FAZODA PERPENDIKULYAR TO'G'RI CHIZIQLAR VA TEKISLIKLAR MAVZUSINI O'QITISH METODIKASI

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Annotatsiya: Ushbu maqolada umumiy o'rta ta'lim maktablari 10-sinfida "Fazoda perpendikulyar to'g'ri chiziqlar va tekisliklar" mavzusini hozirgi axborot resruslari hamta ta'lim texnologiyalari yordamida o'quvchilarga o'qitish metodikasi haqida asosiy tushunchalar, metodlar hamda vositalardan foydalanish bo'yicha ko'rsatmalar keltirilgan. Mavzu bo'yicha zaruriy tushunchalarni o'quvchiga yetkazish bilan birga mavzuga doir masalalar yechimlari ham keltirib o'tilgan, jumladan olimpiada masalalarini bajarish bo'yicha namunalar yechib ko'rsatilgan.

Kalit so'zlar: chiziq, perpendikulyar chiziq, parallel chiziq, tekislik, metod, masala. yechim.

МЕТОДИКА ПРЕПОДАВАНИЯ ПРЕДМЕТА ПЕРПЕНДИКУЛЯРНЫЕ ПРЯМЫЕ И ПЛОСКОСТИ В ПРОСТРАНСТВЕ

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Аннотация: В данной статье в 10 классе общеобразовательной школы даны инструкции по теме «Перпендикулярные прямые и плоскости в пространстве». Помимо донесения до студента необходимого понимания темы, также представлены решения вопросов, связанных с темой, в том числе примеры решения олимпиадных задач.

Ключевые слова: линия, перпендикуляр, параллельная линия, плоскость, метод, задача. решение.

THE METHODOLOGY OF TEACHING THE SUBJECT PERPENDICULAR LINES AND PLANES IN SPACE

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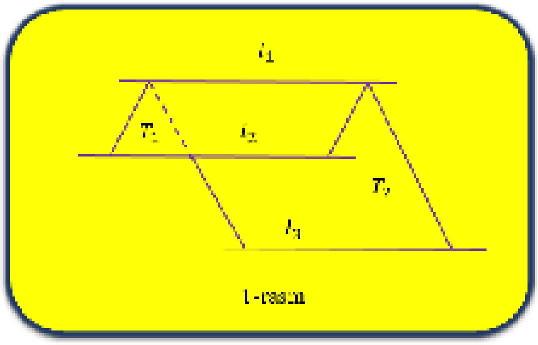
1-masala. Fazoda M nuqta qanday hollarda bir qiymatli aniqlanadi?

$(l_2 || l_1, l_3 || l_1)$



1-rasm

2. To'g'ri chiziq va tekisliklarning parallelligi.

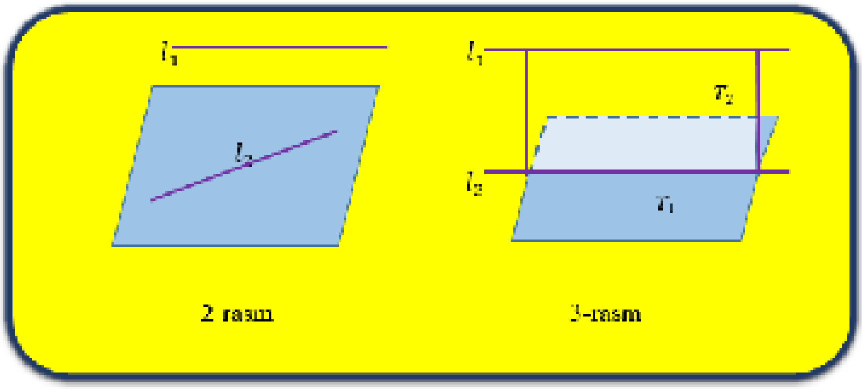
Ta'rif. Agar to'g'ri chiziq va tekislik kesishmasa, ular parallel deb aytiladi.

To'g'ri chiziq va tekislikning parallel bo'lish belgisi:

Agar T tekislikda yotmagan l_1 to'g'ri chiziq shu tekislikdagi birorta l_2 to'g'ri chiziqqa parallel bo'lsa, unda l_1, to'g'ri chiziq T tekislikka parallel bo'ladi(2-rasm).

Xossa: Berilgan T_1, tekislikka parallel bo'lgan l_1, to'g'ri chiziq orqali o'tuvchi har qanday T_2 tekislik T_1 tekislikka parallel bo'lishi yoki berilgan l_1 to'g'ri chiziqqa parallel bo'lgan l_2 to'g'ri chiziq bo'yicha kesib o'tadi(3-rasm):

$(l_1 \subset T_2 \ \ l_1 || T_1) \Rightarrow T_2 || T_1$ yoki $l_2 || l_1$.



2 rasm 3-rasm

3. Tekisliklarning parallelligi.

Ta'rif. Kesishmaydigan tekisliklar parallel tekisliklar deyiladi.

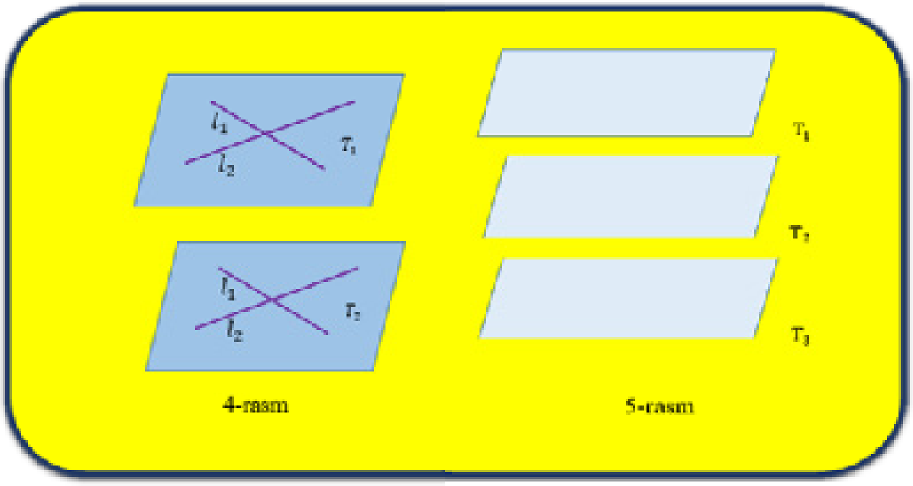
Tekisliklarning parallel bo'lishlik belgilari:

a) agar T_1 tekislikda yotuvchi kesishuvchi ikki l_1 va l_2 to'g'ri chiziq ikkinchi T_2 tekislikda yotuvchi kesishuvchi ikki l_1' va l_2' to'g'ri chiziqlariga parallel bo'lsa, unda T_1 va T_2 tekisliklar parallel bo'ladi, ya'ni(4-rasm)

$(l_1 || l_1', \ l_2 || l_2') \Rightarrow T_1 || T_2$, bu yerda $l_1 \subset T_1, \ l_2 \subset T_1, \ l_1' \subset T_2, \ l_2' \subset T_2$;

b) agar berilgan ikki T_1 va T_2 tekislikning har biri uchinchi T_3 tekislikka parallel bo'lsa, unda berilgan ikki T_1 va T_2 tekislik o'zaro parallel bo'ladi, ya'ni(5-rasm)

$$(T_1 || T_3, T_2 || T_3) \Rightarrow T_1 || T_2.$$



4-rasm 5-rasm

Xossalari:

a) agar ikki T_1 va T_2 parallel tekislik uchinchi tekislik bilan kesilsa, unda tekisliklarning l_1 va l_2 kesishish chiziqlari parallel bo'ladi, ya'ni(6-rasm)

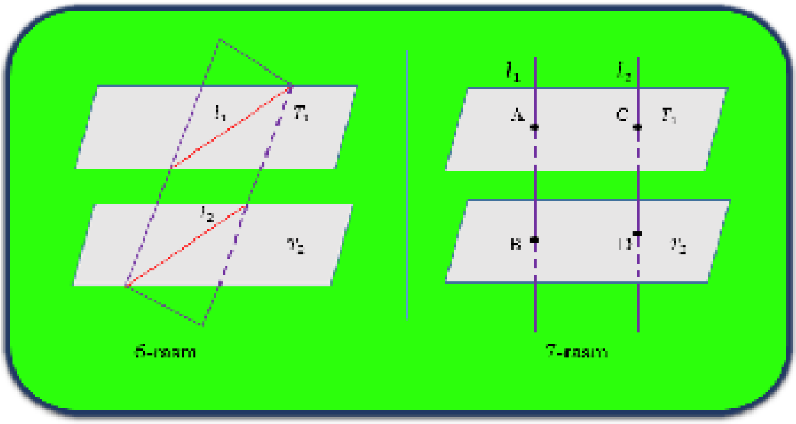
$$T_1 || T_2 => l_1 || l_2,$$

bu yerda $l_1 \subset T_1, \subset T_2$;

b) ikkita parallel tekislik orasidagi parallel kesmalar teng, ya'ni(7-misol)

$$(T_1 || T_2,\ l_1 || l_2) => AV = SD,$$

bu yerda $l_1 \cap T_1 = A,\ l_1 \cap T_2 = V,\ l_2 \cap T_1 = S,\ l_2 \cap T_2 = D,$



6-rasm 7-rasm

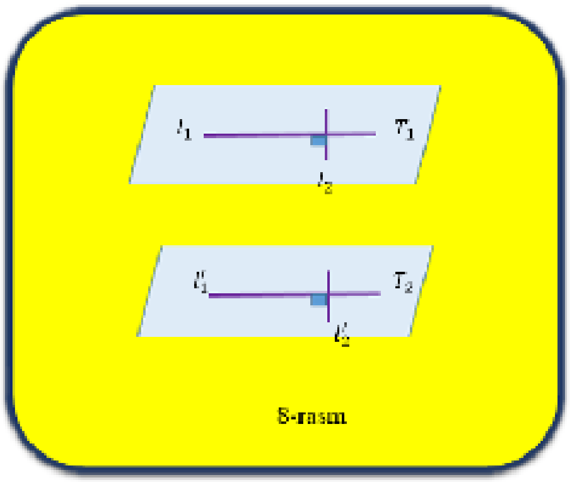
4. To'g'ri chiziqlarning perpendikulyarligi.

Ta'rif. Agar ikki to'g'ri chiziq to'g'ri burchak ostida kesishsa, ular perpendikulyar to'g'ri chiziqlar deb ataladi.

Mos ravishda ikkita l_1 va l_2 perpendikulyar chiziqlarga parallel bo'lgan kesuvchi ikki l_1' va l_2' to'g'ri chiziqlar perpendikulyar bo'ladi, ya'ni(8-rasm)

$$(l_1 || l_1',\ l_2 || l_2',\ l_1 \perp l_2) => l_1' \perp l_2',$$

bu yerda $l_1 \in T_1,\ l_2 \in T_1,\ l_1' \in T_2, l_2' \in T_2$



8-rasm

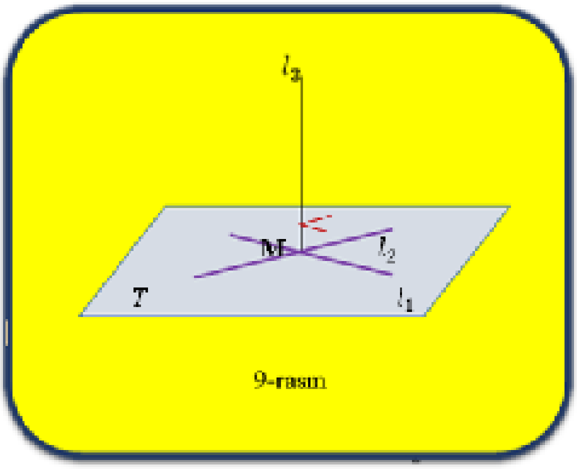
5. To‘g‘ri chiziq va tekislikning perpendikulyarligi

Ta’rif. Agar T tekislikni kesuvchi l_1 va l_2 to‘g‘ri chiziq shu tekislikni kesishish nuqtasi orqali o‘tuvchi har qanday l_3 to‘g‘ri chizig‘iga perpendikulyar bo‘lsa, unda l_3 to‘g‘ri chiziq T tekislikka perpendikulyar bo‘ladi.

To‘g‘ri chiziq va tekislikning perpendikulyar bo‘lishlilik belgisi: agar to‘g‘ri l_3 chiziq berilgan tekislikdagi kesishuvchi l_1 va l_2 to‘g‘ri chiziqlarga perperpendikulyar bo‘lsa, unda l_3 to‘g‘ri chiziq T tekislikka perpendikulyar bo‘ladi, ya’ni(9-rasm)

$(l_3 \perp l_1$ va $l_3 \perp l_2) \Rightarrow l_3 \perp T$,

bu yerda $l_1 \in T,\ l_2 \in T$.



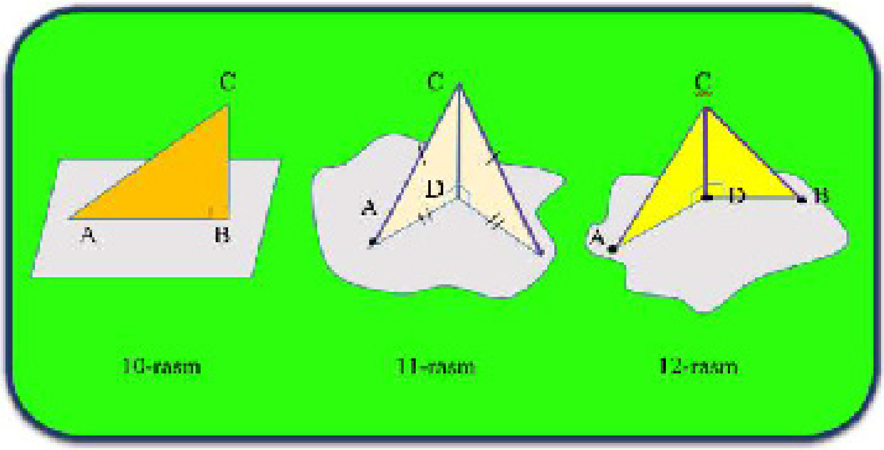
9-rasm

6. Perpendikulyar va og‘ma to‘g‘ri chiziqlar

10-rasmda BC - perpendikulyar, AC - og‘ma, AB - og‘maning soyasi (proyeksiyasi) tasvirlangan.

11-rasmda tekislikka o‘tkazilgan teng og‘malar proyeksiyalarining tengligi tasvirlangan.

12- rasmda ikkita og‘madan qaysi biri katta bo‘lsa, o‘sha og‘maning kata proyeksiyaga ega bo‘lishligi tasvirlangan.

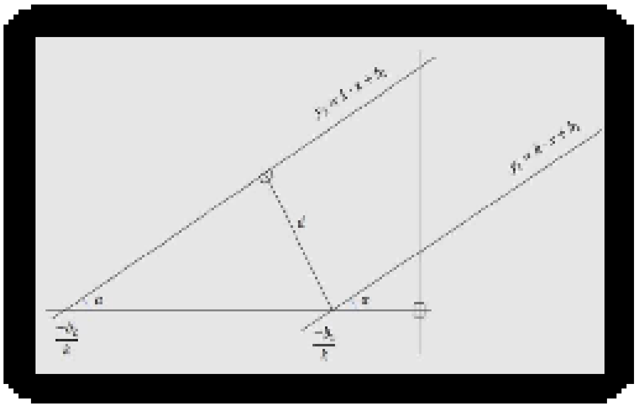


Mavzuga oid murakkab masalalar va ularni yechimlari:

1.

Ikki to'g'ri chiziq orasidagi masofani topish formulasini isbotlang.

$$tg\alpha = k\,,\ sin\alpha = \frac{d}{\frac{|b_2-b_1|}{k}}$$



$$cos^2\alpha = \frac{1}{tg^2\alpha + 1}$$

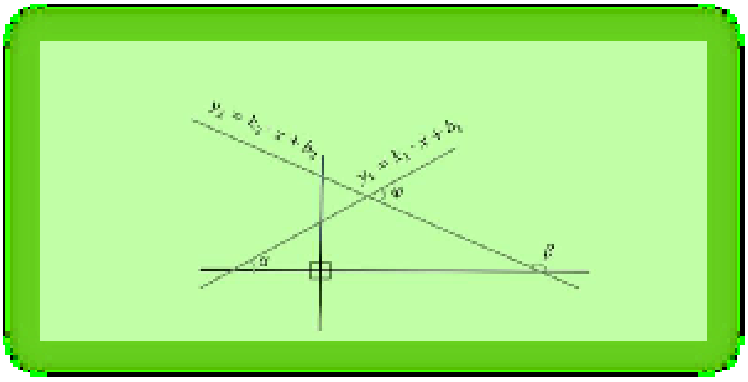
$$1 - sin^2\alpha = \frac{1}{k^2+1}$$

$$sin\alpha = \sqrt{\frac{k^2}{k^2+1}} = \frac{d\cdot k}{|b_2-b_1|}$$

$$\frac{k}{\sqrt{k^2+1}} = \frac{d\cdot k}{|b_2-b_1|}$$

$$d = \frac{|b_2-b_1|}{\sqrt{k^2+1}}$$

1. **To'g'ri chiziqlar orasidagi burchak tangensi formulasini isbotlang.**



$$\alpha + 180^\circ - \beta = \varphi$$

$$180^\circ - \varphi = \beta - \alpha$$

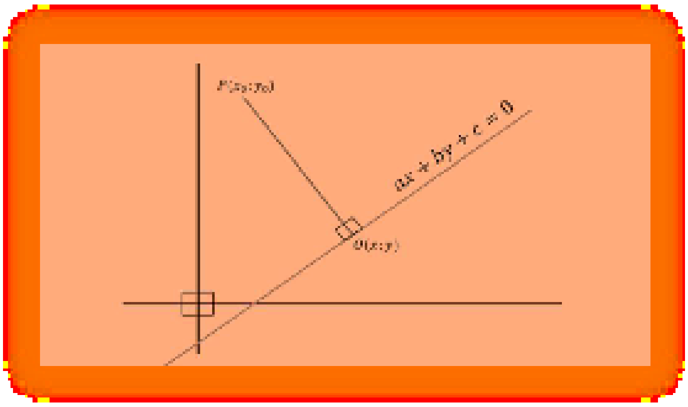
$$tg(180^\circ - \varphi) = tg(\beta - \alpha)$$

$$-tg\varphi = \frac{tg\beta - tg\alpha}{1 + tg\alpha \cdot tg\beta}$$

$$tg\varphi = \frac{tg\alpha - tg\beta}{1 + tg\alpha\cdot tg\beta} = \frac{k_1 - k_2}{1 + k_1\cdot k_2}$$

$$tg\varphi = \frac{k_1 - k_2}{1 + k_1 \cdot k_2}$$

2. Nuqtadan toʻgʻri chiziqgacha eng qisqa masofani aniqlash formulasini keltirib chiqaring.



$$\begin{cases} y = -\frac{a}{b}x - \frac{c}{b} \\ y_2 = \frac{b}{a}x + A = \frac{b}{a}x + \left(y_0 - \frac{b}{a}x_0\right) \end{cases}$$

$$-\frac{a}{b}x - \frac{c}{b} = \frac{b}{a}x + \left(y_0 - \frac{b}{a}x_0\right)$$

$$x = \frac{b^2x_0 - aby_0 - ac}{a^2 + b^2}$$

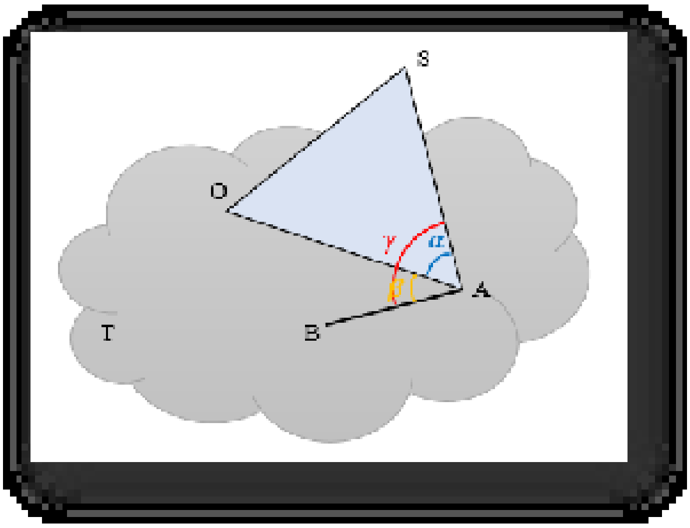
$$y = -\frac{a}{b}x - \frac{c}{b} = \frac{a^2y_0 - abx_0 - bc}{a^2 + b^2}$$

$$L = |PQ| = \sqrt{(x - x_0)^2 + (y - y_0)^2} =$$

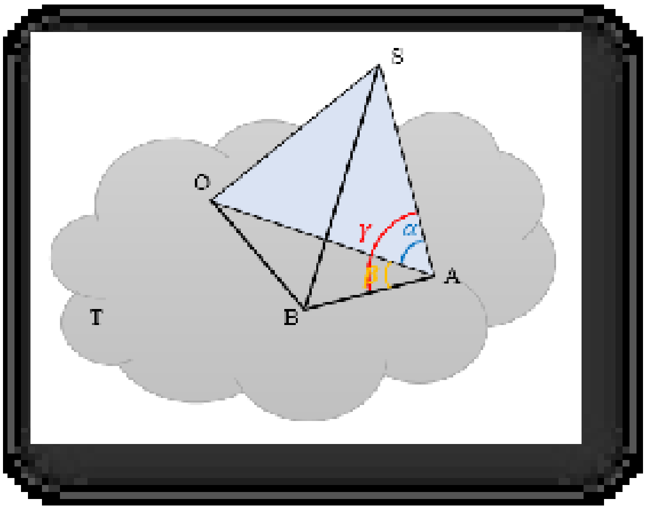
$$\sqrt{\left(\frac{b^2x_0 - aby_0 - ac}{a^2 + b^2} - x_0\right)^2 + \left(\frac{a^2y_0 - abx_0 - bc}{a^2 + b^2} - y_0\right)^2} =$$

$$\sqrt{\left(\frac{-a(ax_0 + by_0 + c)}{a^2 + b^2}\right)^2 + \left(\frac{-b(ax_0 + by_0 + c)}{a^2 + b^2}\right)^2} = \frac{|ax_0 + by_0 + c|}{\sqrt{a^2 + b^2}}$$

3. Ogʻma tekislik α burchak tashkil etadi. Shu burchak uchidan tekislikda ogʻma bilan γ burchak tashkil etuvchi va ogʻmaning tekislikdagi proyeksiyasi bilan β burchak tashkil etuvchi toʻgʻri chiziq oʻtkazilgan. $Cos\gamma = cos\alpha \cdot cos\beta$ ekanligini isbotlang.

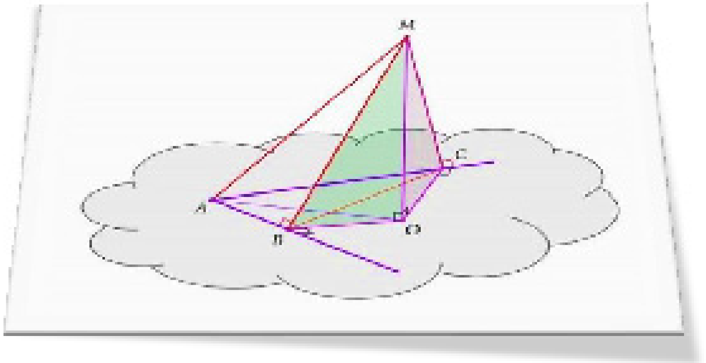


Yechilishi: SA kesma T tekislikka o'tkazilgan og'ma bo'lsin, AB esa T tekislikda berilgan to'g'ri chiziq. Tekislik bilan SA og'ma orasidagi α burchakni yasash uchun S nuqtadan T tekislikka perpendikulyar tushiramiz. SA ning T tekislikdagi proyeksiyasi AO ni yasaymiz. $\angle SAO = \alpha$ bo'lsin. Shartga ko'ra, $\angle BAS = \gamma$ va $\angle BAO = \beta$. Aytaylik, $OA \perp AB$ bo'lsin, unda $SA \perp AB$.



ΔSAB dan $os\gamma = \frac{AB}{SA}$, ΔSAO dan $cos\alpha = \frac{OA}{SA}$, ΔOAB dan $cos\beta = \frac{AB}{OA}$.
Unda $cos\alpha \cdot cos\beta = \frac{OA}{SA} = \frac{AB}{OA} = \frac{AB}{SA}$ $cos\gamma$.
$SA = x$ bo'lsin.
ΔSBA dan $AB = SAcos\gamma = xcos\gamma$ (1)
ΔSAO dan $OA = SAcos\,\alpha = xcos\alpha$
ΔOAB dan $AB = OAcos\beta = xcos\alpha \cdot cos\beta$ (2)
(1) va (2) => $xcos\gamma = xcos\alpha cos\beta$ x kesma uzunligi bo'lgani uchun har ikkala tomonini x ga bo'lib yuboramiz va $cos\gamma = cos\alpha \cdot cos\beta$ ni hosil qilamiz.

4. Tekislikda olingan CAB burchak 60° ga teng. Fazodagi M nuqtadan burchak uchigacha bo'lgan masofa 25 ga. burchak tomonlarigacha bo'lgan masofalar 20 va 7 ga teng bo'lsa, M nuqtadan tekislikkacha bo'lgan masofani toping.
Yechilishi:
Masala shartiga mos chizma chizib olamiz:



$$AM = 25,\ MC = 7,\ MB = 20 \text{ va } \angle CAB = 60^\circ;\ MO = h = ?$$
$$\Delta AMC: AC^2 = AM^2 - MC^2 \to AC^2 = 25^2 - 7^2 \to AC = 24$$
$$\Delta AMB: AB^2 = AM^2 - MB^2 \to AB^2 = 25^2 - 20^2 \to AB = 15$$
$$\Delta ABC: BC^2 = AC^2 + AB^2 - 2 \cdot AC \cdot AB \cdot cos(\angle CAB) \to BC^2 = 441$$
$$\Delta MOC: OC^2 = MC^2 - MO^2 \to OC^2 = 7^2 - h^2 \to OC = \sqrt{49 - h^2}$$
$$\Delta MOB: OB^2 = MB^2 - MO^2 \to OB^2 = 20^2 - h^2 \to OB = \sqrt{400 - h^2}$$
$$\boxdot\ ABOC: \angle CAB = 60^\circ, \angle ABO = 90^\circ,\ \angle ACO = 90^\circ \to \angle COB = 120^\circ$$
$$\Delta BOC: BC^2 = OC^2 + OB^2 - 2 \cdot OC \cdot OB \cdot cos(\angle COB)$$
$$BC^2 = 49 - h^2 + 400 - h^2 - 2 \cdot \sqrt{49 - h^2} \cdot \sqrt{400 - h^2} \cdot (-\frac{1}{2})$$
$$449 - 2h^2 + \sqrt{19600 - 449h^2 + h^4} = 441$$
$$\sqrt{19600 - 449h^2 + h^4} = 2h^2 - 8$$
$$h = \sqrt{37}$$

Javob: $\sqrt{37}$