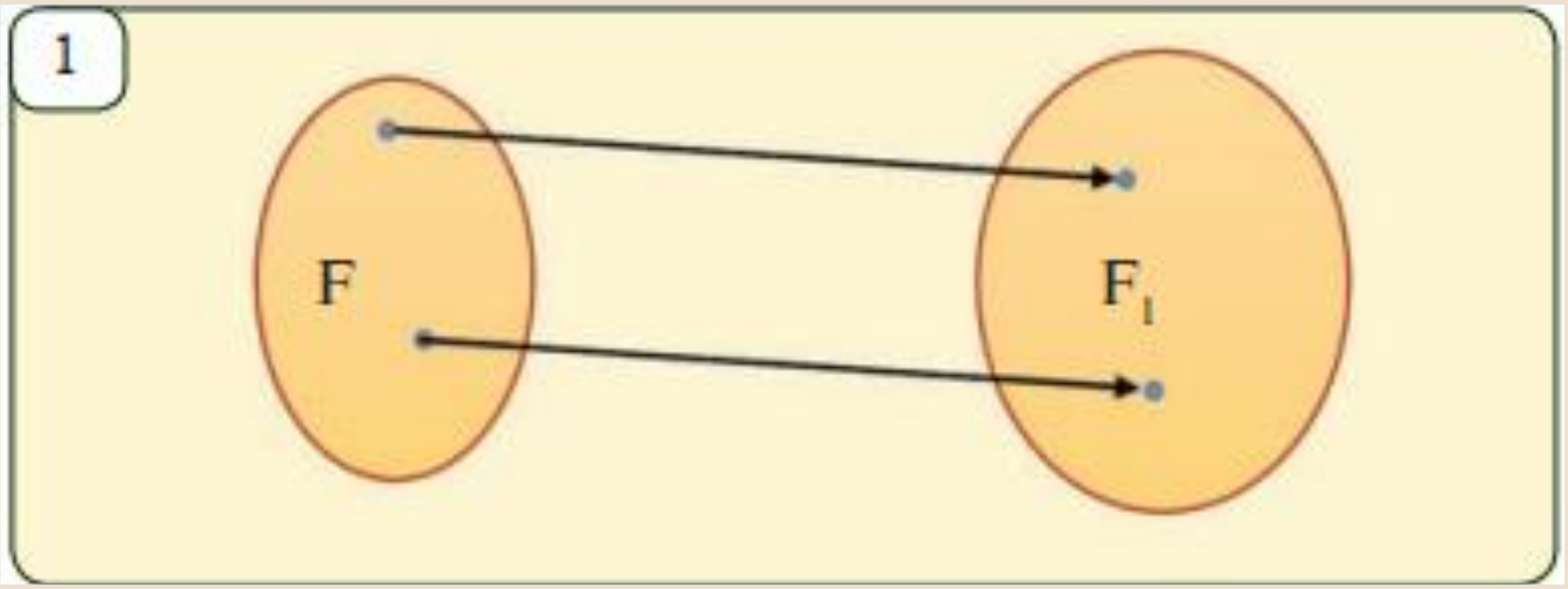
Mavzu: Harakat. Parallel ko`chirish. Simmetrik shakllar. O`qqa nisbatan simmetriya va uning xossalari. Markaziy simmetriya va uning xossalari. Ixtiyoriy uchburchakka burish. Gomotetiya. Gomotetik ko`pburchaklar va shakllar. Geometrik almashtirishning kompozitsiyalari.

Reja:

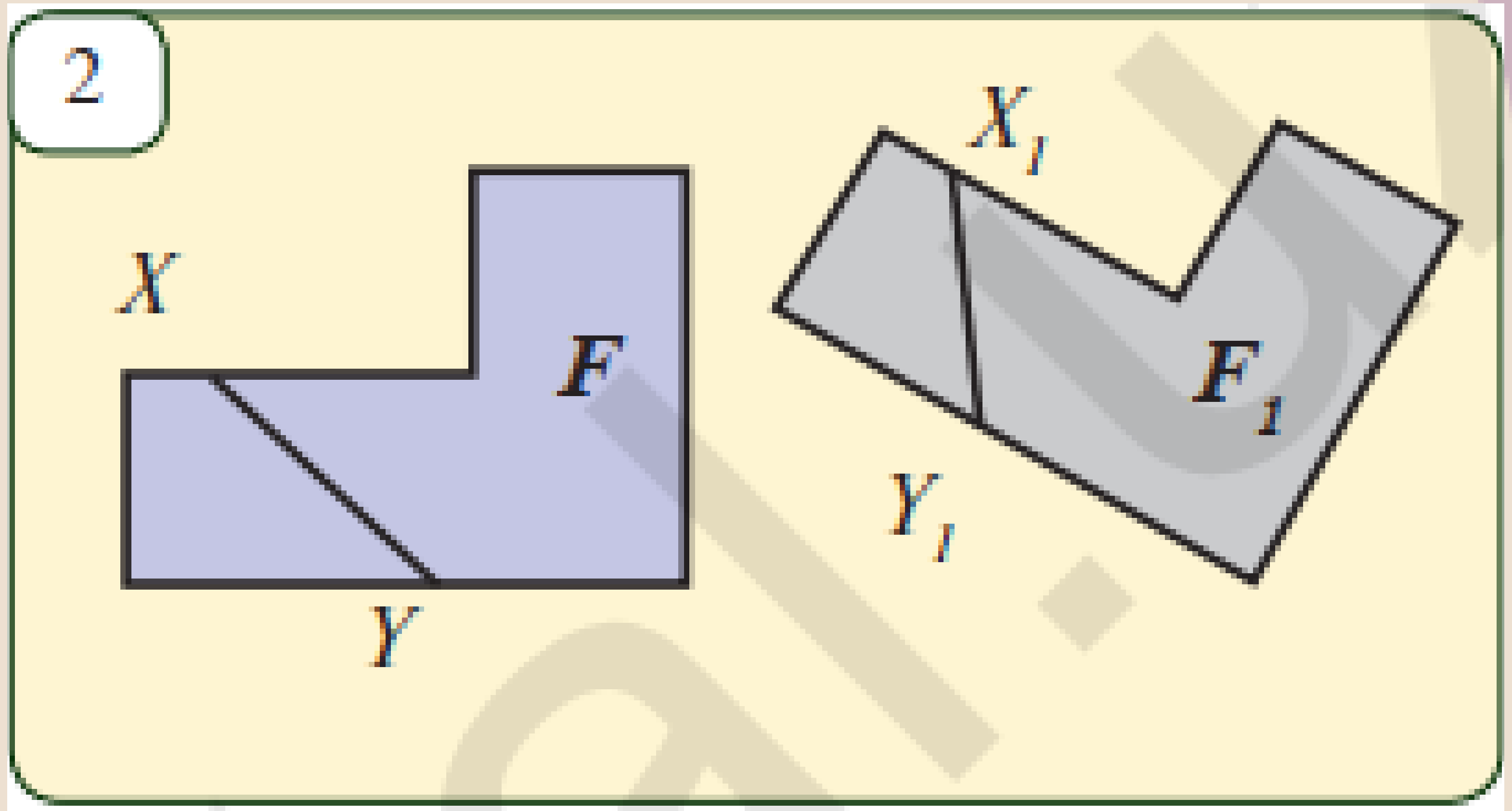
1. Harakat. Parallel ko`chirish. Simmetrik shakllar.
2. O`qqa nisbatan simmetriya, markaziy simmetriya va uning xossalari.
3. Ixtiyoriy burchakka burish. Gomotetiya.
4. Gomotetik ko`pburchaklar va shakllar. Geometrik almashtirish-ning kompozitsiyalari

TEKISLIKDA GEOMETRIK ALMASHTIRISHLAR.

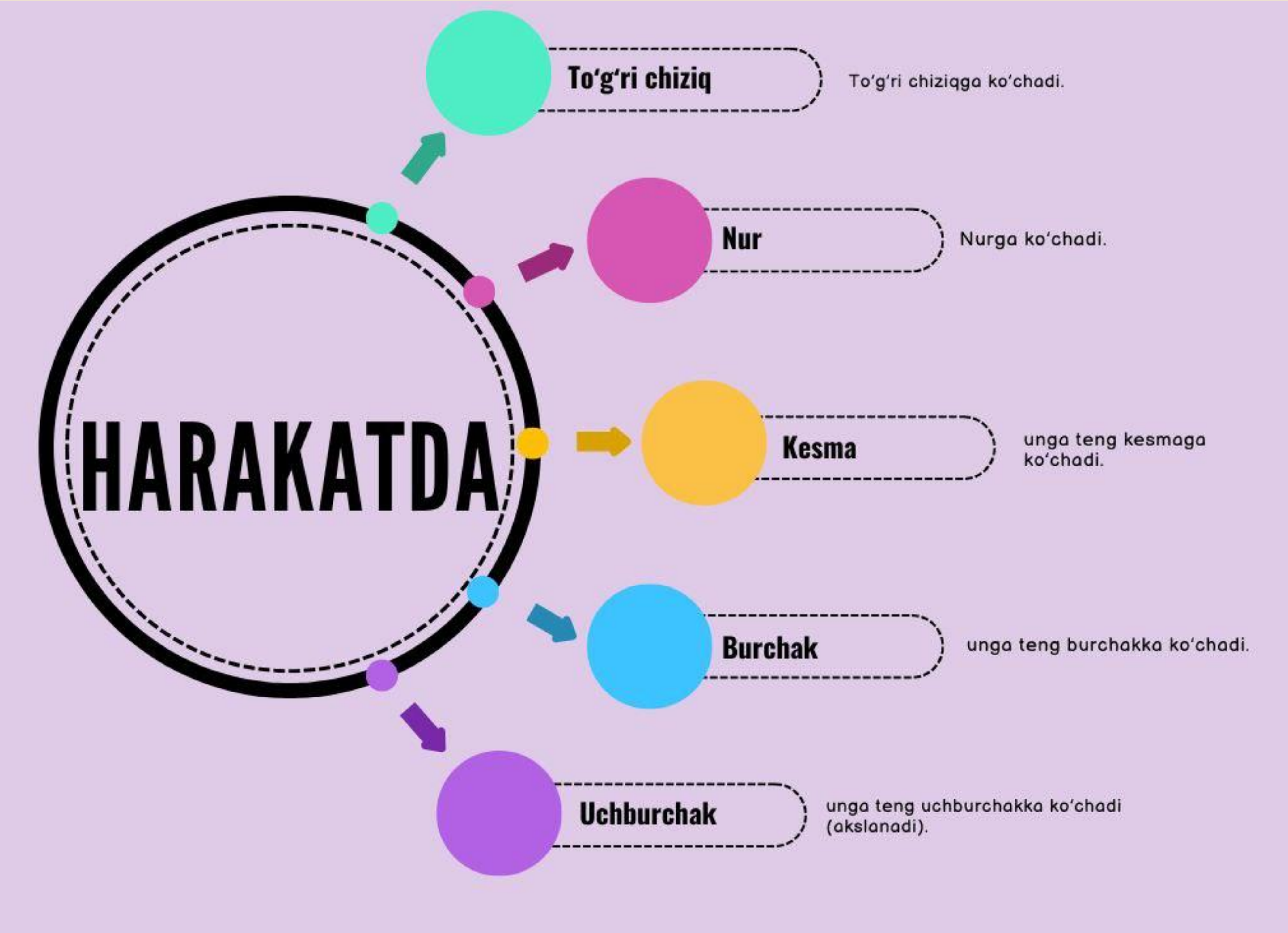
Tekislikda berilgan F shaklning har bir nuqtasi biror bir usulda ko‘chirilsa, yangi F1 shakl hosil bo‘ladi (1- rasm). Agar bu ko‘chirishda (akslantirishda) birinchi shaklning har xil nuqtalari ikkinchi shaklning har xil nuqtalariga ko‘chsa (akslantirish o‘zaro bir qiymatli bo‘lsa), bu ko‘chirishga geometrik shakl almashtirish deb ataladi



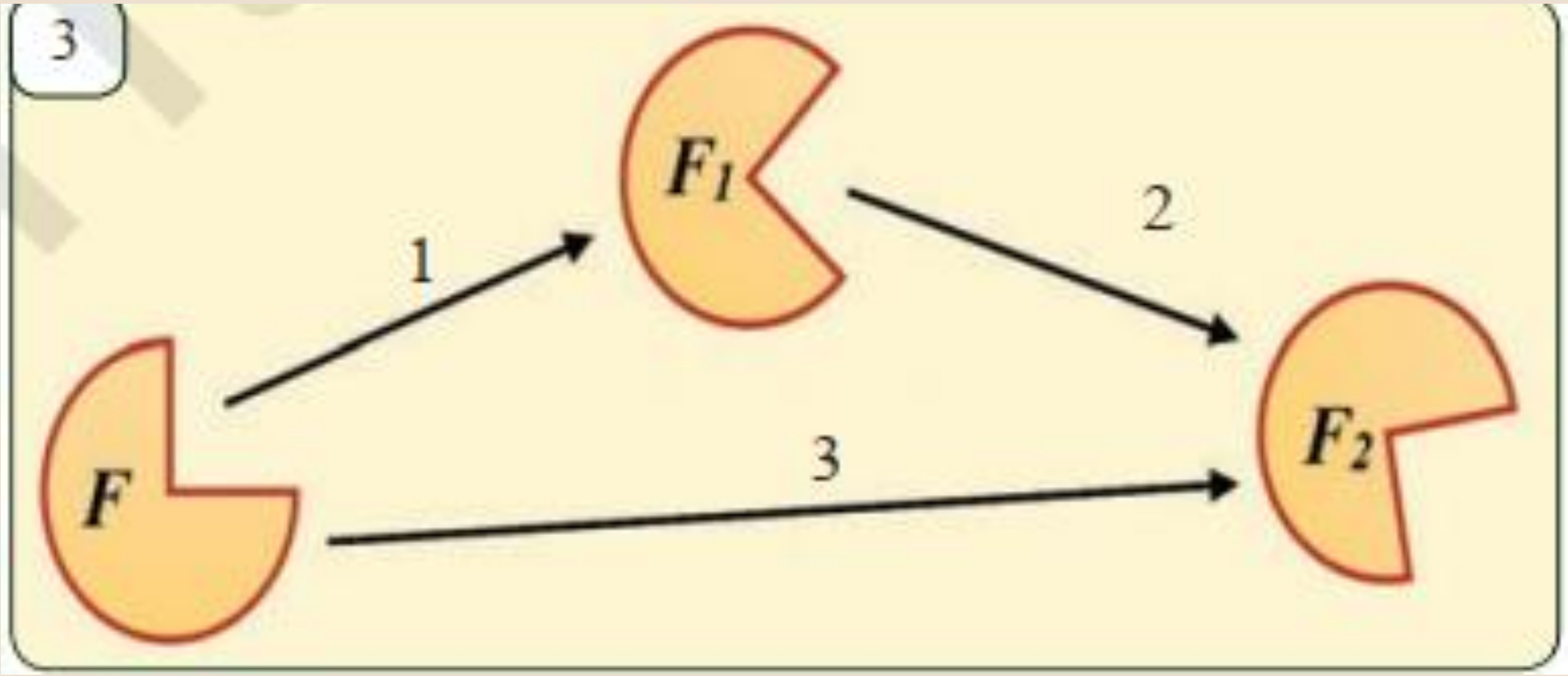
Nuqtalar orasidagi masofani saqlaydigan shakl almashtirish harakat deb ataladi. Ta'rifga ko'ra, shakl almashtirshda F shaklning ixtiyoriy X va Y nuqtalari F1 shaklning qandaydir X1 va Y1 nuqtalariga o'tgan bo'lib, XY = X1Y1 tenglik bajarilsa (ya'ni masofa saqlansa), bunday shakl almashtirish harakat bo'ladi (2-rasm).



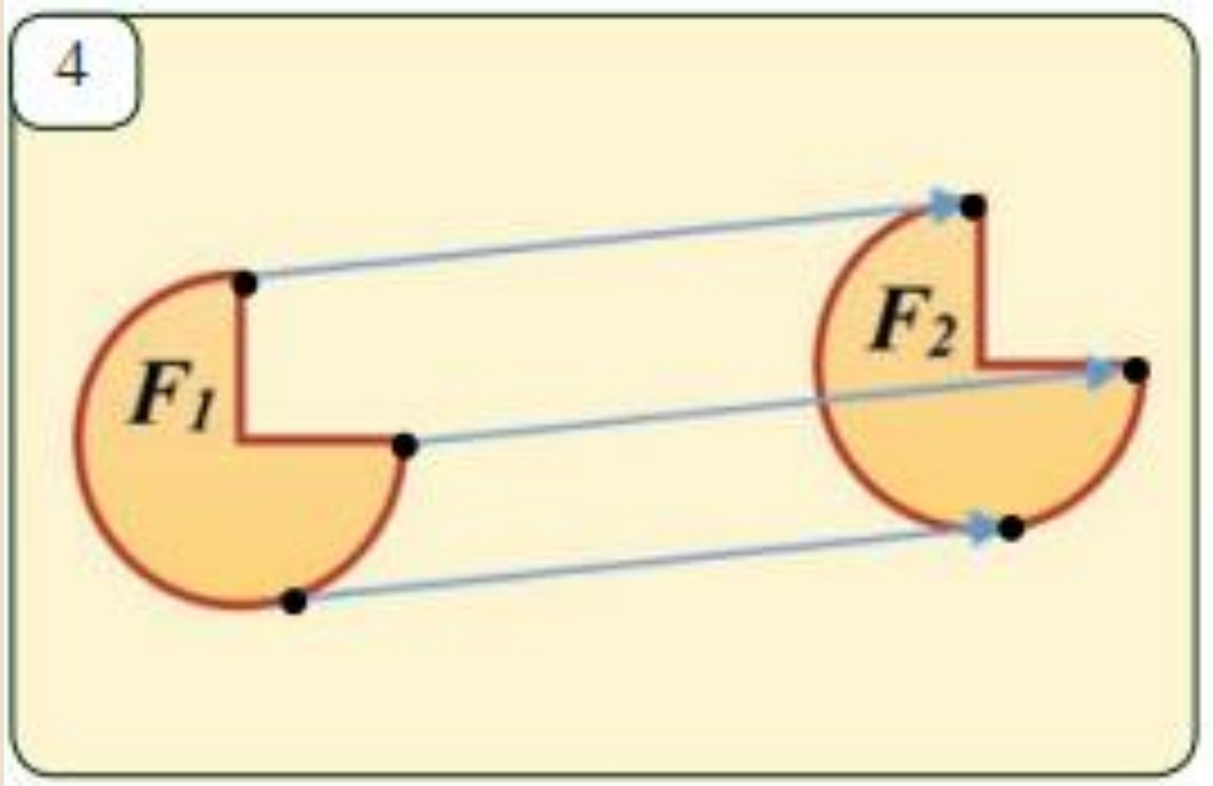
HARAKATNING QUYIDAGI XOSSALARINI KELTIRISH MUMKIN.



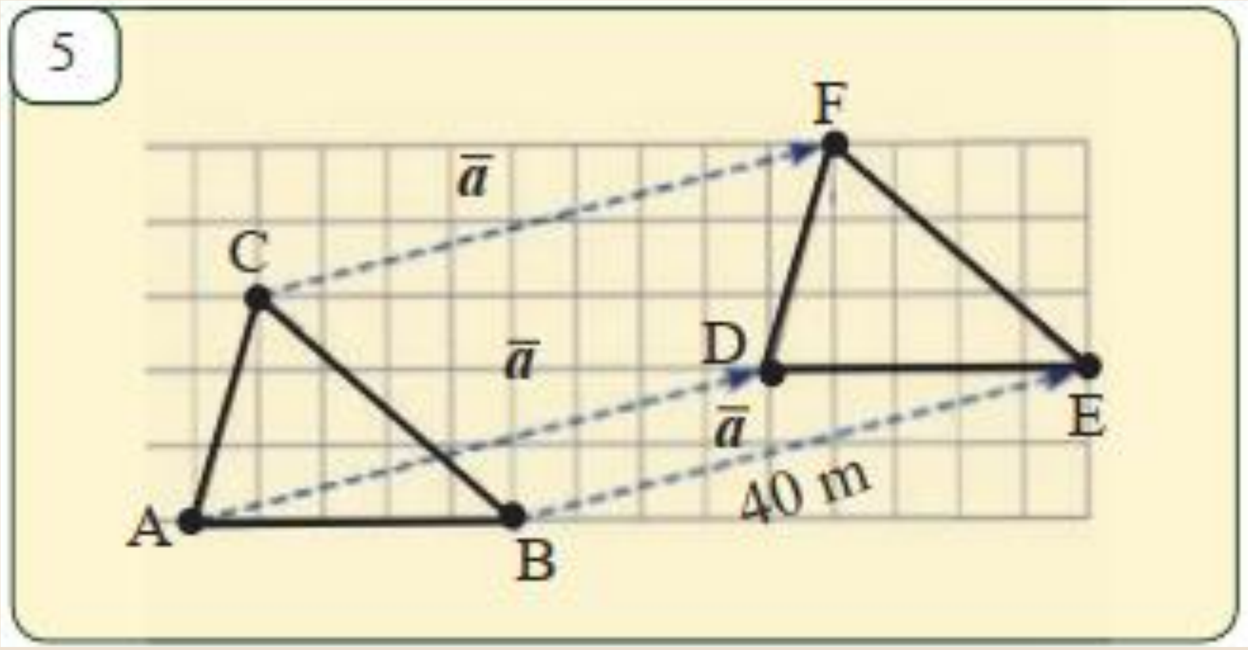
Aytaylik, F shakl birinchi harakat natijasida F1 shaklga, F1 shakl esa ikkinchi harakat yordamida F2 shaklga o‘tgan bo‘lsin. Natijada, F shakl bu ikki harakat yordamida F2 shaklga ko‘chadi va bu ko‘chish o‘z navbatida yana harakat bo‘ladi (3-rasm).

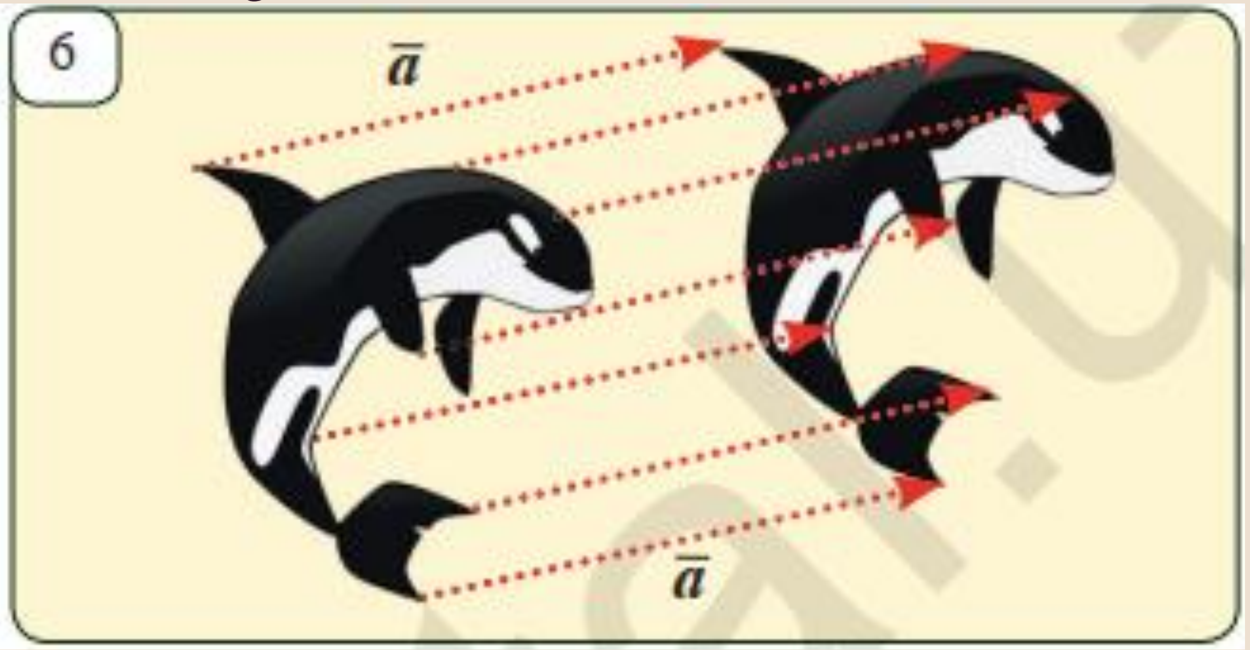


Tekislikda biror harakat yordamida birini ikkinchisiga ko‘chirish mumkin bo‘lgan shakllar teng deyiladi. Tekislikda biror AB vektor va ixtiyoriy X nuqta berilgan bo‘lsin. Agar X1 nuqta uchun XX1 = AB shart bajarilsa, X nuqta X1 nuqtaga AB vektor bo‘ylab parallel ko‘chirilgan deb ataladi.



Agar tekislikda berilgan F shaklning har bir nuqtasi AB vektor bo‘ylab ko‘chirilsa (5- rasm), yangi F1 shakl hosil bo‘ladi. Bu holda F shakl F1 shaklga parallel ko‘chirilgan deyiladi. Parallel ko‘chirishda F shaklning har bir nuqtasi bir xil yo‘nalishda bir xil masofaga ko‘chirilgan bo‘ladi.
5- rasmda tasvirlangan uchburchakning har bir nuqtasi boshlang‘ich holatiga nisbatan 40 m ga parallel ko‘chgan. 6- rasmdagi delfin ham a vektor bo‘ylab parallel ko‘chirilgan





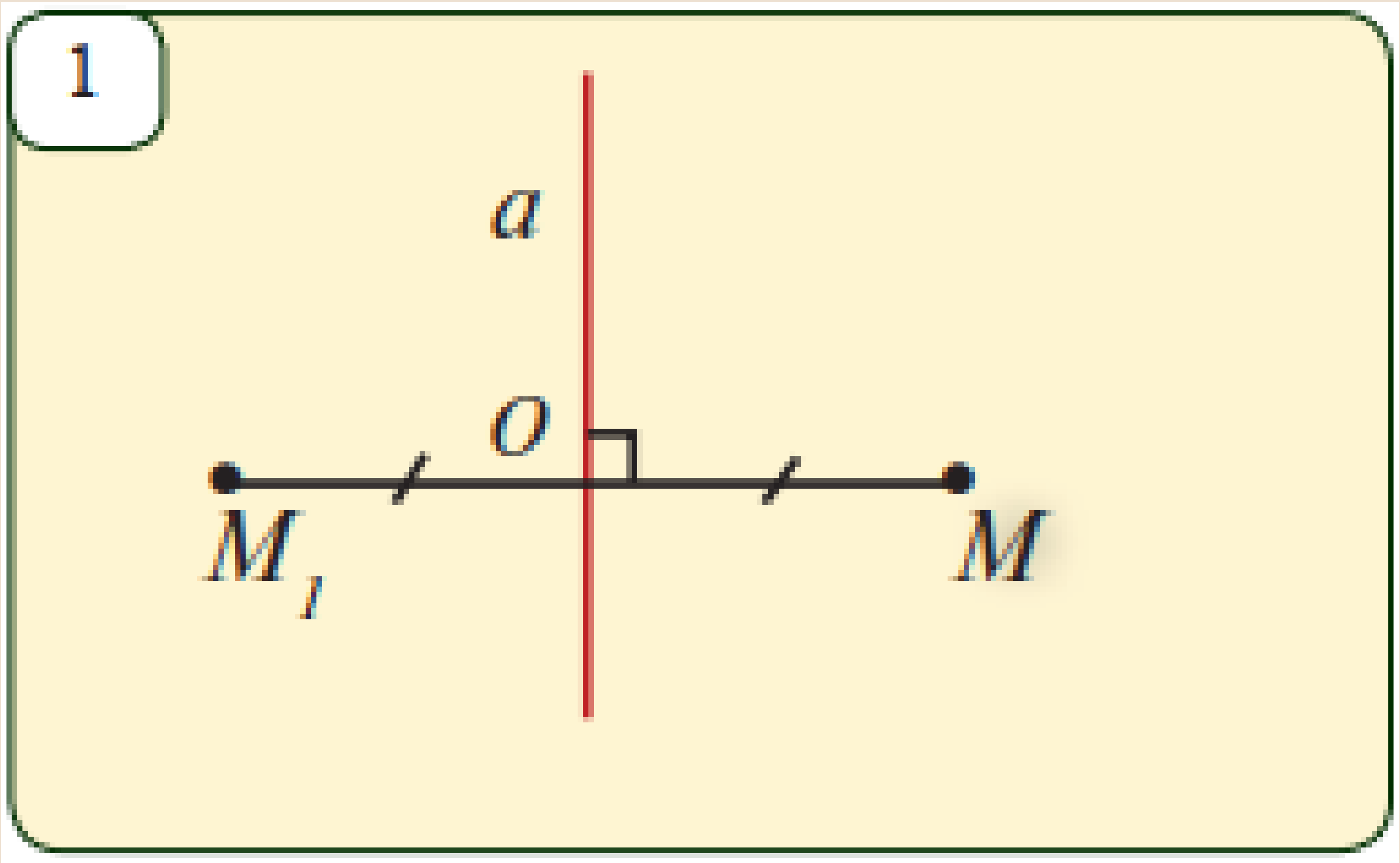
Ravshanki, parallel ko‘chirish harakatdir. Shuning uchun, parallel ko‘chirishda to‘g‘ri chiziq - to‘g‘ri chiziqqa, nur – nurga, kesma - unga teng kesmaga ko‘chadiva hokazo. Aytaylik, AB = (a; b) vektor bo‘ylab parallel ko‘chirishda F shaklning nuqtasi X (x; y) va F1 shaklning nuqtasi X1 (x1; y1) ga o‘tsin. Unda ta‘rifga ko‘ra quyidagilarga egamiz:

x1 – x = a , y1 – y = b yoki x1 = x + a , y1 = y + b.

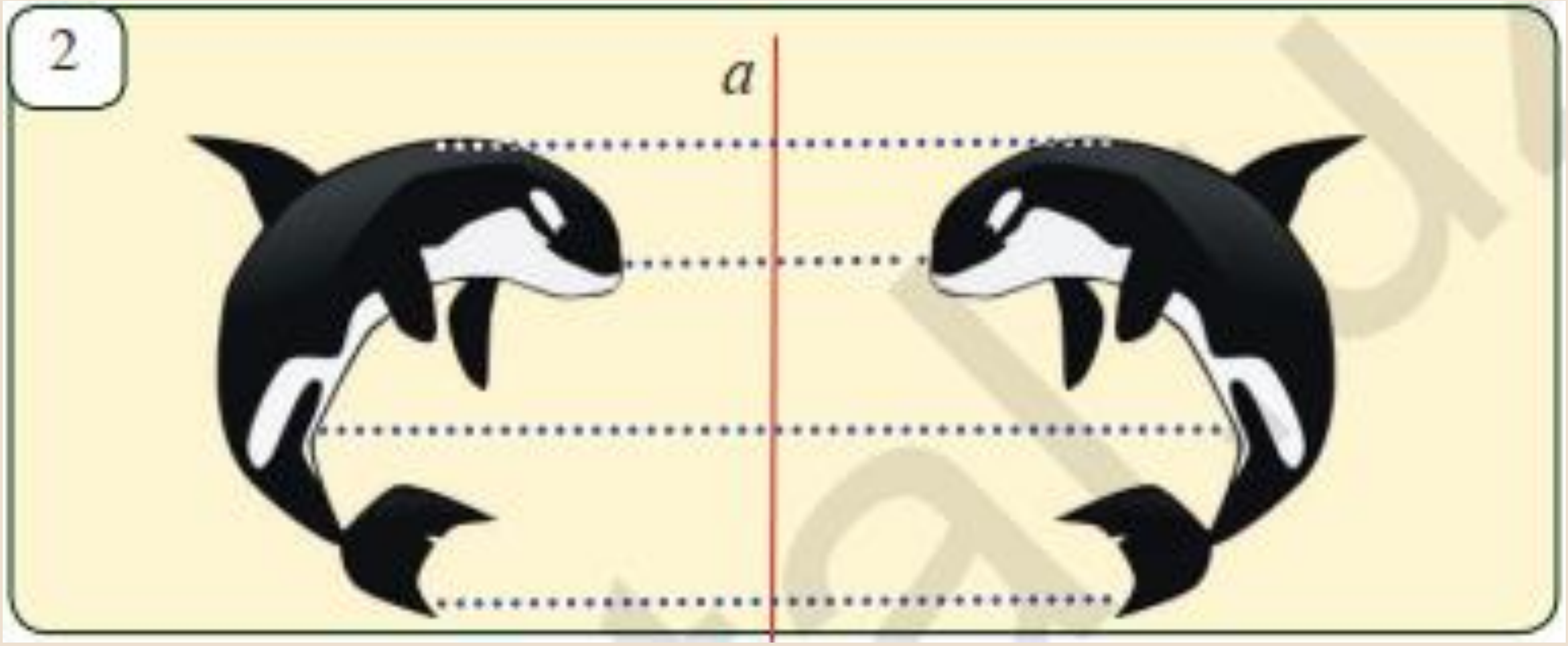
Bu tengliklar paralel ko‘chirish formulalari deb ataladi.

O'QQA NISBATAN SIMMETRIYA

Tekislikda biror a to'g'ri chiziq va unda yotmaydigan ixtiyoriy M nuqta berilgan bo'lsin. M nuqtadan a to'g'ri chiziqqa perpendikular tushiramiz va uning asosini O bilan belgilaymiz (1-rasm).Perpendikularda yotgan M1 nuqta uchun MO =M1O bo'lsa, M va M1 nuqtalarga a to'g'ri chiziq yoki o'qqa nisbatan simmetrik nuqtalar deyiladi

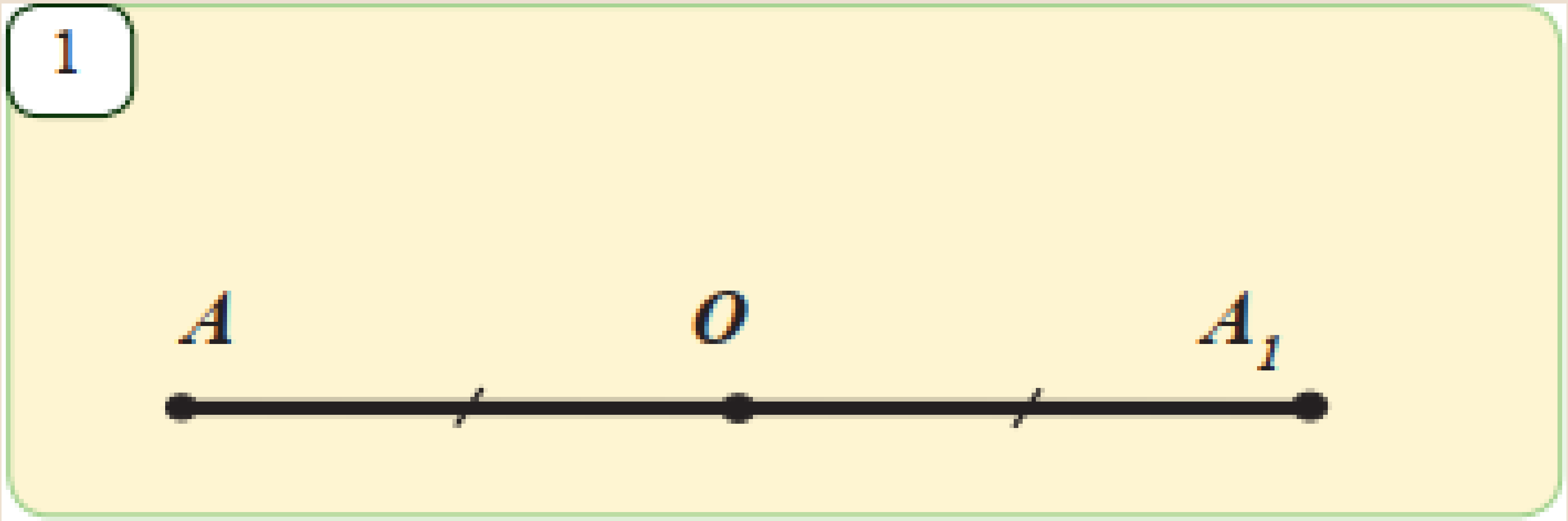


Tekislikning ixtiyoriy M nuqtasiga a to‘g‘ri chiziq (o‘qqa) nisbatan unga simmetrik bo‘lgan M1 nuqtani mos qo‘yamiz. Tekislikni bunday o‘zini-o‘ziga akslantirishga o‘qqa nisbatan simmetriya deymiz. To‘g‘ri chiziqni esa simmetriya o‘qi deb yuritamiz.
2-rasmda tasvirlangan delfinlar o‘zaro a o‘qqa nisbatan simmetrik bo‘ladi

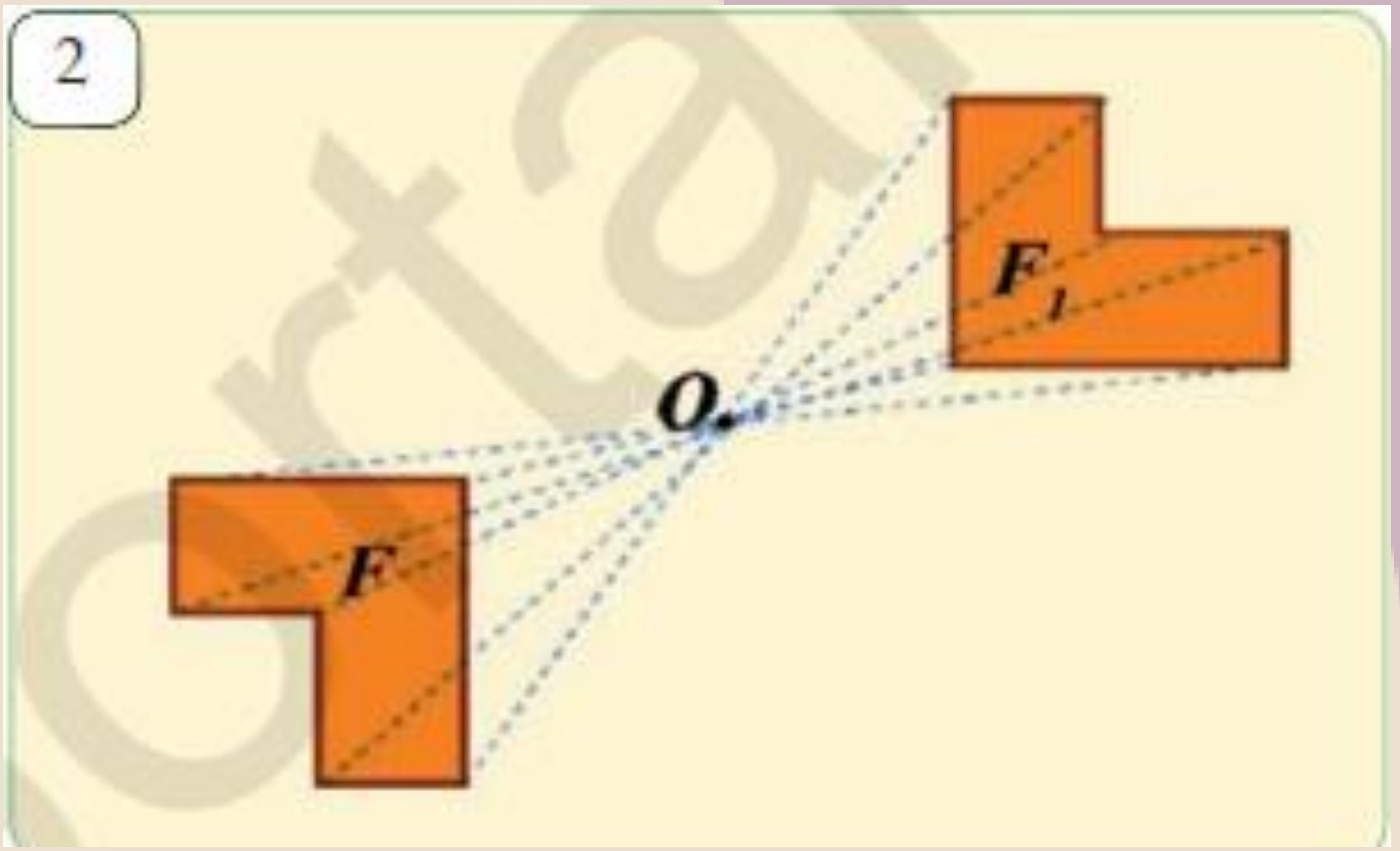


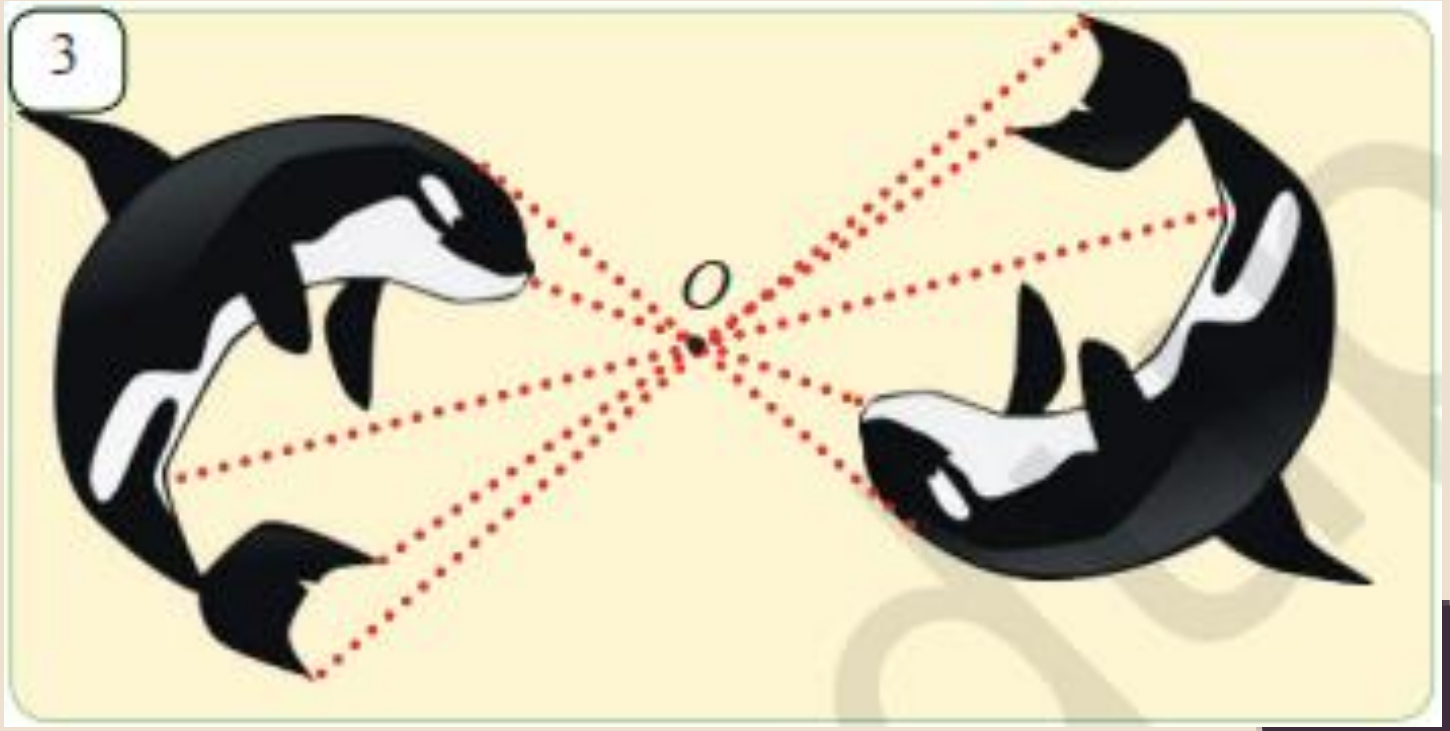
MARKAZIY SIMMETRIYA VA BURISH

Tekislikda berilgan A va A1 nuqtalar O nuqtaga nisbatan simmetrik deyiladi, agar AO =· OA 1 ya’ni O nuqta AA1 kesmaning o‘rtasi bo‘lsa (1- rasm).

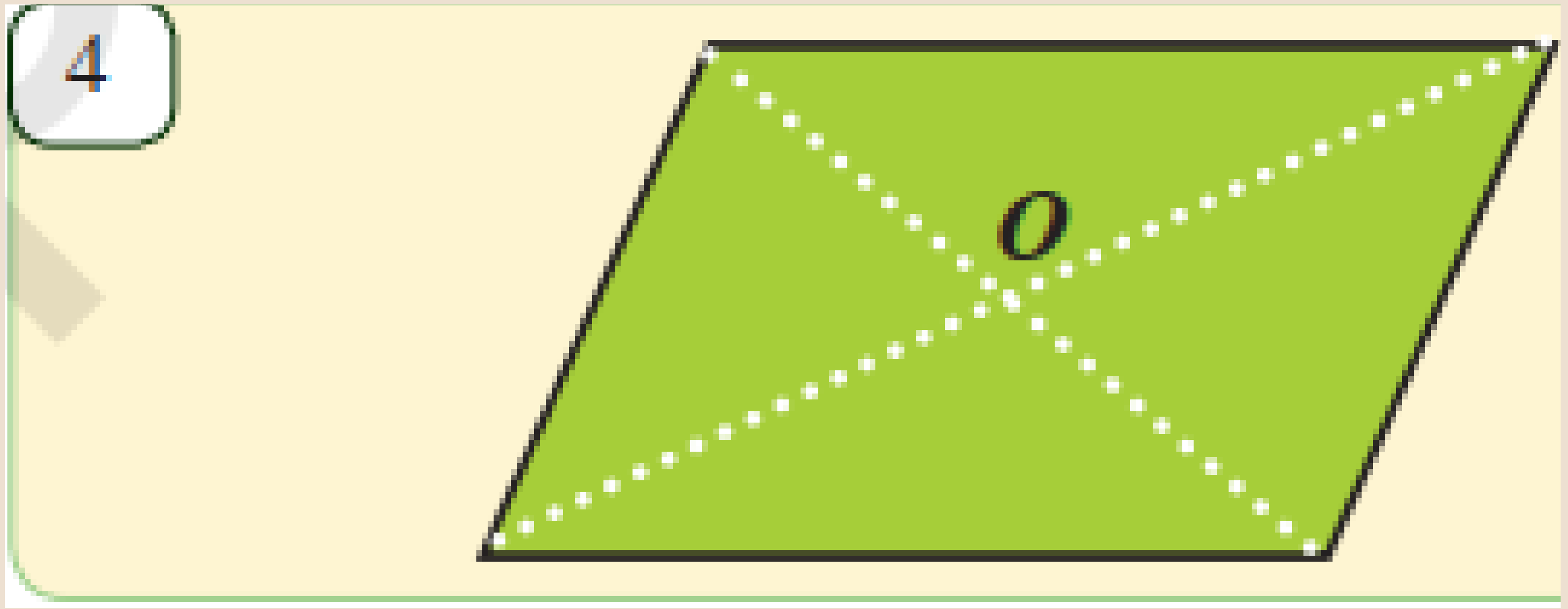


Agar tekislikda berilgan F shaklning har bir nuqtasi O nuqtaga nisbatan simmetrik nuqtaga ko‘chsa (2- rasm), yangi F1 shakl hosil bo‘ladi. Bunday almashtirishda F va F
1 shakllar O nuqtaga nisbatan simmetrik deyiladi. 3- rasmlardagi delfinlar rasmi O nuqtaga nisbatan simmetrik shakllar bo‘ladi

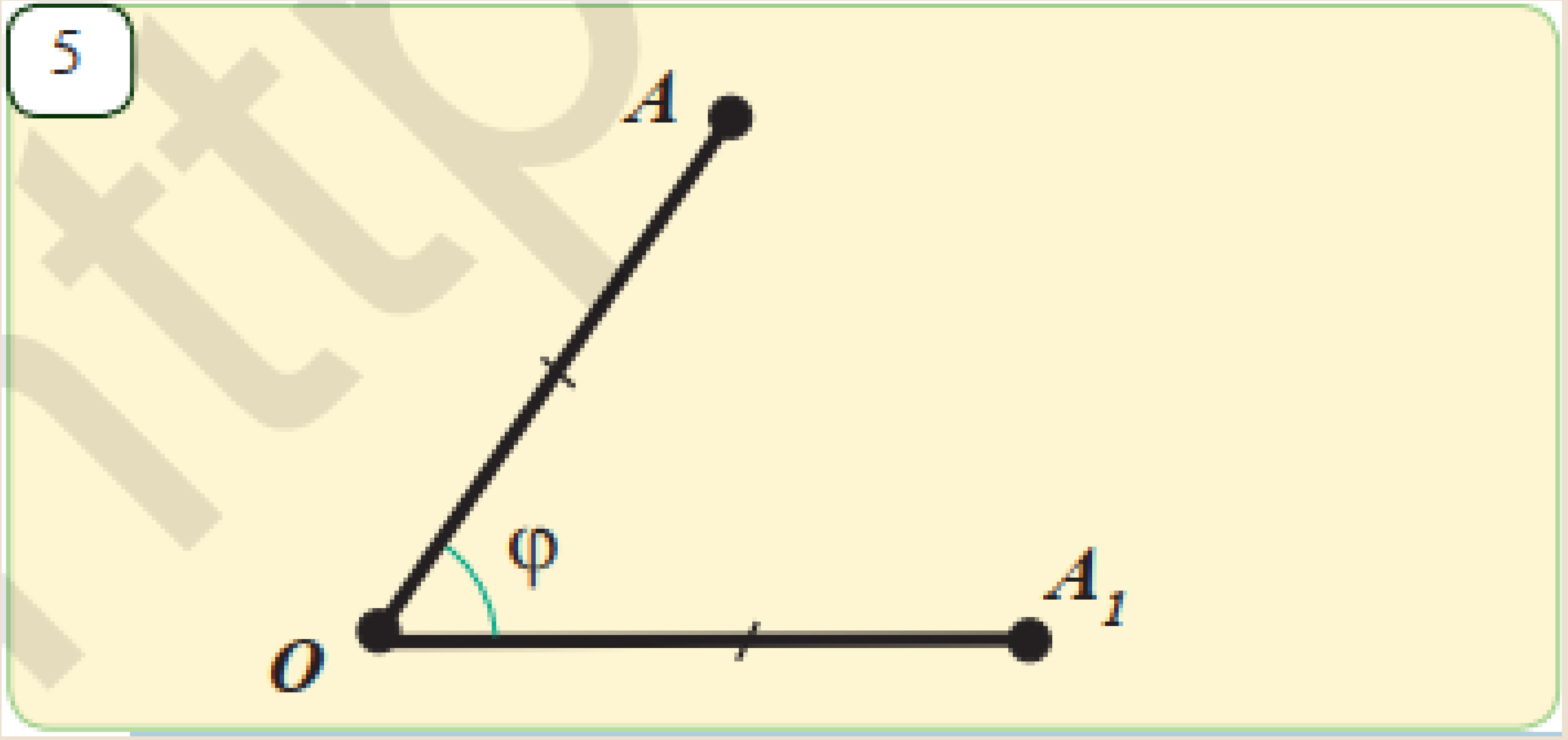




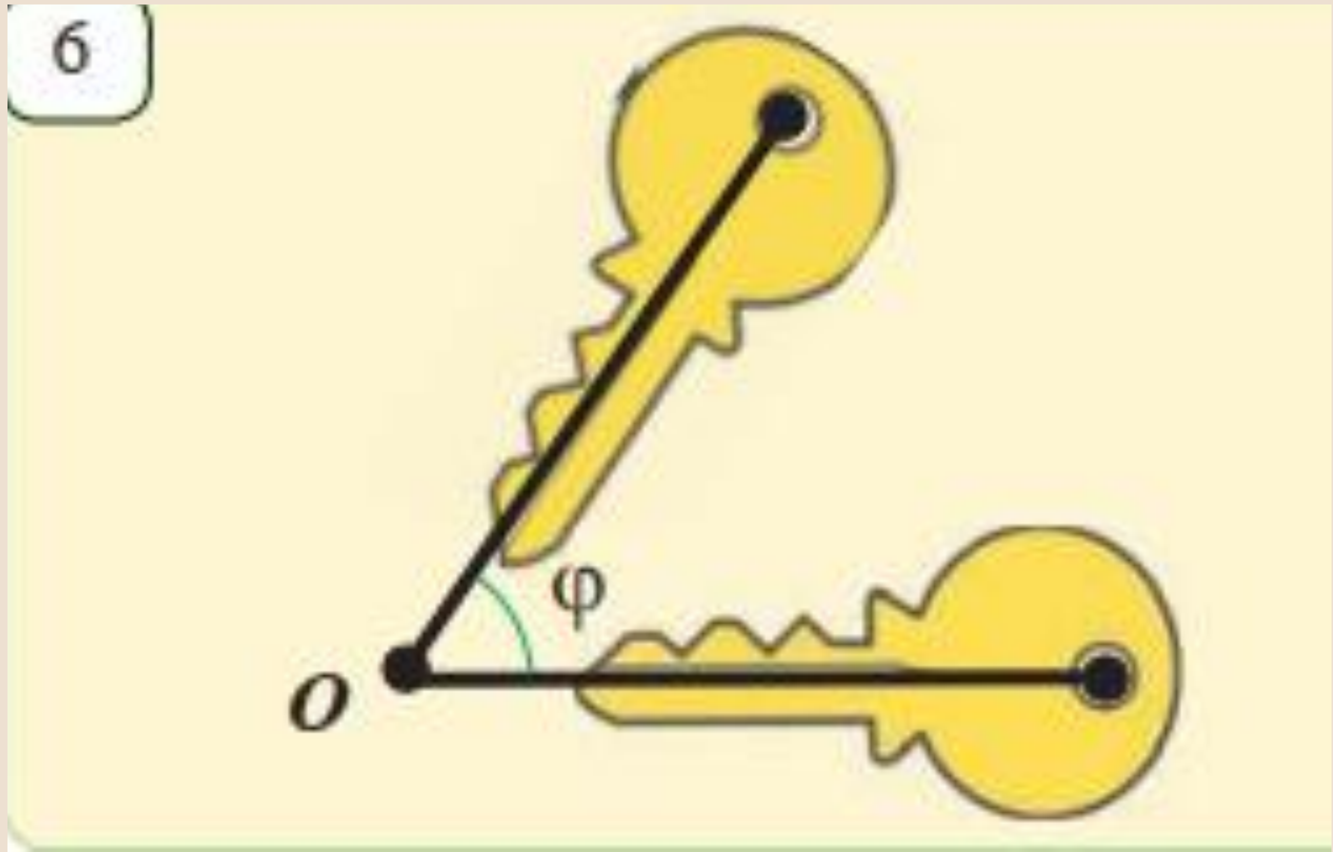
Nuqtaga nisbatan simmetriya – harakatdir.
Agar F shakl O nuqtaga nisbatan simmetrik almashtirishda o‘ziga ko‘chsa, u markaziy simmetrik shakl deb ataladi.
Masalan, parallelogramm (4- rasm) diagonallari kesishish nuqtasi O ga nisbatan markaziy simmetrik shakl hisoblanadi.



Aytaylik, tekislikda O nuqta va ·ϕ burchak berilgan bo‘lib, shakl almashtirishda tekislikning ixtiyoriy A nuqtasi shunday A1 nuqtaga ko‘chsinki, OA = OA1 va ·∠AOA1 = ϕ · bo‘lsin. Bunday shakl almashtirish tekislikni O nuqta atrofida ϕ ·burchakka burish deb ataladi (5-rasm).



Agar tekislikda berilgan F shaklning har bir nuqtasini O nuqtaga nisbatan ϕ burchakka bursak, yangi F1 shakl hosil bo'ladi. Bunda F shakl O nuqtaga nisbatan ϕ burchakka burishda F1 shaklga o'tdi deyiladi.6-rasmda kalit rasmi va uni biror burchakka burishda hosil bo'lgan shakl kerltirilgan.

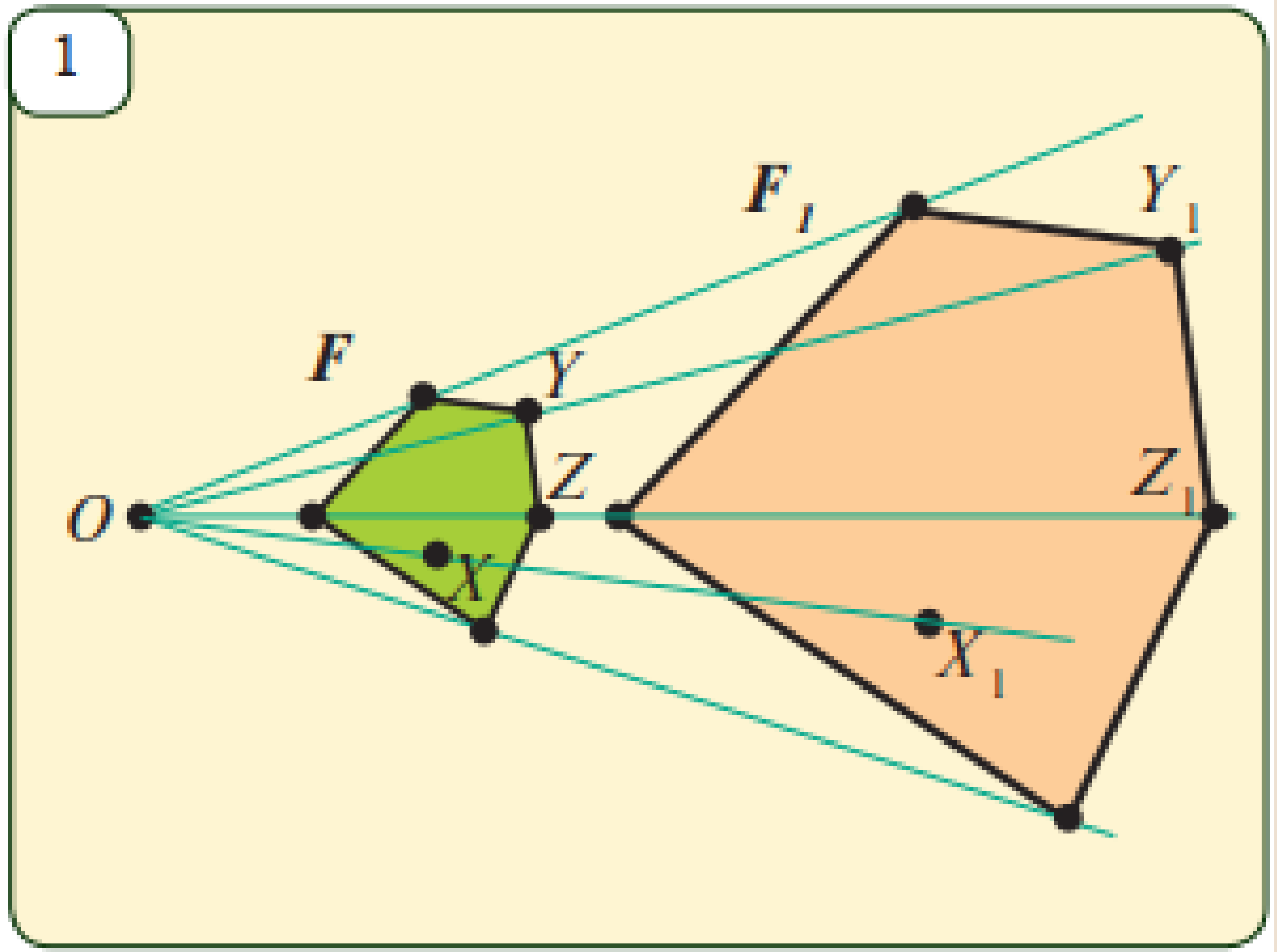


Nuqtaga nisbatan burish ham harakat bo‘ladi.
O nuqtaga nisbatan 180o burchakka burish O nuqtaga nisbatan markaziy simmetriyadan iborat bo‘ladi. Koordinatalari bilan berilgan A (x; y) nuqta koordinata boshiga nisbatan simmetriyada A1 (-x; -y) nuqtaga o‘tadi:

A (x; y)   A1 (-x; -y)

Tabiatda simmetriyani har qadamda uchratish mumkin. Masalan, jonli mavjudodlarning ko‘pchiligi, xususan, inson va hayvonlar gavdasi, o‘simliklarning barglari va gullari simmetrik tuzilgan (7- rasm). Shuningdek, jonsiz tabiat unsurlari ham borki, masalan qor zarralari, tuz kristallari, moddalarning molekulyar tuzilishi ham ajoyib simmetrik shakllardan iboratdir.

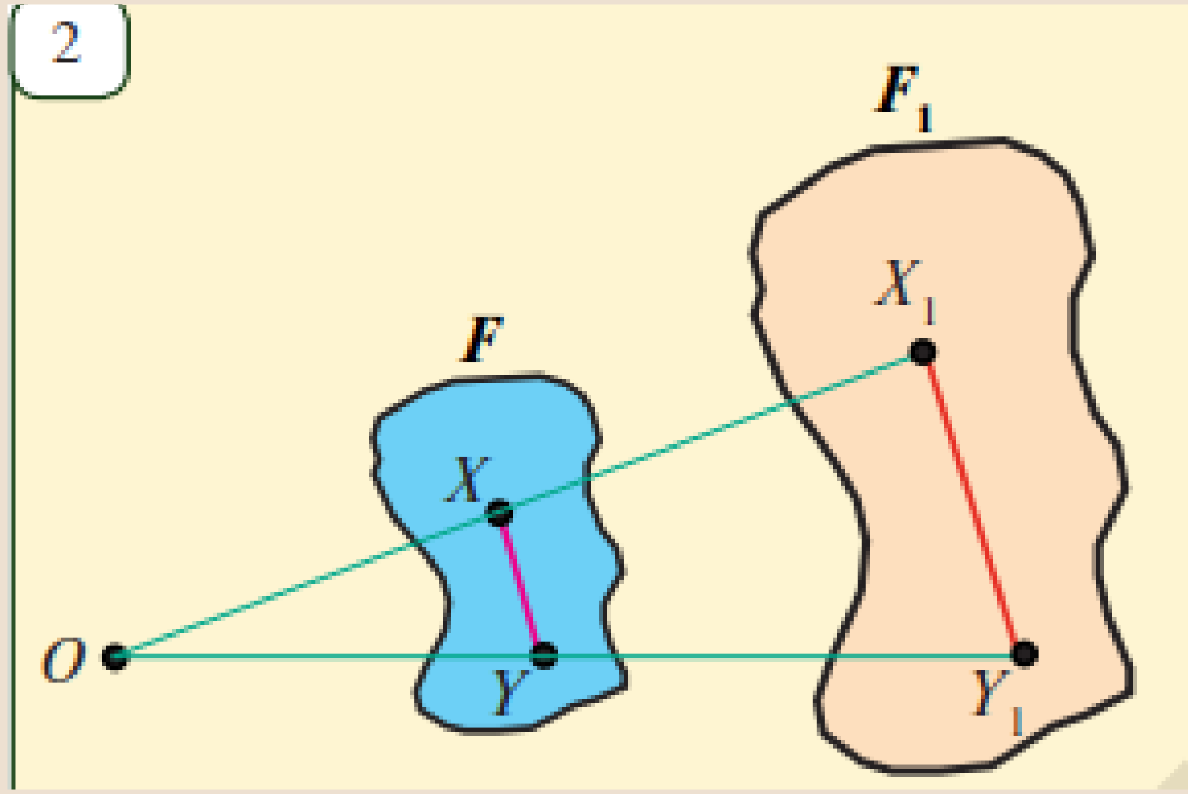
GOMOTETIYA VA O‘XSHASHLIK



Eng sodda o‘xshash almashtirishlardan biri gomotetiyadir. Aytaylik, F — shakl, O — nuqta va k — musbat son berilgan bo‘lsin. F shaklning istalgan X nuqtasi orqali OX nur o‘tkazamiz va bu nurda uzunligi k. OX bo‘lgan OX 1 kesmani qo‘yamiz (1-rasm). Shu usul bilan F shaklning har bir X nuqtasiga X 1 nuqtani mos qo‘yadigan almashtirish gomotetiya deyiladi. Bunda, O nuqta gomotetiya markazi, k soni gomotetiya koeffitsiyenti, F va gomotetiya natijasida F shakl almashadigan F 1 shakllar esa gomotetik shakllar deyiladi.

TEOREMA. GOMOTETIYA O‘XSHASHLIK almashtirishi bo‘ladi.

Isbot. Ixtiyoriy O markazli, k koeffitsiyentli gomotetiyada F shaklning X va Y nuqtalari X1 va Y1 nuqtalarga o‘tsin (2-rasm). U holda, gomotetiya ta’rifiga ko‘ra, XOY va X1OY1 uchburchaklarda ∠O — umumiy va $\frac{OX_1}{OX} = \frac{OY_1}{OY} = k$ **bo`ladi.**

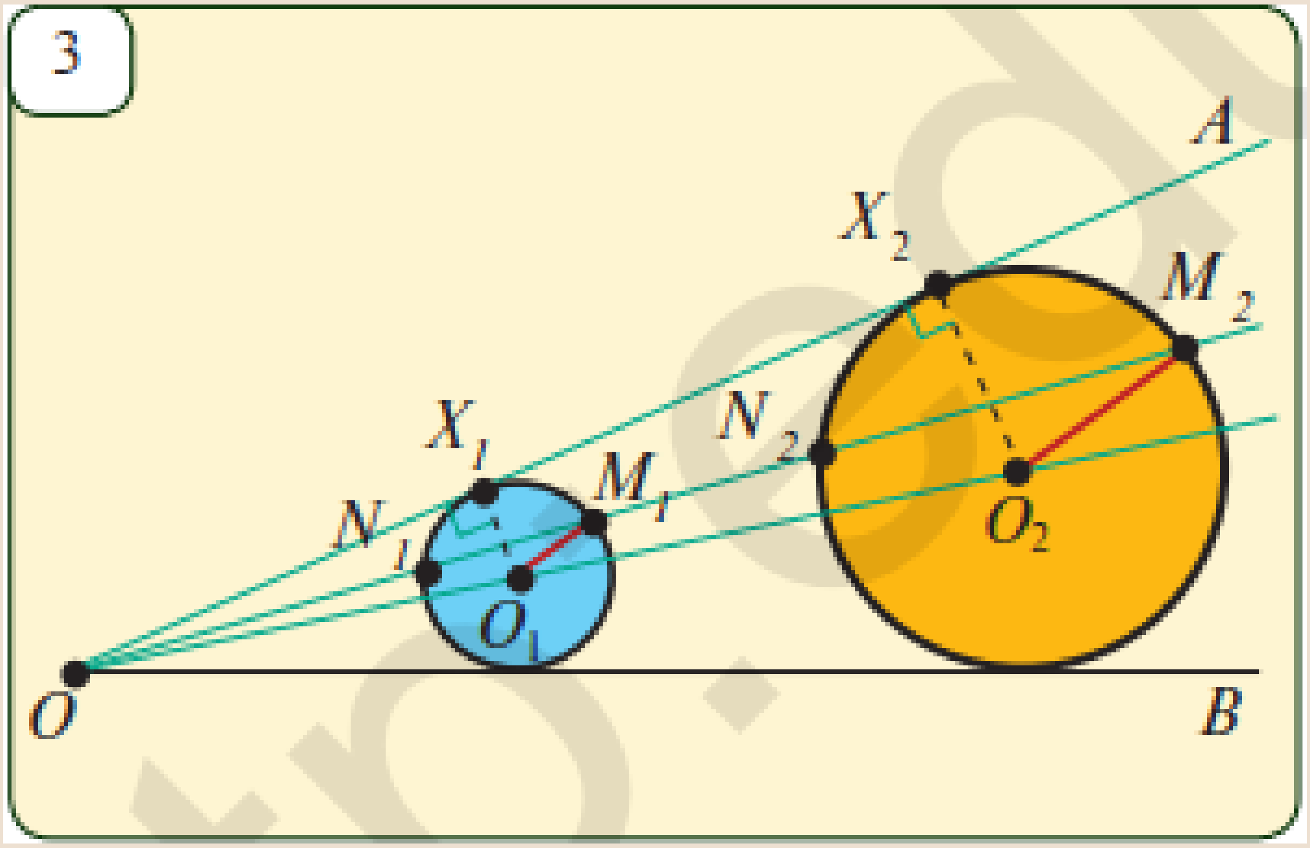


Demak, XOY va X1OY1 uchburchaklar ikki tomoni va ular orasidagi burchagi bo‘yicha o‘xshash.

Shuning uchun $\frac{X_1Y_1}{XY}=\frac{OX_1}{OX}$**, xususan,**

X1Y1=k*XY

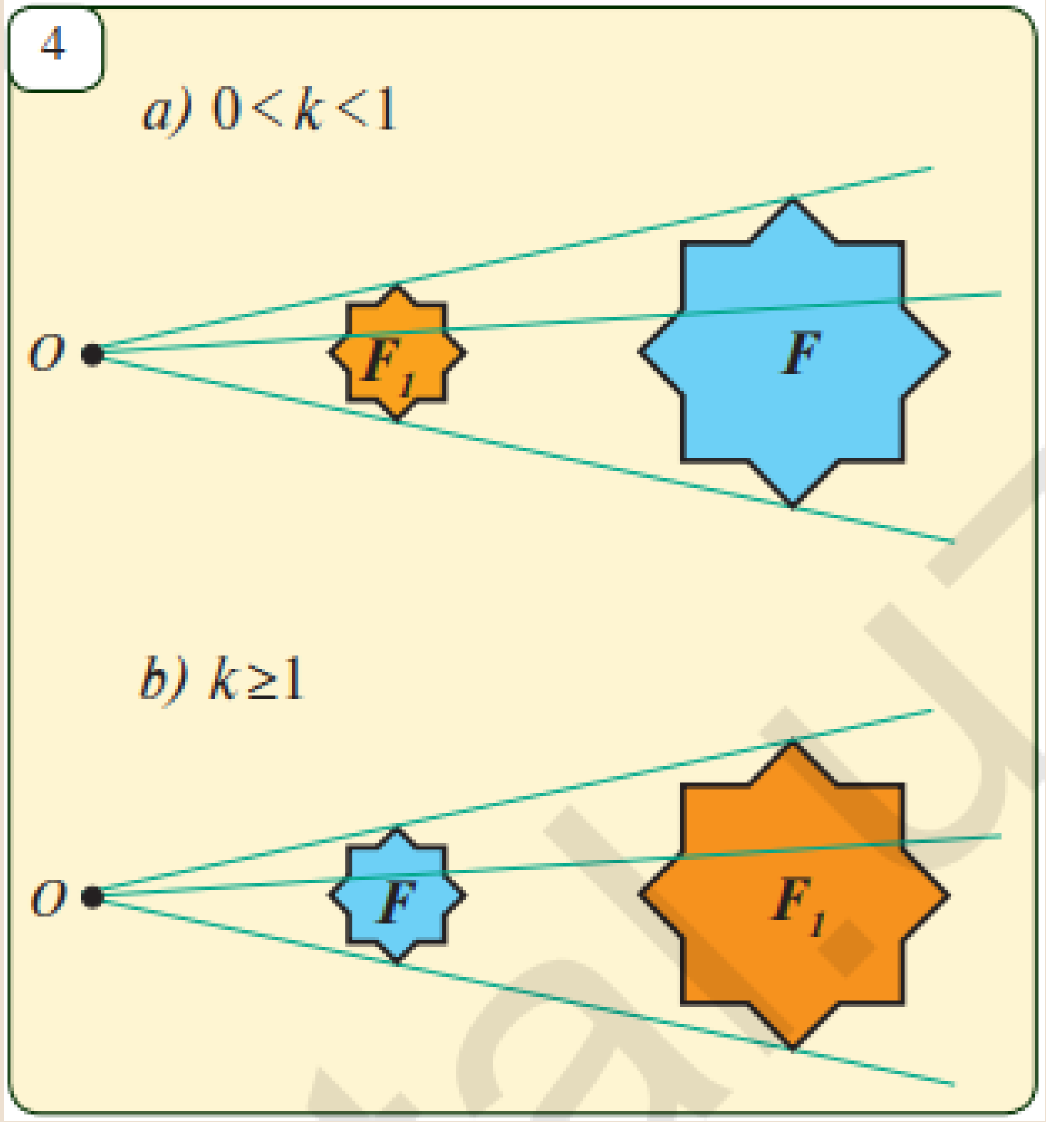
Teorema isbotlandi



AOB burchak tomonlariga urinuvchi ixtiyoriy ikki aylana gomotetik bo‘lishini va O nuqta bu gomotetiya uchun markaz ekanligini isbotlang.

Isbot. Markazlari O1 va O 2 bo‘lgan aylanalar AOB burchak tomonlariga urinsin (3-rasm). Bu aylanalarning gomotetik ekanligini isbotlaymiz. Aylanalar OA nurga mos ravishda X1va X 2 nuqtalarda uringan bo‘lsin (3-rasm). U holda, ΔOX1O1 ΔOX2O2, chunki ∠X1OO1 = ∠X2OO2 va ∠OX1O1 =∠OX2O2 = 90°. Bundan, $\frac{O_2X_2}{O_1X_1}=\frac{OO_2}{OO_1}$.

O‘ng tomondagi nisbatni k bilan belgilaymiz va koeffitsiyenti k=$\frac{O_2X_2}{O_1X_1}$, markazi O bo‘lgan gomotetiyani qaraymiz. Aytaylik, bu gomotetiyada O1 markazli aylananing istagan M1 nuqtasi M2 nuqtaga o‘tgan bo‘lsin. U holda, O2M2= k O1M1 yoki O2M2= $\frac{O_2X_2}{O_1X_1} \cdot O_1M_1$.
Bundan, O1X1=O1M1 bo‘lgani uchun O2M2=O2X 2 tenglikni hosil qilamiz. Bu M2 nuqta markazi O2 nuqtada, radiusi O2X 2 ga teng bo‘lgan aylanada yotishini bildiradi. Demak, qaralayotgan aylanalar o‘zaro gomotetik ekan



E`tiboringiz uchun rahmat!