STEREOMETRIYA MASALLARINI YECHISHDA MAPLE DASTURLASH TILINI QO‘LLASH

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Annotatsiya: Maqolada geometriyaning stereometriya masalalarni yechishda Maple simvolik matematika dasturlash tilining grafik imkoniyatlari ko‘rsatilgan.
Kalit so‘zlar: geometriya, stereometriya, Maple, kompyuterda modellashtirish.
Abstract: The article demonstrates the graphical capabilities of the Maple symbolic mathematics programming language in solving geometry and stereometry problems.
Keywords: geometry, stereometry, Maple, computer modeling.
Аннотация: В статье показаны графические возможности языка символьной математики Maple при решении задач геометрии и стереометрии.
Ключевые слова: геометрия, стереометрия, Maple, компьютерное моделирование.

Kirish

O‘rta maktab stereometriya kursi matematikani o‘qitishning muhim vazifalaridan biri bo‘lgan o‘quvchilarning fazoviy tafakkurini rivojlantirishga qaratilganligi bilan tavsiflanadi.

Stereometriya kursining nazariy va amaliy materialini muvaffaqiyatli o‘rganish uchun geometrik tasvirlarni va ularning fazodagi o‘zgarishlarini fikran tasavvur qilish qobiliyati zarur shartlardan biridir.

Axborot texnologiyalari vositalari o‘quvchiga kompyuter monitorida kerakli tasvirni yaratish jarayonini ko‘rish imkonini berib, birinchi qadamni qo‘yishga yordam beradi.

Shaxsiy kompyuterlar uchun dasturiy ta’minot sohasidagi zamonaviy komayuterlar geometrik ob’ektlarni qurish va ularning o‘ziga xos xususiyatlarini vizual ravishda aks ettirish uchun dasturlarning keng tanlovini taklif etadi. Muayyan dasturiy ta’minotni tanlashda uning o‘quv muhiti tomonidan o‘zlashtirilganlik darajasini hisobga olish kerak. Xozirda Maple matematik tizimi

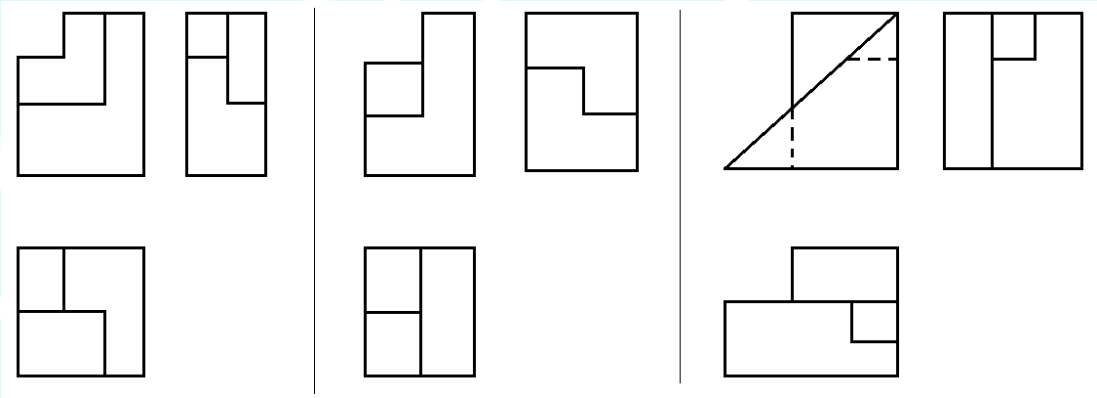
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keng tarqaldi. Ushbu paket ajoyib grafik dasturlash imkoniyatlariga ega, jumladan animatsion grafik kliplarni yaratish. Maple dasturi 2D va 3D grafik buyruqlarning boy to‘plamini taqdim etadi.

Masalaning qo‘yilishi va yechish usullari.

Stereometriya bo‘yicha maktab kursi maktab o‘quvchilarida fazoviy fikrlashni yuqori darajada rivojlantirishni talab qiladigan muammoli xarakterdagi juda ko‘p masalalarni o‘z ichiga oladi. Unda fazoviy tasvirlar bilan ishlashning uchta turi bo‘yicha topshiriqlar alohida o‘rin tutadi.

Topshiriqlarning birinchi turi harakat masalasini jarayonida boshlang‘ich tasvirning masala sharoitiga mos ravishda fikran o‘zgartirilishi yoki uni yaratish jarayonida fikran aylanish va harakatning amalga oshirilishi bilan tavsiflanadi. Shunday qilib, “Ko‘pyoqlar va uning elementlari” mavzusini o‘rganayotganda, o‘quvchilarga figurani tasavvurda aks ettirish uchun quyidagi masalalar qatorini yechish taklif etiladi: 1-rasmda ko‘rsatilgan uchta o‘zaro perpendikulyar tekisliklarda proeksiyalar bilan berilgan ko‘pyoqlarni chizish[1].



a) b) c)

1-rasm

Shuningdek, "Hajm" mavzusini ko‘rib chiqishda, hisoblash talablari murakkab bo‘lgan bir qator masalalarga duch keladi. Masalan: ko‘pburchak uchta proeksiya bilan aniqlanadi. Uning hajmini hisoblash uchun bu proeksiyalar bo‘yicha qanday o‘lchovlarni bajarish kerak?

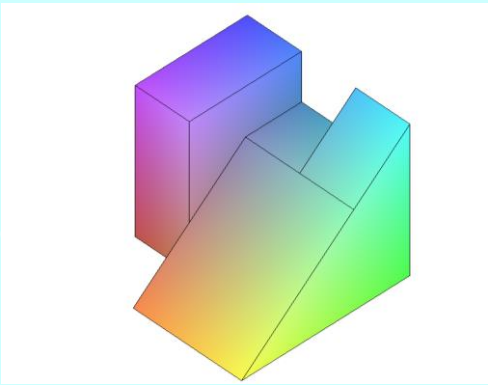
Fazoviy tasvirlar bilan ishlashning ushbu turiga oid masalalarni yechishda o‘quvchilar kerakli figuralarning dinamik tasvirlarini yaratishda muayyan qiyinchiliklarga duch kelishlari mumkin. Shuning uchun o‘qituvchi o‘quvchining fikrlash jarayonini osonlashtiradigan vizual ko‘rsatmalar to‘plamiga ega bo‘lishi kerak[1]. Misol tariqasida yuqoridagi c) banddagi birinchi masaladagi figuraning dinamik tasvirini tasvirlovchi Maple tilida dasturni keltiramiz[2].

```
> restart:
```


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```
> with(plots): with(plottools):
A:=plot3d([x,y,3],x=0..2,y=0..1,grid=[2,2]):
B:=plot3d([2,x,y],x=0..1,y=0..3,grid=[2,2]):
C:=plot3d([x,1,y],x=0..2,y=0..3,grid=[2,2]):
DD:=plot3d([x,0,y],x=0..2,y=0..3,grid=[2,2]):
E:=plot3d([x,y,2],x=0..1,y=1..2,grid=[2,2]):
F:=plot3d([0,x,y],x=0..1,y=0..3,grid=[2,2]):FF:=plot3d([0,x,y],x=2..3,y=2..3,
grid=[2,2]):
G:=plot3d([0,x,y],x=1..3,y=0..2,grid=[2,2]):
K:=plot3d([x,y,0],x=0..3,y=1..3,grid=[2,2]):
M:=plot3d([x,y,0],x=0..2,y=0..1,grid=[2,2]):
N:=plot3d([3-2*y,3-
2*x,2*y],x=0..1,y=0..1,grid=[2,2]): P:=plot3d([1-
y,3-
x,2+y],x=0..1,y=0..1,grid=[2,2]): T:=plot3d([3-
x,3,y],x=0..3,y=0..x,grid=[2,2]): S:=plot3d([1-
x,2,2+y],x=0..1,y=0..x,grid=[2,2]): SS:=plot3d([3-
x,1,y],x=0..1,y=0..x,grid=[2,2]):
ST:=plot3d([1+x,1,2-
y],x=0..1,y=0..x,grid=[2,2]):
plots[display]([A,B,C,DD,E,F,FF,G,K,M,N,P,T,S,SS
],style=patch,scaling=
constrained);
```

Dasturning natijasi 2-rasmda keltirilgan shaklning jonlantirilgan uch o‘lchovli modeli bo‘lib, u asl nusxaga asoslangan yangi tasvirni yaratishda yuzaga kelgan qiyinchiliklarni bartaraf etishga yordam beradi.



2-rasm

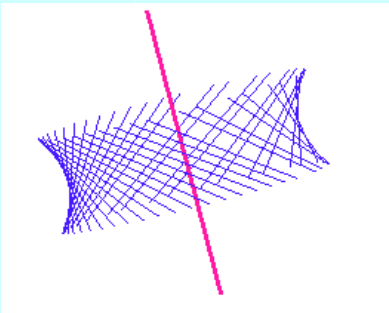
Fazoviy tasvirlar bilan ishlashning ikkinchi turi masala talabi ta’sirida berilgan tasvirning tuzilishida o‘zgarishi bilan tavsiflanadi. Stereometrik kursda

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bunday vazifalar uchun alohida o‘rin "O‘zgartirishshlar" bo‘limida berilgan. Ushbu bo‘limning asosiy vazifasi segmentni u bilan kesishgan o‘q atrofida aylantirish natijasida olingan aylanish figurasini topish masalasidir. Aylanish natijasi (parabolik giperboloid yoki aylanish giperboloidi) o‘quvchilarga ma’lum emas. Masala figuralarining dinamik obrazlarini manipulyatsiya qilishda yuqori darajadagi fazoviy fikrlashni talab qiladi, shuning uchun uni hal qilishdan oldin, birinchi navbatda, quyidagi kichik vazifalarni hal qilish tavsiya yetiladi: to‘g‘ri chiziq kesmasini o‘q atrofida aylantirish natijasini tasavvur qilish: a) unga perpendikulyar va uning uchlaridan biridan o‘tishi; b) uni uchidan birini kesib, unga perpendikulyar emas; v) uni ichki nuqtada kesib o‘tishi; d) unga parallel; d) u bilan ayqash. Ikkinchidan, har bir kichik vazifa vizualizatsiyani talab qiladi.

Maple matematik paketidagi yakuniy masalani jonlantirish dasturi:

```
restart:
> with(plottools):with(plots):
ff:=PLOT3D(CURVES([[1,1,0],[0,1,0]],COLOR(HUE,0.7),
THICKNESS(1)), STYLE(PATCH)):
fff:=PLOT3D(CURVES([[0,0,0],[1,1,1]]),COLOR(HUE,0.9),
THICKNESS(3)):
f:=display([ff,fff]): RTS:=[seq(U[k],k=0..40)]:
for k from 0 to 40 do b:=k*0.25*Pi:
U[k]:=rotate(f,b,[[0,0,0],[1,1,1]]): end
do:
RRT:=[seq(Y[j],j=0..40)]: for j from 0 to 40 do
RRS:=[seq(T[i],i=0..j)]:
for i from 0 to j do b:=i*0.12*Pi:T[i]:=rotate(f,b,[[0,0,0],[1,1,1]]): end do:
Y[j]:=plots[display](RRS[],scaling=constrained,style=patch):end
do:display(RTS[],RRT[],insequence=true,scaling=constrained,style=patch);
```



3-rasm.

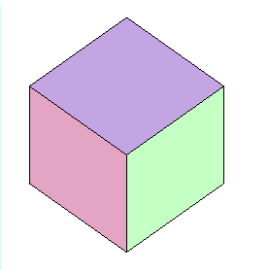
Ko‘rib chiqilgan asosiy masalaga asoslanib, ko‘plab masalalar, shu jumladan "Ko‘pyoqlar va ularning birikmalarining aylanishi". Misol tariqasida quyidagi

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mashqni keltirish mumkin: kubni diagonal chetiga aylantirish natijasida xosil qilingan jismni chizish. Bunday sharoitda barcha kerakli o‘zgarishlarni tasavvur qilish va tasavvurda yangi tasvirni gavdalantirish juda qiyin bo‘lishi mumkin, shuning uchun grafik ko‘rgazmalilikning turli shakllariga ehtiyoj yana paydo bo‘ladi.

Bu yerda, mos ravishda birinchi va ikkinchi masalalarga oid figuralarni qurishnini vizualizatsiya qilish uchun Maple tilida yozilgan dasturlarni keltiramiz:

```
> restart:
> with(plottools):with(plots):
f := cuboid([0,0,0],[1,1,1]):fff:=PLOT3D(CURVES([[0,-
0.5,0],[0,1.5,0]]),COLOR(HUE,0.9),
THICKNESS(3)):
f:=display([ff,fff]): RTS:=[seq(U[k],k=0..40)]:
for k from 0 to 40 do b:=k*0.25*Pi:
U[k]:=rotate(f,b,[[0,0,0],[0,1,0]]): end do:
RRT:=[seq(Y[j],j=0..15)]: for j from 0 to 15 do
RRS:=[seq(T[i],i=0..j)]: for i from 0 to j do
b:=i*0.125*Pi:
T[i]:=rotate(f,b,[[0,0,0],[0,1,0]]): end do:
Y[j]:=plots[display](RRS[],scaling=constrained,style=patch):end do:
display(RTS[],RRT[],insequence=true,scaling=constrained,style=patch);
```



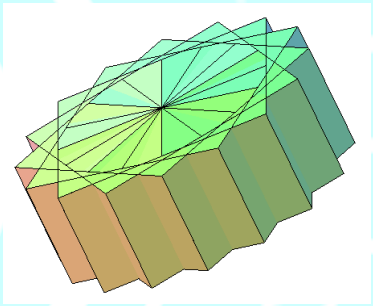
4.a-rasm

Aylanish natijasi 4-rasmda ko‘rsatilgan.

```
> with(plottools):with(plots):
ff := cuboid([0,0,0],[1,1,1]):
fff:=PLOT3D(CURVES([[-0.5,-0.5,- 0.5],[1.5,1.5,1.5]]),
COLOR(HUE,0.9), THICKNESS(3)):
f:=display([ff,fff]): RTS:=[seq(U[k],k=0..40)]:
for k from 0 to 40 do b:=k*0.25*Pi:
U[k]:=rotate(f,b,[[0,0,0],[1,1,1]]): end do:
RRT:=[seq(Y[j],j=0..15)]: for j from 0 to 15 do
RRS:=[seq(T[i],i=0..j)]: for i from 0 to j do
```

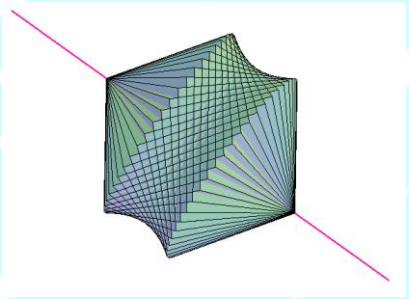

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```
b:=i*0.125*Pi:
T[i]:=rotate(f,b,[[0,0,0],[1,1,1]]): end do:
Y[j]:=plots[display](RRS[],scaling=constrained,style=patch):end do:
display(RTS[],RRT[],insequence=true,scaling=constrained,
style=patch);
```



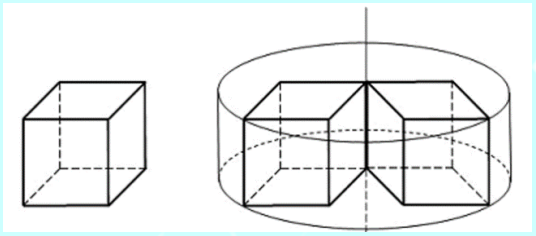
4-rasm.

Aylanish natijasi 5-rasmda ko‘rsatilgan.

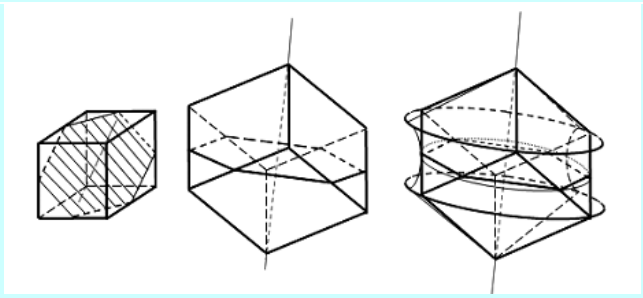


5-rasm

O‘quvchi kerakli figuralarning chizmalarini proektiv geometriya qonunlari doirasida mustaqil ravishda bajaradi (6, 7-rasm).



6-rasm



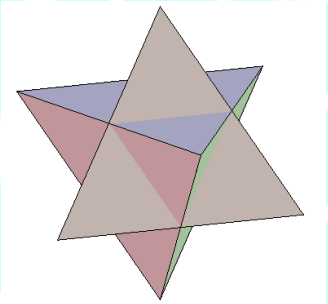
7-rasm

Fazoviy tasvirlar bilan ishlashning uchinchi turida izlanayotgan tasvir burilgan tasvirni qayta-qayta o‘zgartirish natijasida yuzaga keladigan yangi tasvirni yaratish uchun asosdir. Ushbu turdagi o‘zgartirishlar bo‘yicha vazifalar murakkablashadi, chunki o‘quvchilar o‘z vaqtida o‘zlarini berilgan tasvirga e’tibor bermasligi, uning barcha fikran o‘zgarishlarini xotirada saqlab qolishlari va

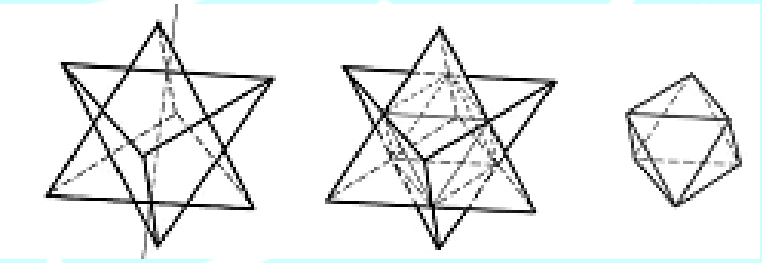
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natijada yangi tasvirni yaratishlari kerak. Bunga quyidagi mashqlar misol bo‘la oladi: 1) agar muntazam tetraedr qarama-qarshi qirralarning o‘rta nuqtalarini tutashtiruvchi to‘g‘ri chiziq atrofida 90° aylantirilsa, 2) agar kub bita yoqda yotmaydigan parallel qirralarning o‘rta nuqtalarini birlashtiruvchi to‘g‘ri chiziq atrofida 90° aylantirilsa, berilgan va hosil bo‘lgan ko‘pyoqning kesishishi va birlashishini tasvirlash.

Yakuniy model (8-rasm) va berilgan chizma (9-rasm) bilan birinchi masalanini vizualizatsiya qilish dasturi:



8-rasm

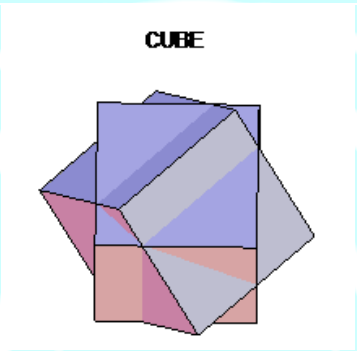


9-rasm

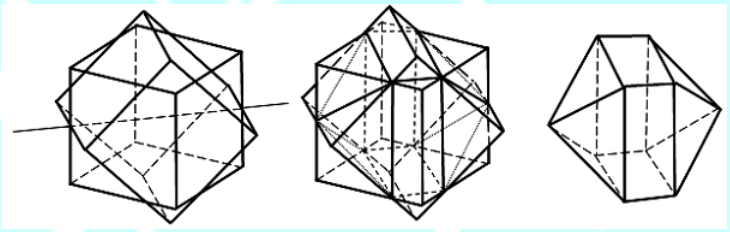
Yakuniy animatsiya va chizma (mos ravishda 10 va 11-rasm) bilan berilgan ikkinchi masaladagi figuraning dinamik tasvirini tasvirlovchi dastur quyidagicha:

```
> restart:
> with(plots):with(plottools):
f:=PLOT3D(POLYGONS([[0,0,0],[1,0,0],[1,1,0],[0,1,0]],
[[0,0,0],[0,1,0],[0,1,1],[0,0,1]],
[[1,0,0],[1,1,0],[1,1,1],[1,0,1]],
[[0,0,0],[1,0,0],[1,0,1],[0,0,1]],
[[0,1,0],[1,1,0],[1,1,1],[0,1,1]],
[[0,0,1],[1,0,1],[1,1,1],[0,1,1]]),
TITLE(CUBE),STYLE(PATCH)):
g:=rotate(f,Pi/2,[[0,0,0.5],[1,1,0.5]]):
display([f,g],scaling=constrained);
```


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10-rasm



11-rasm

XULOSALAR

Fazoviy tasvirlar bilan ishlash turlari o‘quvchilarning fazoviy tasavurining rivojlanish darajalari sifatida qaraladi. Shuning uchun stereometriyani o‘rganish fazoviy tasvirlar bilan ishlashning sanab o‘tilgan turlari bo‘yicha vazifalarni hal qilishni o‘z ichiga olishi kerak. Fazoviy tasavvurni rivojlantirish uchun stereometriyani o‘rganishda an’anaviy usullar va axborot kompyuter texnologiyalarining kombinatsiyasi yordam beradi.

Foydalanilgan adabiyotlar

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