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Actual problems of social and humanitarian sciences  
Актуальные проблемы социальных и гуманитарных наук

# Ijtimoiy-gumanitar fanlarning dolzarb muammolari

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**2026**

**SCIENCEPROBLEMS.UZ**

**IJTIMOIIY-GUMANITAR FANLARNING  
DOLZARB MUAMMOLARI**

*№ S/2 (6) – 2025*

**АКТУАЛЬНЫЕ ПРОБЛЕМЫ СОЦИАЛЬНО-  
ГУМАНИТАРНЫХ НАУК**

**ACTUAL PROBLEMS OF HUMANITIES AND SOCIAL SCIENCES**

**TOSHKENT-2026**

## **BOSH MUHARRIR:**

Isanova Feruza Tulqinovna

## **TAHRIR HAY'ATI:**

### *07.00.00- TARIX FANLARI:*

Yuldashev Anvar Ergashevich – tarix fanlari doktori, siyosiy fanlar nomzodi, professor;

Mavlanov Uktam Maxmasabirovich – tarix fanlari doktori, professor;

Xazratkulov Abror – tarix fanlari doktori, dotsent;

Tursunov Ravshan Normuratovich – tarix fanlari doktori;

Xolikulov Axmadjon Boymahmatovich – tarix fanlari doktori;

Gabrielyan Sofya Ivanovna – tarix fanlari doktori, dotsent;

Saidov Sarvar Atabullo o'g'li – katta ilmiy xodim, Imom Termiziy xalqaro ilmiy-tadqiqot markazi, ilmiy tadqiqotlar bo'limi.

### *08.00.00- IQTISODIYOT FANLARI:*

Karlibayeva Raya Xojabayevna – iqtisodiyot fanlari doktori, professor;

Nasirxodjayeva Dilafruz Sabitxanovna – iqtisodiyot fanlari doktori, professor;

Ostonokulov Azamat Abdukarimovich – iqtisodiyot fanlari doktori, professor;

Arabov Nurali Uralovich – iqtisodiyot fanlari doktori, professor;

Xudoyqulov Sadirdin Karimovich – iqtisodiyot fanlari doktori, dotsent;

Azizov Sherzod O'ktamovich – iqtisodiyot fanlari doktori, dotsent;

Xojayev Azizxon Saidaloxonovich – iqtisodiyot fanlari doktori, dotsent

Xolov Aktam Xatamovich – iqtisodiyot fanlari bo'yicha falsafa doktori (PhD), dotsent;

Shadiyeva Dildora Xamidovna – iqtisodiyot fanlari bo'yicha falsafa doktori (PhD), dotsent v.b.;

Shakarov Qulmat Ashirovich – iqtisodiyot fanlari nomzodi, dotsent.;

Jabborova Charos Aminovna - iqtisodiyot fanlari bo'yicha falsafa doktori (PhD).

### *09.00.00- FALSAFA FANLARI:*

Hakimov Nazar Hakimovich – falsafa fanlari doktori, professor;

Yaxshilikov Jo'raboy – falsafa fanlari doktori, professor;

G'aybullayev Otabek Muhammadiyevich – falsafa fanlari doktori, professor;

Saidova Kamola Uskanbayevna – falsafa fanlari doktori;

Hoshimxonov Mo'min – falsafa fanlari doktori, dotsent;

O'roqova Oysuluv Jamoliddinovna – falsafa fanlari doktori, dotsent;

Nosirxodjayeva Gulnora Abdukaxxarovna – falsafa fanlari nomzodi, dotsent;

Turdiyev Bexruz Sobirovich – falsafa fanlari doktori (DSc), Professor.

### *10.00.00- FILOLOGIYA FANLARI:*

Axmedov Oybek Saporbayevich – filologiya fanlari doktori, professor;

Ko'chimov Shuxrat Norqizilovich – filologiya fanlari doktori, dotsent;

Hasanov Shavkat Ahadovich – filologiya fanlari doktori, professor;

Baxronova Dilrabo Keldiyorovna – filologiya fanlari doktori, professor;

Mirsanov G'aybullo Qulmurodovich – filologiya fanlari doktori, professor;

Salaxutdinova Musharraf Isamutdinovna – filologiya fanlari nomzodi, dotsent;

Kuchkarov Raxman Urmanovich – filologiya fanlari nomzodi, dotsent v/b;

Yunusov Mansur Abdullayevich – filologiya fanlari nomzodi;

Saidov Ulugbek Aripovich – filologiya fanlari nomzodi, dotsent;

Qodirova Muqaddas Tog'ayevna - filologiya fanlari nomzodi, dotsent.

#### *12.00.00- YURIDIK FANLAR:*

Axmedshayeva Mavlyuda Axatovna – yuridik fanlar doktori, professor;

Muxitdinova Firyuza Abdurashidovna – yuridik fanlar doktori, professor;

Esanova Zamira Normurotovna – yuridik fanlar doktori, professor, O'zbekiston Respublikasida xizmat ko'rsatgan yurist;

Hamroqulov Bahodir Mamasharifovich – yuridik fanlar doktori, professor v.b.,;

Zulfiqorov Sherzod Xurramovich – yuridik fanlar doktori, professor;

Xayitov Xushvaqt Saparbayevich – yuridik fanlar doktori, professor;

Asadov Shavkat G'aybullayevich – yuridik fanlar doktori, dotsent;

Ergashev Ikrom Abdurasulovich – yuridik fanlari doktori, professor;

Utemuratov Maxmut Ajimuratovich – yuridik fanlar nomzodi, professor;

Saydullayev Shaxzod Alixanovich – yuridik fanlar nomzodi, professor;

Hakimov Komil Baxtiyarovich – yuridik fanlar doktori, dotsent;

Yusupov Sardorbek Baxodirovich – yuridik fanlar doktori, professor;

Amirov Zafar Aktamovich – yuridik fanlar doktori (PhD);

Jo'rayev Sherzod Yuldashevich – yuridik fanlar nomzodi, dotsent;

Babadjanov Atabek Davronbekovich – yuridik fanlar nomzodi, professor;

Normatov Bekzod Akrom o'g'li — yuridik fanlar bo'yicha falsafa doktori;

Rahmatov Elyor Jumaboyevich — yuridik fanlar nomzodi;

#### *13.00.00- PEDAGOGIKA FANLARI:*

Xashimova Dildarxon Urinboyevna – pedagogika fanlari doktori, professor;

Ibragimova Gulnora Xavazmatovna – pedagogika fanlari doktori, professor;

Zakirova Feruza Maxmudovna – pedagogika fanlari doktori;

Kayumova Nasiba Ashurovna – pedagogika fanlari doktori, professor;

Taylanova Shoxida Zayniyevna – pedagogika fanlari

doktori, dotsent;

Jumaniyozova Muhayyo Tojiyevna – pedagogika fanlari doktori, dotsent;

Ibraximov Sanjar Urunbayevich – pedagogika fanlari doktori;

Javliyeva Shaxnoza Baxodirovna – pedagogika fanlari bo'yicha falsafa doktori (PhD);

Bobomurotova Latofat Elmurodovna — pedagogika fanlari bo'yicha falsafa doktori (PhD).

#### *19.00.00- PSIXOLOGIYA FANLARI:*

Karimova Vasila Mamanosirovna – psixologiya fanlari doktori, professor, Nizomiy nomidagi Toshkent davlat pedagogika universiteti;

Hayitov Oybek Eshboyevich – Jismoniy tarbiya va sport bo'yicha mutaxassislarni qayta tayyorlash va malakasini oshirish instituti, psixologiya fanlari doktori, professor

Umarova Navbahor Shokirovna– psixologiya fanlari doktori, dotsent, Nizomiy nomidagi Toshkent davlat pedagogika universiteti, Amaliy psixologiyasi kafedrasini mudiri;

Atabayeva Nargis Batirovna – psixologiya fanlari doktori, dotsent;

Shamshetova Anjim Karamaddinovna – psixologiya fanlari doktori, dotsent;

Qodirov Obid Safarovich – psixologiya fanlari doktori (PhD).

#### *22.00.00- SOTSIOLOGIYA FANLARI:*

Latipova Nodira Muxtarjanovna – sotsiologiya fanlari doktori, professor, O'zbekiston milliy universiteti kafedra mudiri;

Seitov Azamat Po'latovich – sotsiologiya fanlari doktori, professor, O'zbekiston milliy universiteti;

Sodiqova Shohida Marxaboyevna – sotsiologiya fanlari doktori, professor, O'zbekiston xalqaro islom akademiyasi.

#### *23.00.00- SIYOSIY FANLAR*

Nazarov Nasriddin Ataqulovich –siyosiy fanlar doktori, falsafa fanlari doktori, professor, Toshkent arxitektura qurilish instituti;

Bo'tayev Usmonjon Xayrullayevich –siyosiy fanlar doktori, dotsent, O'zbekiston milliy universiteti kafedra mudiri.

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## **OAK Ro'yxati**

Mazkur jurnal Vazirlar Mahkamasi huzuridagi Oliy attestatsiya komissiyasi Rayosatining 2022-yil 30-noyabrdagi 327/5-son qarori bilan tarix, iqtisodiyot, falsafa, filologiya, yuridik va pedagogika fanlari bo'yicha ilmiy darajalar yuzasidan dissertatsiyalar asosiy natijalarini chop etish tavsiya etilgan ilmiy nashrlar ro'yxatiga kiritilgan.

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(99) 602-09-84 (telegram).

**07.00.00 – TARIX FANLARI**

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## **APPLICATION OF VECTOR ALGEBRA IN SOLVING ELEMENTARY PROBLEMS**

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**Abstract.** The thesis reveals the rules and essence of using coordinate and vector methods in teaching elementary mathematics, and these methods create the opportunity to express geometric problems in algebraic form, accurately calculate them using coordinates, and analyze spatial directions and movements using vectors. Spatial thinking represents the student's ability to understand, imagine and analyze spatial objects, their mutual location, shape, size and interrelationships.

As a result, students can describe abstract geometric relationships in precise numerical and analytical expressions.

**Keywords:** spatial shapes, spatial figures, vector, collinear vectors, basis vectors, plane, distance between two points.

## **VEKTORLAR ALGEBRASINING ELEMENTAR MASALALAR YECHISHGA TATBIQI**

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Termiz davlat pedagogika instituti katta o'qituvchisi

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**Annotatsiya.** Bitiruv ishida elementar matematika kursini o'qitishda koordinata va vektor usullaridan foydalanish qoidalari hamda mohiyati ochib berilgan bo'lib, mazkur usullar yordamida geometrik masalalarni algebraik shaklda ifodalash, ularni koordinatalar orqali aniq hisoblash, vektorlar yordamida fazoviy yo'nalishlar va harakatlarni tahlil qilish imkoniyati yaratiladi. Fazoviy tafakkur o'quvchining fazoviy obyektlarni, ularning o'zaro joylashuvi, shakli, hajmi va o'zaro bog'liqligini anglash, tasavvur qilish va tahlil etish qobiliyatini ifodalaydi.

Natijada o'quvchilar abstrakt shakldagi geometrik munosabatlarni aniq raqamli va analitik ifodalarda tasvirlay oladilar.

**Kalit so'zlar:** fazoviy shakllar, fazoviy figuralar, vektor, kolleniar vektorlar, basis vektorlar, tekislik, ikki nuqta orasidagi masofa.

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**Kirish.** O'rta maktabda o'rganiladigan matematik tushunchalar, masalalar hamda ularni yechishda keng qo'llaniladigan, amaliyotda keng targ'ib etiladigan tushunchalardan bo'lgan koordinata va vektor tushunchalari muhim ahamiyatga ega. Chunki berilgan geometrik masalalarda koordinatalar sistemasini to'g'ri kiritish yoki berilgan masalalarga vektorlar algebrasini qo'llash orqali masalani yechimini topishda nisbatan soddaroq usul sifatida qarash mumkin. Bundan tashqari ta'limida nazariyani amaliyot bilan bog'lab o'rgatish hozirgi zamonning ustuvor vazifasi sifatida turibdi.

**Adabiyotlar tahlili va metodologiya.** O'zbek va rus tilidagi ilmiy adabiyotlarda vektorlar algebrasiga oid elementar masalalar ko'pincha geometriya va fizikaga bog'langan holda tahlil qilingan. Masalan, A. Yu. Kostrikin [9] va B. P. Demidovichning [10] klassik matematika darsliklarida vektorlar algebra asoslari, vektorlar koordinatalari va ularning o'zaro operatsiyalari batafsil yoritilgan bo'lib, turli masalalarni yechish orqali mavzu mustahkamlanadi. Shuningdek, O'zbekiston maktablari va oliy ta'lim muassasalari uchun ishlab chiqilgan metodik qo'llanmalarda, masalan, M. Raximov va Sh. Xolmatovning "Chiziqli algebra va vektorlar" darsligida [12], vektorlar bilan ishlashning elementar masalalari amaliy misollar bilan tushuntirilgan. Ushbu manbalar vektorlarning geometrik talqinidan boshlab, ularning analitik ifodalari va matematik formulalar orqali yechiladigan masalalargacha bo'lgan jarayonni bosqichma-bosqich ko'rsatadi.

**Muhokama va natijalar.** Bizning fikrimizcha, vektorlarni koordinata shaklida xususiyatlari, vektorlar ustida amallarni sonlar, vektorlarning koordinatalari ustidagi amallarga olib keladigan vektor hisobining soddaligi tufayli, koordinata-vektor usuli geometrik masalalarni yechishning ishonchli vositalaridan biri hisoblanadi. Koordinatalar usuli-bu geometrik shakllarni analitik usul bilan ya'ni hisoblashlar yordamida o'rganish usulidir. U geometrik masalalarni algebraik masalaga olib keladi.

Bunday masalalar esa oson algoritmlashtiriladi, ya'ni aniq hisoblashlar ketma-ketligiga olib keladi. Koordinatalar usuli matematikaning ikki tarmog'i algebra va geometriyaning uchrashuvi bo'lib, u geometrik obyektlar va algebraik formulalar orasida uzviy bog'lanish o'rnatadi. Bu bog'lanish koordinatalar sistemasi orqali amalga oshiriladi. Hozirgi vaqtda bu usuldan fan va ishlab chiqarishning turli sohalarida (grafiklar, jadvallar, sxemalar, xaritalar va h.k) foydalanilmoqda.

**1-masala:**  $ABCD A_1 B_1 C_1 D_1$  birlik kubda  $A$  nuqtadan  $BDA_1$  tekislikkacha bo'lgan masofani toping.

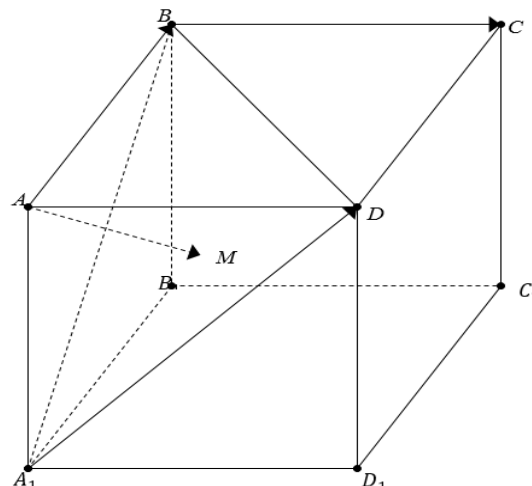
**Yechish:**  $\overrightarrow{BC}, \overrightarrow{DA_1}, \overrightarrow{BA_1}$  vektorlarni  $\vec{a}, \vec{b}, \vec{c}$  bazis vektorlar orqali ifodalaymiz (1-chizma):

$$\overrightarrow{BC} = \vec{b} - \vec{a}, \overrightarrow{DA_1} = \vec{c} - \vec{b}, \overrightarrow{BA_1} = \vec{c} - \vec{a}.$$

$AM \perp BDA_1$  bo'lsin, bu yerda  $M \in BDA_1$ .

Vektor

$$\begin{aligned} \overrightarrow{A_1 M} &= x \cdot \overrightarrow{A_1 B} + y \cdot \overrightarrow{A_1 D}, \\ \overrightarrow{AM} &= \overrightarrow{AA_1} + \overrightarrow{A_1 M} = \overrightarrow{AA_1} + x \cdot \overrightarrow{A_1 B} + y \cdot \overrightarrow{A_1 D}. \end{aligned}$$



**1-chizma.**

$$\begin{aligned} \begin{cases} \overrightarrow{AM} \perp \overrightarrow{A_1 B} \\ \overrightarrow{AM} \perp \overrightarrow{A_1 D} \end{cases} &\Leftrightarrow \begin{cases} \overrightarrow{AM} \cdot \overrightarrow{A_1 B} = 0 \\ \overrightarrow{AM} \cdot \overrightarrow{A_1 D} = 0 \end{cases} \Leftrightarrow \begin{cases} (\overrightarrow{AA_1} + x \cdot \overrightarrow{A_1 B} + y \cdot \overrightarrow{A_1 D}) \cdot \overrightarrow{A_1 B} = 0 \\ (\overrightarrow{AA_1} + x \cdot \overrightarrow{A_1 B} + y \cdot \overrightarrow{A_1 D}) \cdot \overrightarrow{A_1 D} = 0 \end{cases} \Leftrightarrow \\ &\Leftrightarrow \begin{cases} (x \cdot \overrightarrow{A_1 B}^2 + y \cdot \overrightarrow{A_1 D} \cdot \overrightarrow{A_1 B}) + \overrightarrow{AA_1} \cdot \overrightarrow{A_1 B} = 0 \\ (x \cdot \overrightarrow{A_1 B} \cdot \overrightarrow{A_1 D} + y \cdot \overrightarrow{A_1 D}^2) + \overrightarrow{AA_1} \cdot \overrightarrow{A_1 D} = 0 \end{cases} \end{aligned}$$

Shunday qilib

$$\begin{aligned} \overrightarrow{AA_1} \cdot \overrightarrow{A_1 B} &= \vec{c} \cdot (\vec{a} - \vec{c}) = -\vec{c}^2 = -1 \\ \overrightarrow{AA_1} \cdot \overrightarrow{A_1 D} &= \vec{c} \cdot (\vec{b} - \vec{c}) = -\vec{c}^2 = -1 \\ \overrightarrow{A_1 D} \cdot \overrightarrow{A_1 B} &= (\vec{b} - \vec{c}) \cdot (\vec{a} - \vec{c}) = \vec{c}^2 = 1 \\ \overrightarrow{A_1 B}^2 &= (\vec{a} - \vec{c})^2 = \vec{a}^2 + \vec{c}^2 = 2 \\ \overrightarrow{A_1 D}^2 &= (\vec{b} - \vec{c})^2 = \vec{b}^2 + \vec{c}^2 = 2 \end{aligned}$$

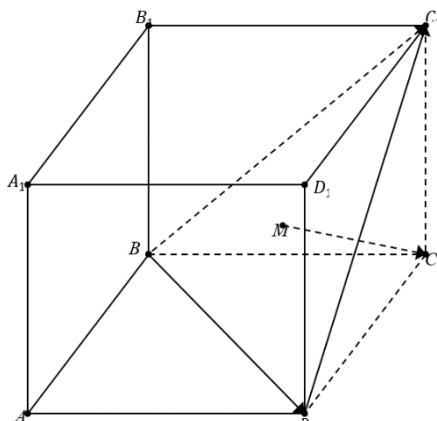
$$\begin{cases} (x \cdot 2 + y \cdot (-1)) - 1 = 0 \\ (x \cdot 1 + 2 \cdot y) - 1 = 0 \end{cases} \Leftrightarrow \begin{cases} 2x - y = 1 \\ x + 2y = 1 \end{cases} \Leftrightarrow \begin{cases} x = \frac{1}{3} \\ y = \frac{1}{3} \end{cases}$$

Bu natijadan quyidagini olamiz

$$\begin{aligned} \overrightarrow{AM} &= \vec{c} + \frac{1}{3} \cdot (\vec{a} - \vec{c}) + \frac{1}{3} \cdot (\vec{b} - \vec{c}) = \frac{1}{3} \vec{a} + \frac{1}{3} \vec{b} + \frac{1}{3} \vec{c}, \\ |\overrightarrow{AM}| &= \sqrt{\left(\frac{1}{3} \vec{a} + \frac{1}{3} \vec{b} + \frac{1}{3} \vec{c}\right)^2} = \sqrt{\frac{1}{9} + \frac{1}{9} + \frac{1}{9}} = \frac{\sqrt{3}}{3} \end{aligned}$$

**Javob:**  $\frac{\sqrt{3}}{3}$ . [2]

**2 -masala:**  $ABCD A_1 B_1 C_1 D_1$  kubning barcha qirralari  $\sqrt{3}$  ga teng. Kubning  $C$  uchidan  $BDA_1$  tekislikkacha bo'lgan masofani toping.



2-chizma.

**Yechish:**  $\overrightarrow{AB} = \vec{a}$ ,  $\overrightarrow{BC} = \vec{b}$ ,  $\overrightarrow{AA_1} = \vec{c}$  bo'lsin (2-chizma), bu yerda  $|\vec{a}| = |\vec{b}| = |\vec{c}| = \sqrt{3}$ ,  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = \vec{b} \cdot \vec{c} = 0$ .  $\overrightarrow{BD}$ ,  $\overrightarrow{DC_1}$ ,  $\overrightarrow{BC_1}$  vektorlarni  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  bazis vektorlar orqali ifodalaymiz:

$$\overrightarrow{BD} = \vec{b} - \vec{a}, \quad \overrightarrow{DC_1} = \vec{a} + \vec{c}, \quad \overrightarrow{BC_1} = \vec{c} + \vec{b}.$$

$CM \perp BDC_1$  bo'lsin, bu yerda  $M \in BDC_1$ .

Vektorlarning chiziqli bog'langanligidan:

$$\overrightarrow{C_1 M} = x \cdot \overrightarrow{C_1 B} + y \cdot \overrightarrow{C_1 D},$$

$$\overrightarrow{MC} = \overrightarrow{MC_1} + \overrightarrow{C_1 C} = \overrightarrow{C_1 C} + x \cdot \overrightarrow{BC_1} + y \cdot \overrightarrow{DC_1}.$$

$$\begin{cases} \overrightarrow{MC} \perp \overrightarrow{DC_1} \\ \overrightarrow{MC} \perp \overrightarrow{BC_1} \end{cases} \Leftrightarrow \begin{cases} \overrightarrow{MC} \cdot \overrightarrow{DC_1} = 0 \\ \overrightarrow{MC} \cdot \overrightarrow{BC_1} = 0 \end{cases}$$

$$\Leftrightarrow \begin{cases} (\overrightarrow{C_1 C} + x \cdot \overrightarrow{BC_1} + y \cdot \overrightarrow{DC_1}) \cdot \overrightarrow{DC_1} = 0 \\ (\overrightarrow{C_1 C} + x \cdot \overrightarrow{BC_1} + y \cdot \overrightarrow{DC_1}) \cdot \overrightarrow{BC_1} = 0 \end{cases} \Leftrightarrow$$

$$\Leftrightarrow \begin{cases} (x \cdot \overrightarrow{BC_1} \cdot \overrightarrow{DC_1} + y \cdot \overrightarrow{DC_1}^2) + \overrightarrow{CC_1} \cdot \overrightarrow{DC_1} = 0 \\ (x \cdot \overrightarrow{BC_1}^2 + y \cdot \overrightarrow{DC_1} \cdot \overrightarrow{BC_1}) + \overrightarrow{CC_1} \cdot \overrightarrow{BC_1} = 0 \end{cases}$$

$$\overrightarrow{BC_1} \cdot \overrightarrow{DC_1} = (\vec{c} + \vec{b}) \cdot (\vec{a} + \vec{c}) = \vec{c}^2 = 3$$

$$\overrightarrow{CC_1} \cdot \overrightarrow{DC_1} = -\vec{c} \cdot (\vec{a} + \vec{c}) = -\vec{c}^2 = -3$$

$$\overrightarrow{CC_1} \cdot \overrightarrow{BC_1} = -\vec{c} \cdot (\vec{c} + \vec{b}) = -\vec{c}^2 = -3$$

$$\overrightarrow{DC_1}^2 = (\vec{a} + \vec{c})^2 = \vec{a}^2 + \vec{c}^2 = 6$$

$$\overrightarrow{BC_1}^2 = (\vec{c} + \vec{b})^2 = \vec{c}^2 + \vec{b}^2 = 6$$

$$\begin{cases} (x \cdot 3 + y \cdot 6) - 3 = 0 \\ (x \cdot 6 + y \cdot 3) - 3 = 0 \end{cases} \Leftrightarrow \begin{cases} x + 2y = 1 \\ 2x + y = 1 \end{cases} \Leftrightarrow \begin{cases} x = \frac{1}{3} \\ y = \frac{1}{3} \end{cases}$$

$$\overrightarrow{MC} = \frac{1}{3} \cdot (\vec{c} + \vec{b}) + \frac{1}{3} \cdot (\vec{a} + \vec{c}) - \vec{c} = \frac{1}{3} \vec{a} + \frac{1}{3} \vec{b} - \frac{1}{3} \vec{c},$$

$$|\overrightarrow{AM}| = \sqrt{\left(\frac{1}{3} \vec{a} + \frac{1}{3} \vec{b} - \frac{1}{3} \vec{c}\right)^2} = \sqrt{\frac{3}{9} + \frac{3}{9} + \frac{3}{9}} = 1.$$

**Javob:** 1. [3]

**3-masala:**  $ABCA_1B_1C_1$  uchburchakli to'g'ri prizmada  $M$  nuqta  $AA_1$  qirra o'rtasi,  $K$  nuqta  $BB_1$  qirra o'rtasi. Agar  $AA_1 = 6$ ,  $AB=4$  bo'lsa,  $A_1$  uchdan  $CMK$  tekislikkacha bo'lgan masofani toping.

**Yechish:**  $\overrightarrow{AA_1} = \vec{a}$ ,  $\overrightarrow{AC} = \vec{b}$ ,  $\overrightarrow{AB} = \vec{c}$  bo'lsin, bu yerda  $|\vec{a}| = 6$   $|\vec{b}| = |\vec{c}| = 4$ ,  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ ,  $\vec{b} \cdot \vec{c} = 8$ . Yuqoridagilardan foydalangan holda  $\overrightarrow{MC} = \frac{\vec{a}}{2} + \vec{b}$ ,  $\overrightarrow{MK} = \vec{c}$  ekanini bilamiz (3-chizma).  $A_1O \perp MKC$  bo'lsin, bu yerda  $O \in MKC$ . Vektorlarning chiziqli bog'langanligidan

$$\overrightarrow{MO} = x \cdot \overrightarrow{MK} + y \cdot \overrightarrow{MC},$$

$$\overrightarrow{A_1O} = \overrightarrow{A_1M} + \overrightarrow{MO}$$

$$= \overrightarrow{A_1M} + x \cdot \overrightarrow{MK} + y \cdot \overrightarrow{MC}.$$

$$\begin{aligned} \begin{cases} \overrightarrow{A_1O} \perp \overrightarrow{MK} \\ \overrightarrow{A_1O} \perp \overrightarrow{MC} \end{cases} &\Leftrightarrow \begin{cases} \overrightarrow{A_1O} \cdot \overrightarrow{MK} = 0 \\ \overrightarrow{A_1O} \cdot \overrightarrow{MC} = 0 \end{cases} \Leftrightarrow \begin{cases} (\overrightarrow{A_1M} + x \cdot \overrightarrow{MK} + y \cdot \overrightarrow{MC}) \cdot \overrightarrow{MK} = 0 \\ (\overrightarrow{A_1M} + x \cdot \overrightarrow{MK} + y \cdot \overrightarrow{MC}) \cdot \overrightarrow{MC} = 0 \end{cases} \Leftrightarrow \\ &\Leftrightarrow \begin{cases} (x \cdot \overrightarrow{MK}^2 + y \cdot \overrightarrow{MC} \cdot \overrightarrow{MK}) + \overrightarrow{A_1M} \cdot \overrightarrow{MK} = 0 \\ (x \cdot \overrightarrow{MK} \cdot \overrightarrow{MC} + y \cdot \overrightarrow{MC}^2) + \overrightarrow{A_1M} \cdot \overrightarrow{MC} = 0 \end{cases} \end{aligned}$$

$$\overrightarrow{MC} \cdot \overrightarrow{MK} = \left(\frac{\vec{a}}{2} + \vec{b}\right) \cdot \vec{c} = 8,$$

$$\overrightarrow{A_1M} \cdot \overrightarrow{MK} = \frac{\vec{a}}{2} \cdot \vec{c} = 0,$$

$$\overrightarrow{A_1M} \cdot \overrightarrow{MC} = \frac{\vec{a}}{2} \cdot \left(\frac{\vec{a}}{2} + \vec{b}\right) = 9,$$

$$\overrightarrow{MK}^2 = \vec{c}^2 = 16$$

$$\overrightarrow{MC}^2 = \left(\frac{\vec{a}}{2} + \vec{b}\right)^2 = 25$$

$$\begin{cases} (x \cdot 16 + y \cdot 8) = 0 \\ (x \cdot 8 + y \cdot 25) + 9 = 0 \end{cases} \Leftrightarrow \begin{cases} 8x + 4y = 0 \\ 8x + 25y = -9 \end{cases} \Leftrightarrow \begin{cases} x = \frac{3}{14} \\ y = \frac{-3}{7} \end{cases}$$

Topilgan noma'lum koeffitsiyentlar  $x$  va  $y$  ning qiymatlaridan foydalanib quyidagilarni topamiz

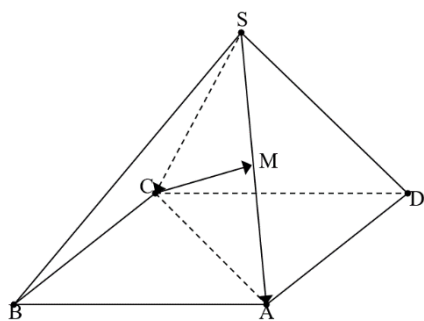
$$\overrightarrow{A_1O} = \frac{3}{14} \cdot \vec{c} - \frac{3}{7} \cdot \left(\frac{\vec{a}}{2} + \vec{b}\right) + \frac{\vec{a}}{2} = \frac{2}{7} \vec{a} - \frac{3}{7} \vec{b} + \frac{3}{14} \vec{c},$$

$$|\overrightarrow{A_1O}| = \sqrt{\left(\frac{2}{7} \vec{a} - \frac{3}{7} \vec{b} + \frac{3}{14} \vec{c}\right)^2} = \frac{1}{14} \cdot \sqrt{16 \cdot 36 + 36 \cdot 16 + 9 \cdot 16 - 2 \cdot 3 \cdot 6 \cdot 4 \cdot 4 \cdot \frac{1}{2}} =$$

$$\frac{6\sqrt{7}}{7}.$$

**Javob:**  $\frac{6\sqrt{7}}{7}$ .

**4-masala.**  $SABCD$  to'rtburchakli to'g'ri piramidada asos tomonlari 1 ga, yon qirralari  $\frac{\sqrt{3}}{2}$  ga teng.  $C$  nuqtadan  $SA$  chiziqqacha bo'lgan masofani toping [4].



4-chizma.

**Yechish:**  $\overrightarrow{SC} = \vec{a}$ ,  $\overrightarrow{CA} = \vec{b}$ , bo'lsin, bu yerda  $|\vec{a}| = \frac{\sqrt{3}}{2}$ ,  $|\vec{b}| = \sqrt{2}$ . Demak,  $\overrightarrow{SA} = \vec{a} + \vec{b}$ ,  $\overrightarrow{SM} = x(\vec{a} + \vec{b})$ ,  $\overrightarrow{CM} = x(\vec{a} + \vec{b}) - \vec{a}$ .  $\overrightarrow{CM} \perp \overrightarrow{SM}$  bo'lgani uchun,  $\overrightarrow{CM} \cdot \overrightarrow{SM} = 0$  (4-chizma).  $(x(\vec{a} + \vec{b}) - \vec{a})(x(\vec{a} + \vec{b})) = 0$   $x^2(\vec{a} + \vec{b})^2 - x(\vec{a}^2 + \vec{a} \cdot \vec{b}) = 0$   $(\vec{a} + \vec{b})^2 = \vec{a}^2 + 2 \cdot \vec{a} \cdot \vec{b} + \vec{b}^2$   $\vec{a} \cdot \vec{b} = -1$

$$x = \frac{\vec{a}^2 + \vec{a} \cdot \vec{b}}{\vec{a}^2 + 2 \cdot \vec{a} \cdot \vec{b} + \vec{b}^2} = \frac{\frac{3}{4} - 1}{\frac{3}{4} - 2 + 2} = -\frac{1}{3},$$

$$\overrightarrow{CM} = -\frac{1}{3} \cdot (\vec{a} + \vec{b}) - \vec{a} = -\frac{1}{3}(4\vec{a} + \vec{b})$$

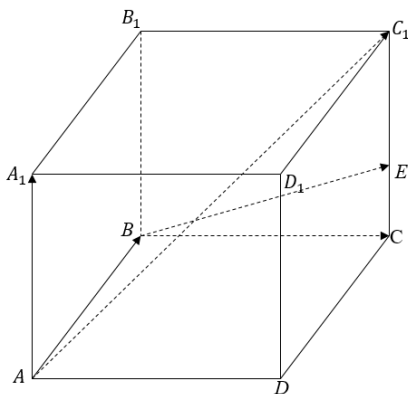
$$|\overrightarrow{CM}| = \frac{1}{3} \sqrt{(4\vec{a} + \vec{b})^2} = \frac{1}{3} \sqrt{16\vec{a}^2 + 2 \cdot 4 \cdot \vec{a} \cdot \vec{b} + \vec{b}^2} =$$

$$= \frac{1}{3} \sqrt{16 \cdot \frac{3}{4} - 8 + 2} = \sqrt{\frac{2}{3}}$$

**Javob:**  $\sqrt{\frac{2}{3}}$ .

**5-masala:**  $ABCD A_1 B_1 C_1 D_1$  birlik kubning  $CC_1$  qirrasida  $E$  nuqta shunday belgilab olinganki, bunda  $CE : EC_1 = 1 : 2$   $BE$  va  $AC_1$  chiziqlar orasidagi burchakni toping.

**Yechish:**  $\overrightarrow{AB} = \vec{a}$ ,  $\overrightarrow{BC} = \vec{b}$ ,  $\overrightarrow{AA_1} = \vec{c}$  bo'lsin (5-chizma), bu yerda  $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$ ,  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = \vec{b} \cdot \vec{c} = 0$ .  $\overrightarrow{BE} = \overrightarrow{BC} + \overrightarrow{CE} = \vec{b} + \frac{\vec{c}}{3}$   $\overrightarrow{AC_1} = \vec{a} + \vec{b} + \vec{c}$



5-chizma.

$$|\overrightarrow{BE}| = \sqrt{(\vec{b} + \frac{\vec{c}}{3})^2} = \sqrt{\vec{b}^2 + 2 \cdot \vec{b} \cdot \frac{\vec{c}}{3} + \frac{\vec{c}^2}{9}} = \sqrt{1 + \frac{1}{9}} = \frac{\sqrt{10}}{3}$$

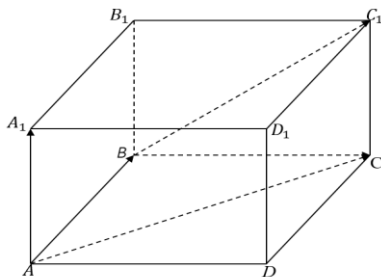
$$|\overrightarrow{AC_1}| = \sqrt{(\vec{a} + \vec{b} + \vec{c})^2} = \sqrt{\vec{a}^2 + \vec{b}^2 + \vec{c}^2 + 2 \cdot \vec{a} \cdot \vec{b} + 2 \cdot \vec{a} \cdot \vec{c} + 2 \cdot \vec{b} \cdot \vec{c}} = \sqrt{1 + 1 + 1} = \sqrt{3}$$

$$\overrightarrow{BE} \cdot \overrightarrow{AC_1} = \left(\vec{b} + \frac{\vec{c}}{3}\right) \cdot (\vec{a} + \vec{b} + \vec{c}) = \vec{b} \cdot \vec{a} + \vec{b}^2 + \vec{b} \cdot \vec{c} + \frac{\vec{c}}{3} \cdot \vec{a} + \frac{\vec{c}}{3} \cdot \vec{b} + \frac{\vec{c}^2}{3} = 1 + \frac{1}{3} = \frac{4}{3}$$

$$\cos \varphi = \frac{\overrightarrow{BE} \cdot \overrightarrow{AC_1}}{|\overrightarrow{BE}| \cdot |\overrightarrow{AC_1}|} = \frac{\frac{4}{3}}{\frac{\sqrt{10}}{3} \cdot \sqrt{3}} = \frac{4}{\sqrt{30}}$$

**Javob:**  $\frac{4}{\sqrt{30}}$ . [5]

**6-masala:** To'rtburchakli to'g'ri  $ABCD A_1 B_1 C_1 D_1$  prizmada asos tomonlari 12 ga, yon qirralar uzunligi 5 ga teng.  $AC$  va  $BC_1$  chiziqlar orasidagi burchakni toping.



6-chizma.

**Yechish:**  $\overrightarrow{AB} = \vec{a}$ ,  $\overrightarrow{BC} = \vec{b}$ ,  $\overrightarrow{AA_1} = \vec{c}$  bo'lsin (6-chizma), bu yerda  $|\vec{a}| = |\vec{b}| = 12$ ,  $|\vec{c}| = 5$ ,  $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = \vec{b} \cdot \vec{c} = 0$ .  $\overrightarrow{AC} = \vec{a} + \vec{b}$   $\overrightarrow{BC_1} = \vec{b} + \vec{c}$ .

$$|\overrightarrow{AC}| = \sqrt{(\vec{a} + \vec{b})^2} = \sqrt{\vec{a}^2 + 2 \cdot \vec{a} \cdot \vec{b} + \vec{b}^2} = \sqrt{12^2 + 12^2} = 12\sqrt{2}$$

$$|\overrightarrow{BC_1}| = \sqrt{(\vec{b} + \vec{c})^2} = \sqrt{\vec{b}^2 + 2 \cdot \vec{b} \cdot \vec{c} + \vec{c}^2} = \sqrt{12^2 + 5^2} = 13$$

$$\overrightarrow{AC} \cdot \overrightarrow{BC_1} = (\vec{a} + \vec{b}) \cdot (\vec{b} + \vec{c}) = \vec{a} \cdot \vec{b} + \vec{a} \cdot \vec{c} + \vec{b}^2 + \vec{b} \cdot \vec{c} = 144$$

$$\cos \varphi = \frac{\overrightarrow{AC} \cdot \overrightarrow{BC_1}}{|\overrightarrow{AC}| \cdot |\overrightarrow{BC_1}|} = \frac{144}{12\sqrt{2} \cdot 13} = \frac{6\sqrt{2}}{13}.$$

**Javob:**  $\frac{6\sqrt{2}}{13}$ .

**Xulosa.** Vektorlar algebrasi zamonaviy matematikaning muhim bo'limi bo'lib, u nazariy bilimlarni amaliy ko'nikmaga aylantirishda asosiy vosita hisoblanadi. Vektor tushunchasi, ularning koordinatalar orqali ifodalanishi, skalyar va vektor ko'paytmalari kabi asosiy operatsiyalar matematik va fizik masalalarni yechishda keng qo'llaniladi. Elementar masalalarni yechish jarayoni talabalarga mantiqiy fikrlash, analitik tafakkur va geometrik tasavvur ko'nikmalarini shakllantirishga xizmat qiladi. Shuningdek, vektorlar algebrasining amaliy tatbiqlari fizikada kuch, tezlik va moment kabi kattaliklarni hisoblashda, muhandislik loyihalarini tahlil qilishda va boshqa ilmiy vaziyatlarda ham muhim ahamiyatga ega.

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## IJTIMOYIY-GUMANITAR FANLARNING DOLZARB MUAMMOLARI

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