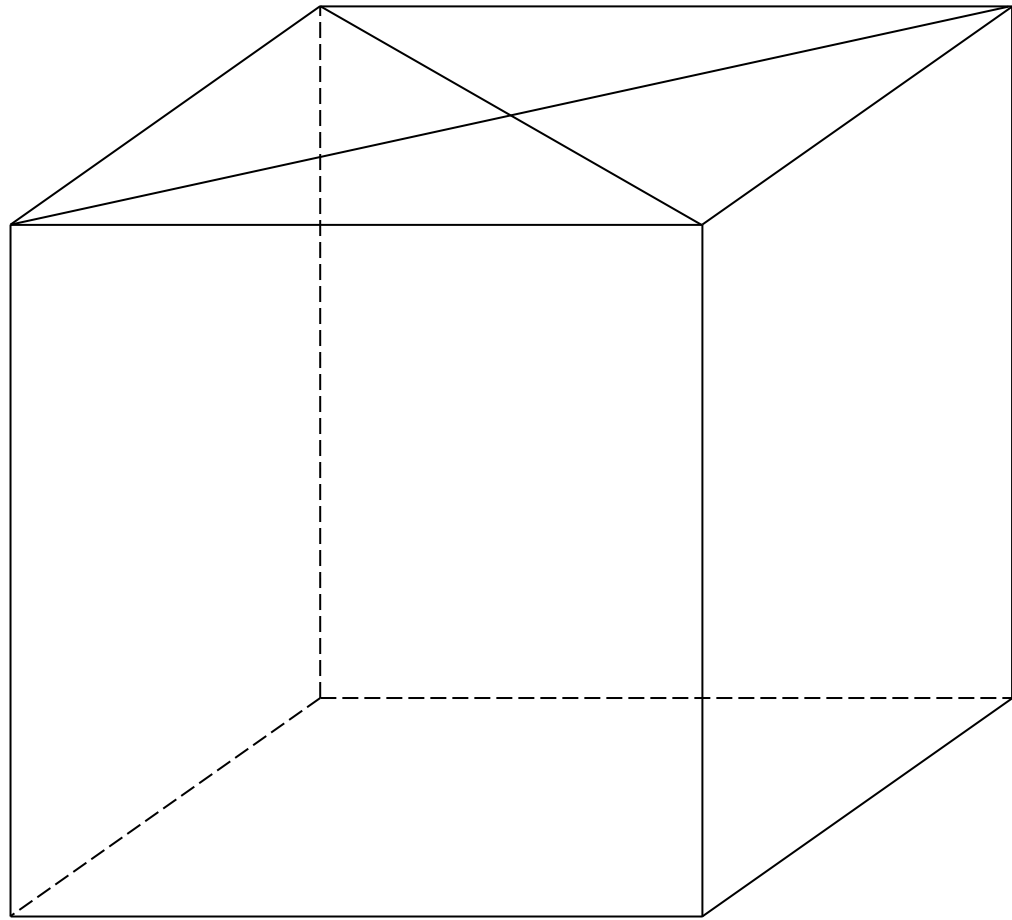
$$\widehat{\overrightarrow{AB} \overrightarrow{DC}} = 180^\circ - \varphi$$

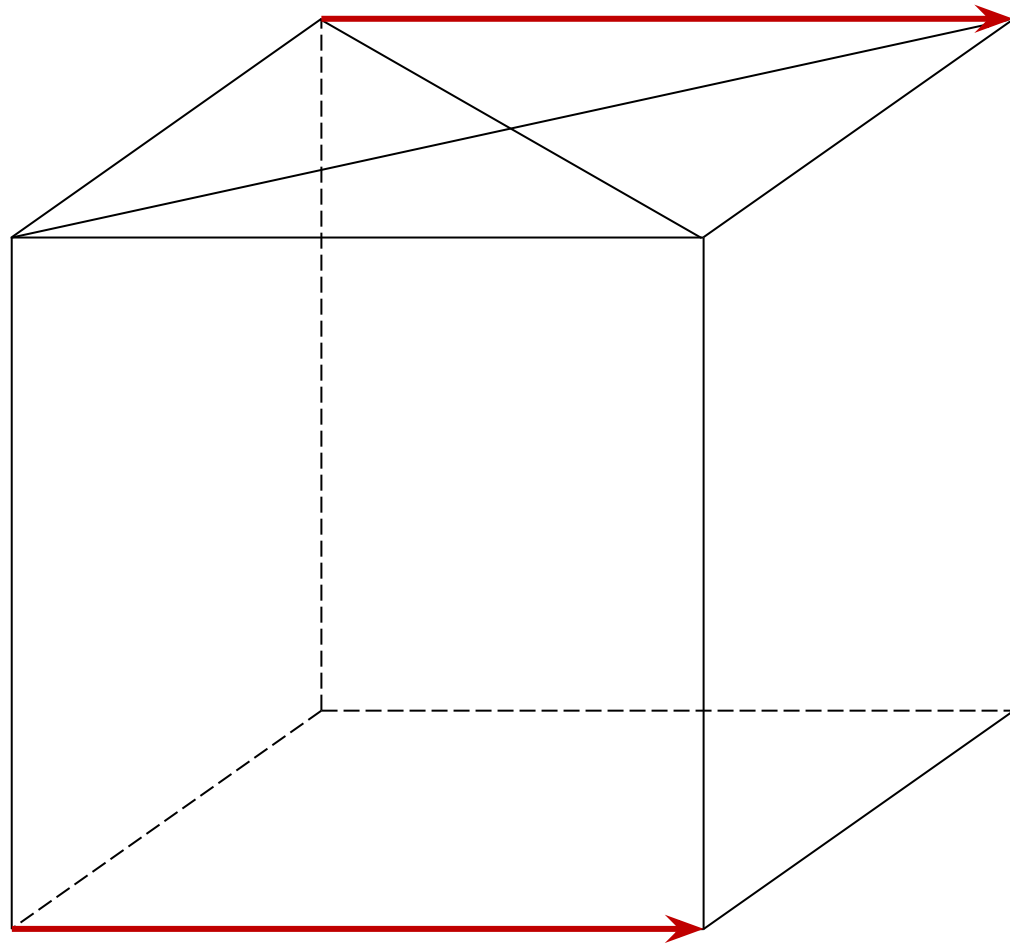


# Скалярное произведение векторов

**Определение. Скалярным произведением** двух векторов называется произведение их *длин* на *косинус* угла между ними.







**Вычислить скалярные произведения (показать решение).**

$$\text{б) } \overrightarrow{AC} \cdot \overrightarrow{C_1A_1} = |\overrightarrow{AC}| \cdot |\overrightarrow{C_1A_1}| \cdot \cos \widehat{\overrightarrow{AC} \overrightarrow{C_1A_1}} = \dots$$

$$\text{в) } \overrightarrow{D_1B} \cdot \overrightarrow{AC} = \dots$$

$$\text{г) } \overrightarrow{BA_1} \cdot \overrightarrow{BC_1} = \dots$$

$$\text{д) } \overrightarrow{A_1O_1} \cdot \overrightarrow{A_1C_1} = \dots$$

$$\text{е) } \overrightarrow{D_1O_1} \cdot \overrightarrow{B_1O_1} = \dots$$

$$\text{ж) } \overrightarrow{BO_1} \cdot \overrightarrow{C_1B} = \dots$$