

UCHBURCHAK VA AYLANA DOIR TUSHUNCHALAR VA ULARGA DOIR BA'ZI
AMALIY MASALALAR YECHISH

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Qo'qon DPI o'qituvchisi

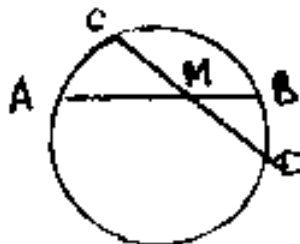
Annotasiya: *Ushbu maqolada aylana, doira, aylanaga o'tkazilgan o'rinmani ta'rifi va xossalari, yuzalari va uzunliklari bo'yicha hisoblash formulalari, uchburchakka ichki va chizilgan aylana radiusini hisoblash hamda uchburchakka tashqi chizilgan aylana radiusi hisoblash formulalar, ularga doir amaliy misollar keltirilgan.*

Aylana deb, aylana markazi deb ataluvchi nuqtadan bir xil masofadagi nuqtalar to'plamiga aytiladi.

Doira deb, doira markazi deb ataluvchi nuqtadan berilgan masofagacha bo'lgan barcha nuqtalar to'plamiga aytiladi. Doira aylana va uning ichki nuqtalaridan tashkil topgan.

2. Vatarining ta'rifi va xossalari:

Vatar deb aylananing ikki nuqtasini tutashtiruvchi kesmaga aytiladi.



Vatarining asosiy xossalari:

- diametr vatarini teng ikki bo'lib, unga perpendikulyardir.
- teng vatarlar aylana markazidan teng uzoqlikda joylashadi va aksincha aylana markazidan teng uzoqlikdagi vatarlar o'zaro teng.
- agar ikki vatar M nuqtada kesishsa quyidagi munosabat o'rinli:

$$AM \cdot MB = CM \cdot MD$$

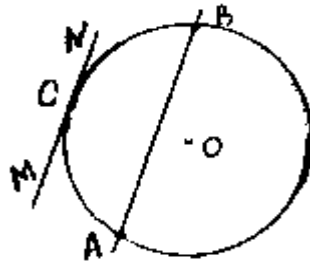
3. Aylanaga o'tkazilgan o'rinmani ta'rifi va xossalari:

Aylanaga o'tkazilgan **o'rinma** deb, aylana bilan bitta umumiy nuqtaga ega bo'lgan to'g'ri chiziqqa aytiladi.

Aylanaga o'tkazilgan o'rinmaning asosiy xossalari:

- urinma aylanaga urinish nuqtasidan o'tuvchi radius bilan o'zaro perpendikulyar; agar to'g'ri chiziq radiusini oxiridan o'tib unga perpendikulyar bo'lsa, aylanaga o'rinadi.

b) agar o'rinma vatarga parallel bo'lsa, u holda u vatarga tiralgan yoyni teng ikkiga bo'ladi.



$$MN \parallel AB \Rightarrow \overset{\frown}{AC} = \overset{\frown}{BC}$$

s) Aylanaga o'tkazilgan ikki o'rinma aylana tashqarisida kesishadi. Bunda ular hosil qilgan kesmalar teng, kesishish nuqtasi va aylana markazidan o'tuvchi to'g'ri chiziq o'rinmalar bilan teng burchaklar hosil qiladi:

$$AB = AC, \angle OAB = \angle OAC.$$

4. Kesuvchi va urinma haqidagi teorema:

Teorema. Agar M nuqtadan MC o'rinma va MA kesuvchi o'tkazilgan bo'lsa, u holda kesuvchini aylanani kesib o'tuvchi nuqtalaridan M nuqttagacha masofalar ko'paytmasi o'rinmani kvadratiga teng bo'ladi:

$$MB \cdot MA = MC^2$$

5. Uzunliklar va yuzalarni hisoblash formulalari.

R radiusli aylana uzunligi: $L = 2\pi R$;

R radiusli doira yuzi: $S = \pi R^2$;

R radiusli aylananing α markaziy burchagiga mos keluvchi yoy uzunligi: $l = R \cdot \alpha$ (α - markaziy burchakni radian o'lchovi);

$$l = \frac{\pi R n}{180^0} \quad (n^0 - \text{markaziy burchakni radius o'lchovi});$$

R radiusli doirani α markaziy burchagiga mos keluvchi doira sektori yuzi:

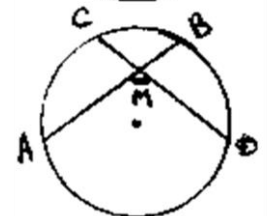
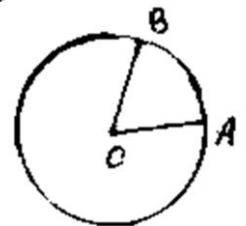
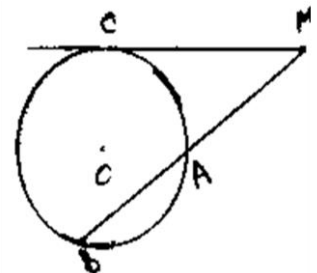
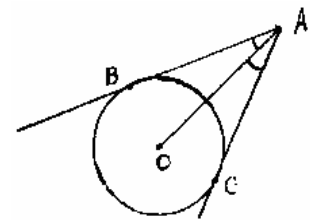
$$S_{\text{sek}} = \frac{Rl}{2} = \frac{R^2 \cdot \alpha}{2}; \quad S_{\text{sek}} = \frac{\pi R^2 n^0}{360^0}.$$

R radiusli doirani α yoyiga mos keluvchi segment yuzi:

$$S_{\text{cegm}} = \frac{R^2}{2} (\alpha - \sin \alpha) \quad (\alpha - \text{yoyning radian o'lchovi})$$

$$S_{\text{segm}} = \frac{R^2}{2} \left(\frac{\pi n^0}{180^0} - \sin n \right) \quad (n^0 - \text{yoyning gradus o'lchovi})$$

Hamma uchlari aylanada yotuvchi uchburchak *aylanaga ichki chizilgan uchburchak* deyilib, aylana esa *uchburchakka tashqi chizilgan aylana* deyiladi.



Uchburchakka tashqi chizilgan aylana markazi uchburchak tomonlari o'rtga perpendikulyarlari kesishgan nuqtasidan iborat. Bundan ko'rinadiki, to'g'ri burchakli uchburchakka tashqi chizilgan aylana markazi gipotenuzada yotadi.

Tomonlari aylanaga o'rinuvchi uchburchak *aylanaga tashqi chizilgan uchburchak* deb atalib, aylana esa uchburchakka *ichki chizilgan aylana* deyiladi.

Uchburchakka ichki chizilgan aylana markazi uchburchak bissektrisalari kesishish nuqtasidan iborat. Teng tomonli uchburchakka tashqi va ichki chizilgan aylanalar markazi ustma-ust tushadi.

2. Uchburchakka tashqi chizilgan aylana radiusi R quyidagi formulalar bilan hisoblanadi:

$$R = \frac{abc}{4S}, \quad R = \frac{a}{2\sin \alpha} = \frac{b}{2\sin \beta} = \frac{c}{2\sin \gamma};$$

bu yerda a, b, c – uchburchakning tomonlari; α, β, γ – uchburchakning mos ravishda a, b, c tomonlari qarshisidagi burchaklari, S_{Δ} – uchburchak yuzi.

Eslatma. To'g'ri burchakli uchburchakka tashqi chizilgan aylana radiusi gipotenuzani yarmiga teng:

$$R = \frac{c}{2}.$$

3. Uchburchakka ichki chizilgan aylana radiusi r quyidagi formulalar bilan hisoblanadi:

$$r = \frac{S_{\Delta}}{p}, \quad r = \frac{1}{\frac{1}{h_a} + \frac{1}{h_b} + \frac{1}{h_c}},$$

bu yerda $p = \frac{1}{2}(a+b+c)$ uchburchakni yarim perimetri h_a, h_b, h_c uchburchakni a, b, c tomonlariga tushirilgan balandliklari.

1-misol. Uchburchakni yuzi 10 sm^2 , unga tashqi chizilgan aylana diametri 16 sm . Uchburchak tomonlari uzunliklari ko'paytmasini toping.

Yechish: a, b, c – uchburchak tomonlari; R – tashqi chizilgan aylana radiusi. Shartga ko'ra $2R = 16 \text{ sm}$, $S_{\Delta} = 10 \text{ sm}^2$.

$$R = \frac{abc}{4S_{\Delta}} \quad \text{formuladan} \quad abc = 4S_{\Delta}R = 320 \text{ cm}^3$$

Javob: 320 cm^3

2 – misol. 120° li teng yonli uchburchak yuzini toping. Bu yerda ichki chizilgan aylana radiusi $\sqrt{12}$

Yechish: Shartga ko'ra $\angle ACB = 120^\circ$, $OD = r = \sqrt{12}$

$AC=BC=x$ deb olsak, ma'lumki

$$\angle ACD = \angle BCD = 60^\circ, AD = AC \sin 60^\circ = \frac{x\sqrt{3}}{2}$$

demak $AC = x\sqrt{3}$. Avval x ni topamiz.

ABC uchburchakni yuzini topishni quyidagi ikki yuza formulasidan:

$$S_{\Delta} = \frac{1}{2} CA \cdot CB \sin 120^\circ = \frac{x^2\sqrt{3}}{4}; S_{\Delta} = p \cdot r = \frac{1}{2} (2AC + AB) \cdot r = \frac{1}{2} (2x + x\sqrt{3})$$

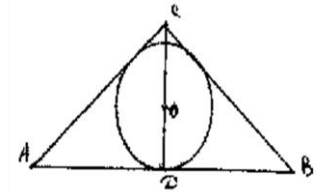
$\sqrt[4]{12}$.

Ushbu tenglamadan $\frac{x^2\sqrt{3}}{4} = \frac{x}{2} (2 + \sqrt{3}) \cdot \sqrt[4]{12}$ noma'lum x ni topamiz:

$$x = 2(2 + \sqrt{3}) \cdot \sqrt[4]{4/3}.$$

$$\text{U holda } S_{\Delta} = \frac{x^2\sqrt{3}}{4} = 2(7 + 4\sqrt{3}) \text{ cm}^2.$$

Javob: $2(7 + 4\sqrt{3}) \text{ sm}^2$.



3 – misol. Asosi 12 sm va balandligi 8 sm bo'lgan teng yonli uchburchakka aylana ichki chizilgan. Unga asosga parallel o'rinma o'tkazilgan. Tomonlar bilan chegaralangan o'rinmaning kesmasini uzunligi necha sm.

Yechish: Shartga ko'ra $AB = 12 \text{ sm}$, $CD = 8 \text{ sm}$. Ko'rinib turibdiki,

$$AC = BC = \sqrt{AD^2 + CD^2} = \sqrt{36 + 64} = 10 \text{ sm}.$$

Ichki chizilgan aylana radiusi r ni aniqlaymiz. Ma'lumki,

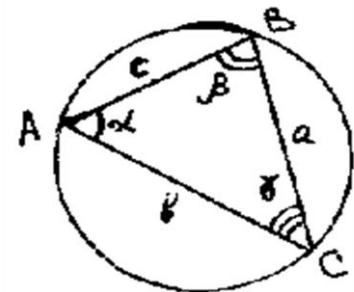
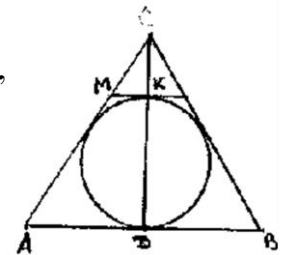
$$S_{\Delta} = \frac{1}{2} (2AC + AB) \cdot r = \frac{1}{2} AB \cdot CD,$$

bu yerdan $r = 3 \text{ sm}$ ekanligi kelib chiqadi.

U holda $CK = CD - 2r = 2 \text{ sm}$. MNC va ABC uchburchaklarning o'xshashligidan:

$$MK:AB = CK:CD, \text{ bundan } MK = \frac{CK}{CD} \cdot AB = 3 \text{ sm}.$$

Javob: 3 sm.



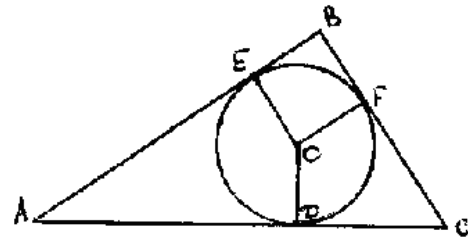
6 – misol. Uchburchakka ichki chizilgan aylana radiusi 4 sm. Tomonlaridan biri aylanaga o'rinish nuqtasida 6 sm, 8 sm, bo'laklarga bo'lingan. Uchburchakni qolgan ikki tomonini toping.

Yechish. $AD = 6 \text{ sm}$, $CD = 8 \text{ sm}$ bo'lsin. ABC uchburchakni AC va BC tomonlarini aniqlash uchun $EB = BF = x$, shuningdek $ABE = AD = 6 \text{ sm}$,

$CF = CD = 8 \text{ sm}$ ekanidan foydalanish mumkin.

Buning uchun uchburchakni yuzini topishishining quyidagi ikki formulasidan foydalanamiz: $S_{\Delta} = p \cdot r$
va $S_{\Delta} = \sqrt{P(P-a)(P-b)(P-c)}$,

R – uchburchakni yarim perimetri, shunga ko‘ra



$$P = \frac{1}{2} (AE + AD + DC + CF + FB + BE) =$$

$$= \frac{1}{2} (28 + 2x) = 14 + x.$$

Navbatdagi tenglamani hosil qilamiz:

$$4(14 + x) = \sqrt{(14 + x) \cdot x \cdot 6 \cdot 8}$$

bu yerdan $x = 7$ sm, u holda $AB = AE + x = 13$ sm, $BC = CF + x = 15$ sm.

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