ISSN: 2181-4341, IMPACT FACTOR (RESEARCH BIB) – 9.145, SJIF – 5,431

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taqrizi ostida

MAPLE DASTURI YORDAMIDA IKKINCHI TARTIBLI EGRICHIZIQLARNI UMUMIY TENGLAMASI BO‘YICHA QUTB KOORDINATALAR SISTEMASIDA QURISH

Аннотация

Ikkinchi tartibli egri chiziqlari muxandislik masalalaridagi ajoyib jarayonlarni ifodalovchi harakat yo’llarini aniqlash va taxlil qilishga yordam beruvchi chziqlar hisoblanadi. Qutb koordinatalar sistemasida bu chiziqlarning umumiy tenglamalari asosida aniqlash va qurishda MAPLE dasturlaridan foydalanish imkoniyatlari ko’rsatilgan.

Kalit so‘zlarlar

qutb, koordinata, egri chiziq, ellipse, hyperbola, animatsiya, plot, polar, symbol, display.

ПОСТРОЕНИЕ КРИВЫХ ВТОРОГО ПОРЯДКА В ПОЛЯРНЫХ КООРДИНАТАХ С ИСПОЛЬЗОВАНИЕМ ОБЩЕГО УРАВНЕНИЯ В ПРОГРАММЕ MAPLE

Аннотация

Кривые второго порядка — это линии, которые помогают определять и анализировать траектории движения, представляющие собой важные процессы в инженерных задачах. Показаны возможности использования программ MAPLE для определения и построения этих линий на основе общих уравнений в полярной системе координат.

Ключевые слова

полюс, координата, кривая, эллипс, гипербола, анимация, график, полярный, символ, отображение.

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CONSTRUCTION OF SECOND-ORDER CURVES IN POLAR COORDINATES USING THE GENERAL EQUATION IN THE MAPLE PROGRAM

Abstract

Second-order curves are lines that help define and analyze motion trajectories, which are important processes in engineering problems. The potential of using MAPLE programs to define and plot these lines based on general equations in a polar coordinate system is demonstrated.

Keyword

pole, coordinate, curve, ellipse, hyperbola, animation, graph, polar, symbol, display.

KIRISH

Maple kabi ixtisoslashtirilgan matematik dasturiy ta'minot paketlari kompyuterlarda muhandislik hisob-kitoblari uchun tobora ko'proq qo'llanilmoqda. Maple interfeysi sodda va intuitiv, ulardan foydalanish oson va Windows standartlariga to'liq mos keladi. Grafiklar va matematik obyektlarni harakatlanuvchi palitralardan sichqonchani bosish orqali kiritish mumkin. Maple grafik muhiti sizga tanish formatda matematik formulalarni yozish imkonini beradi.

ASOSIY QISM. Maple dasturi yordamida ikkinchi tartibli egrichiziqlarni umumiy tenglamasi $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ bo‘yicha qutb koordinatalar sistemasida qurish imkoniyatlarini ko’rsatamiz.

Egri chiziqni umumiy tenglamasi bo‘yicha qurish dasturini tuzamuz..

Quyidagi dastur yordamida egri chiziqning turi bo‘yicha umumiy tenglamasidagi koeffitsentlarini(# belgini olish-ochish bilan) tanlab qutb koordinatalar sistemasida ellips, giperbola, parabola va tarqaluvchi bo‘lgan chiziqlarni quramiz(dasturda qulaylik uchun φ *o‘rniga t olamiz*).

1. $5x^2 + 4xy + 8y^2 + 10x - 6y - 121 = 0$ egri chiziqni aniqlash va shaklini qurish uchun dastur tuzamia.

M a p l e d a s t u r i:

```
> restart; with(plots): with(geometry):

> Digits:=3:
```

Ellipe(1–rasm):

```
> A:=5:B:=4:C:=8:D1:=10:E:=-6:F:=-121:
```

Egri chiziqning umumiy tenglamasi:

```
> UMT:=A*x^2+2*B*x*y+C*y^2+D1*x+E*y+F=0;
```

$UMT := 5x^2 + 8xy + 8y^2 + 10x - 6y - 121 = 0$

> with(Student[Precalculus]):

> KT:=CompleteSquare(UMT,[x,y]);

$$KT := 8\left(y + \frac{x}{2} - \frac{3}{8}\right)^2 + 5\,(x+1)^2 - 126 - \frac{(8x-6)^2}{32} = 0$$

> _EnvHorizontalName := 'x': _EnvVerticalName := 'y':

> ellipse(ELL,UMT,[x, y]); ELL

> detail(ELL);

name of the object	ELL
form of the object	$ellipse2d$
center	$\left[\frac{(10658-438\sqrt{73})(-31+3\sqrt{73})}{85264(13+\sqrt{73})} + \frac{\sqrt{10658-438\sqrt{73}}\,(}{852(}\right.$
foci	$\left[\left[\frac{(10658-438\sqrt{73})(-31+3\sqrt{73})}{85264(13+\sqrt{73})} - \left(\frac{-\sqrt{10658-438\sqrt{}}}{584(-1}\right.\right.$
length of the major axis	$2\sqrt{\frac{4(1241+144\sqrt{73})(69277-5329\sqrt{73})}{73(-13+\sqrt{73})^2} - \frac{4(-1241-}{69277-5329\sqrt{}}}$
length of the minor axis	$2\sqrt{\frac{4(1241+144\sqrt{73})(69277-5329\sqrt{73})}{73(-13+\sqrt{73})^2} - \frac{4(-1241-}{69277+5329\sqrt{}}}$
equation of the ellipse	$5x^2+8xy+8y^2+10x-6y-121=0$

Egri chiziqning qutb koordinata sistemasidagi tenglamasi:

> subs(x=r*cos(t),y=r*sin(t),UMT);

$$5r^2\cos(t)^2 + 8r^2\cos(t)\sin(t) + 8r^2\sin(t)^2 + 10r\cos(t) - 6r\sin(t) - 121 = 0$$

> R1:=solve(%,r): R:=R1[1]: R:=simplify(%);

$$R := \frac{1}{73\cos(t)^4 - 112\cos(t)^2 + 64}\left(39\cos(t)^3 + 31\cos(t)^2\sin(t) - 64\cos(t) + 24\sin(t)\right.$$
$$+ \left(-25939\cos(t)^6 - 68246\cos(t)^5\sin(t) + 105801\cos(t)^4 + 106320\cos(t)^3\sin(t) - 1\right.$$
$$\left.\left.+ 62528\right)^{1/2}\right)$$

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> R2:=subs(t=Pi*i/6,R);

$$R2 := \frac{1}{73\cos\left(\frac{\pi i}{6}\right)^4 - 112\cos\left(\frac{\pi i}{6}\right)^2 + 64}\left(39\cos\left(\frac{\pi i}{6}\right)^3 + 31\cos\left(\frac{\pi i}{6}\right)^2\sin\left(\frac{\pi i}{6}\right) - 64\cos\left(\frac{\pi i}{6}\right) + 24\sin\left(\frac{\pi i}{6}\right) + \left(-25939\cos\left(\frac{\pi i}{6}\right)^6 - 68246\cos\left(\frac{\pi i}{6}\right)^5\sin\left(\frac{\pi i}{6}\right) + 105801\cos\left(\frac{\pi i}{6}\right)^4 + 106320 - 65024\cos\left(\frac{\pi i}{6}\right)\sin\left(\frac{\pi i}{6}\right) + 62528\right)^{1/2}\right)$$

> rf:=seq([evalf(R2),Pi*i/6],i=1..16); rf[1];

$$rf := \left[3.34, \frac{\pi}{6}\right], \left[3.37, \frac{\pi}{3}\right], \left[4.28, \frac{\pi}{2}\right], \left[7.17, \frac{2\pi}{3}\right], \left[10.2, \frac{5\pi}{6}\right], [6.04, \pi], \left[3.96, \frac{7\pi}{6}\right], \left[3.35, \frac{4\pi}{3}\right], \left[3.52, \frac{3\pi}{2}\right], \left[4.49, \frac{5\pi}{3}\right], \left[5.15, \frac{11\pi}{6}\right], [4.04, 2\pi], \left[3.34, \frac{13\pi}{6}\right], \left[3.37, \frac{7\pi}{3}\right], \left[4.28, \frac{5\pi}{2}\right], \left[7.17, \frac{8\pi}{3}\right]$$

> Nuqtalar:=pointplot([rf[1],rf[2],rf[3],rf[4],rf[5], rf[6],rf[7],rf[8],rf[9],rf[10],rf[11],rf[12],rf[12], rf[13],rf[14],rf[15],rf[16]], color=blue,thickness=5, symbol = box, symbolsize = 25,coords=polar):

Qutb koordinata sistemasida hosil bo‘lgan $R=R(t)$ tenglamasi bo‘yicha qurish:

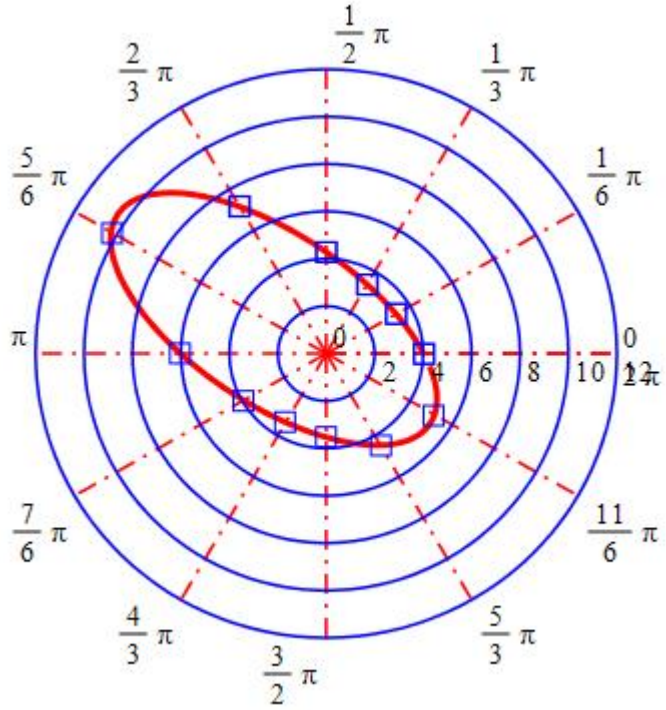
> with(plots):

> P:= plot(R,t=0..2*Pi,thickness=3, color=red, coords=polar):

> Qks:=coordplot(polar,[0..12,0..2*Pi], labelling=true):

> display([P,Qks],Nuqtalar,view=[-12..12,-12..12]);

(1–rasm).



1–rasm.

2. $4x^2+\sqrt{5}xy-2y^2+6x-10y+29=0$ egri chiziqni aniqlash va shaklini qurish uchun dastur tuzamia.

M a p l e d a s t u r i:

> restart; with(plots): with(geometry): Digits:=3:

Giperbola(2–rasm):

> A:=4:B:=sqrt(5):C:=-2:D1:=6:E:=-10:F:=+29:

Egri chiziqning umumiy tenglamasi:

> UMT:=A*x^2+2*B*x*y+C*y^2+D1*x+E*y+F=0;

$$UMT := 4x^2+2\sqrt{5}\,xy-2y^2+6x-10y+29=0$$

> with(Student[Precalculus]):

> KT:=CompleteSquare(UMT,[x,y]);

$$KT := -2\left(y-\frac{\left(x+\frac{3}{4}\right)\sqrt{5}}{2}+\frac{5}{2}+\frac{3\sqrt{5}}{8}\right)^2+4\left(x+\frac{3}{4}\right)^2+\frac{107}{4}+\frac{\left(2\left(x+\frac{3}{4}\right)\sqrt{5}-10-\frac{3\sqrt{5}}{2}\right)^2}{8}=0$$

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> _EnvHorizontalName := 'x': _EnvVerticalName := 'y':

> hyperbola(GP,UMT,[x, y]); *GP*

> detail(GP);

name of the object *GP*

form of the object *hyperbola2d*

center $\left[-\frac{\sqrt{98-21\sqrt{14}}\,(3\sqrt{5}\sqrt{14}+9\sqrt{5}-25)\sqrt{2450+105\sqrt{}}}{4900\,(1+\sqrt{14})} \right.$

foci $\left[\left[-\frac{\sqrt{98-21\sqrt{14}}\,(3\sqrt{5}\sqrt{14}+9\sqrt{5}-25)\sqrt{2450+105\sqrt{}}}{4900\,(1+\sqrt{14})} \right.\right.$

vertices $\left[\left[-\frac{\sqrt{98-21\sqrt{14}}\,(3\sqrt{5}\sqrt{14}+9\sqrt{5}-25)\sqrt{2450+105\sqrt{}}}{4900\,(1+\sqrt{14})} \right.\right.$

the asymptotes $\left[\left(\sqrt{-\frac{2625\sqrt{5}\sqrt{14}}{(-2450+2450\sqrt{14})(-1+\sqrt{14})^2}+\frac{}{(-2450+24:} \right.\right.$
$70\sqrt{-\frac{2625\sqrt{5}\sqrt{14}}{(2450+2450\sqrt{14})(-1+\sqrt{14})}}$

equation of the hyperbola $4x^2+2\sqrt{5}\,xy-2y^2+6x-10y+29=0$

Egri chiziqning qutb koordinata sistemasidagi tenglamasi:

> subs(x=r*cos(t),y=r*sin(t),UMT);

$$4r^2\cos(t)^2+2\sqrt{5}\,r^2\cos(t)\sin(t)-2r^2\sin(t)^2+6r\cos(t)-10r\sin(t)+29=0$$

> R1:=solve(%,r): R:=R1[1]: R:=simplify(%);

$$R:=\frac{1}{28\cos(t)^4-22\cos(t)^2+2}\left(\left(\left(-180\cos(t)^6+908\cos(t)^5\sin(t)+240\cos(t)^4\right.\right.\right.$$
$$\left.\left.-820\cos(t)^3\sin(t)-60\cos(t)^2+108\cos(t)\sin(t)\right)\sqrt{5}-2500\cos(t)^6$$
$$-120\cos(t)^5\sin(t)+2842\cos(t)^4+30\cos(t)^3\sin(t)-853\cos(t)^2-30\cos(t)\sin(t)$$
$$\left.+83\right)^{1/2}+\left(5\cos(t)^3+3\cos(t)^2\sin(t)-5\cos(t)\right)\sqrt{5}-9\cos(t)^3+15\cos(t)^2\sin(t)$$
$$\left.+3\cos(t)-5\sin(t)\right)$$

> R2:=subs(t=Pi*i/6,R);

$$R2 := \frac{1}{28\cos\left(\frac{\pi i}{6}\right)^4 - 22\cos\left(\frac{\pi i}{6}\right)^2 + 2}\left(\left(\left(-180\cos\left(\frac{\pi i}{6}\right)^6 + 908\cos\left(\frac{\pi i}{6}\right)^5\sin\left(\frac{\pi i}{6}\right) + 240\cos\left(\frac{\pi i}{6}\right)^4 - 820\cos\left(\frac{\pi i}{6}\right)^3\sin\left(\frac{\pi i}{6}\right) - 60\cos\left(\frac{\pi i}{6}\right)^2 + 108\cos\left(\frac{\pi i}{6}\right)\sin\left(\frac{\pi i}{6}\right)\right)\sqrt{5} - 2500\cos\left(\frac{\pi i}{6}\right)^6 - 120\cos\left(\frac{\pi i}{6}\right)^5\sin\left(\frac{\pi i}{6}\right) + 2842\cos\left(\frac{\pi i}{6}\right)^4 + 30\cos\left(\frac{\pi i}{6}\right)^3\sin\left(\frac{\pi i}{6}\right) - 853\cos\left(\frac{\pi i}{6}\right)^2 - 30\cos\left(\frac{\pi i}{6}\right)\sin\left(\frac{\pi i}{6}\right) + 83\right)^{1/2} + \left(5\cos\left(\frac{\pi i}{6}\right)^3 + 3\cos\left(\frac{\pi i}{6}\right)^2\sin\left(\frac{\pi i}{6}\right) - 5\cos\left(\frac{\pi i}{6}\right)\right)\sqrt{5} - 9\cos\left(\frac{\pi i}{6}\right)^3 + 15\cos\left(\frac{\pi i}{6}\right)^2\sin\left(\frac{\pi i}{6}\right) + 3\cos\left(\frac{\pi i}{6}\right) - 5\sin\left(\frac{\pi i}{6}\right)\right)$$

> rf:=seq([evalf(R2),Pi*i/6],i=1..16); #rf[1];

$$rf := \left[-0.03 + 2.54\,I, \frac{\pi}{6}\right], \left[1.99 - 4.05\,I, \frac{\pi}{3}\right], \left[2.06, \frac{\pi}{2}\right], \left[-6.61, \frac{2\pi}{3}\right], \left[14.6, \frac{5\pi}{6}\right], [0.750 + 2.59\,I, \pi], \left[0.03 + 2.54\,I, \frac{7\pi}{6}\right], \left[-1.99 - 4.05\,I, \frac{4\pi}{3}\right], \left[7.06, \frac{3\pi}{2}\right], \left[-1.79, \frac{5\pi}{3}\right], \left[-3.51, \frac{11\pi}{6}\right], [-0.750 + 2.59\,I, 2\pi], \left[-0.03 + 2.54\,I, \frac{13\pi}{6}\right], \left[1.99 - 4.05\,I, \frac{7\pi}{3}\right], \left[2.06, \frac{5\pi}{2}\right], \left[-6.61, \frac{8\pi}{3}\right]$$

> Nuqtalar:=pointplot([rf[1],rf[2],rf[3],rf[4],rf[5], rf[6],rf[7],rf[8],rf[9],rf[10],rf[11],rf[12],rf[13], rf[14],rf[15],rf[16]],color=blue, thickness=5,

symbol = box, symbolsize = 25,coords=polar):

Error, (in plots:-pointplot) incorrect specification of points data (qutb o'qi bilan kesishmaydi)

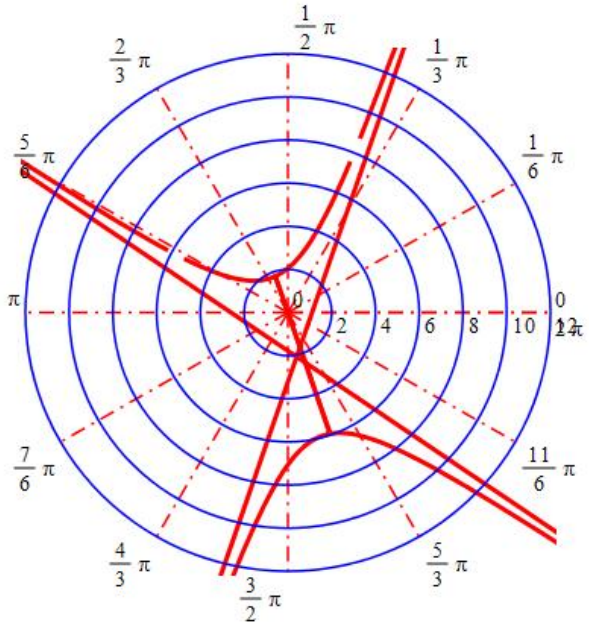
Qutb koordinata sistemasida hosil bo'lgan $R=R(t)$ tenglamasi bo'yicha qurish:

> with(plots):

> P:= plot(R,t=0..2*Pi,thickness=3, color=red, coords=polar):

> Qks:=coordplot(polar,[0..12,0..2*Pi], labelling=true):

> display([P,Qks],view=[-12..12,-12..12]); (2–rasm)



2–rasm.

3. $x^2 - xy + y^2 + 4x - 8y + 7 = 0$ egri chiziqni aniqlash va shaklini qurish uchun dastur tuzamia.

M a p l e d a s t u r i:

> restart; with(plots): with(geometry): Digits:=3:

Parabola(3–rasm):

> A:=1:B:=-1:C:=1:D1:=4:E:=-8:F:=7:

Egri chiziqning umumiy tenglamasi:

> UMT:=A*x^2+2*B*x*y+C*y^2+D1*x+E*y+F=0;

$UMT := x^2 - 2xy + y^2 + 4x - 8y + 7 = 0$

> with(Student[Precalculus]):

> KT:=CompleteSquare(UMT,[x,y]);

$KT := (y - x - 4)^2 + (x + 2)^2 + 3 - \frac{(-2x - 8)^2}{4} = 0$

> _EnvHorizontalName := 'x': _EnvVerticalName := 'y':

> parabola(PAR,UMT,[x, y]); *PAR*

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> detail(PAR);

name of the object	*PAR*
form of the object	*parabola2d*
vertex	$[-2, 1]$
focus	$\left[-\frac{7}{4}, \frac{5}{4}\right]$
directrix	$\frac{\sqrt{2}\,x}{2} + \frac{\sqrt{2}\,y}{2} + \frac{3\sqrt{2}}{4} = 0$
equation of the parabola	$x^2 - 2xy + y^2 + 4x - 8y + 7 = 0$

>

Egri chiziqning qutb koordinata sistemasidagi tenglamasi:

> subs(x=r*cos(t),y=r*sin(t),UMT);

$$r^2\cos(t)^2 - 2r^2\cos(t)\sin(t) + r^2\sin(t)^2 + 4r\cos(t) - 8r\sin(t) + 7 = 0$$

> R1:=solve(%,r): R:=R1[1]: R:=simplify(%);

$$R := \frac{1}{(2\cos(t)^2 - 1)^2}\left(-4\sin(t)\cos(t)^2 - 8\cos(t)^3 + 4\sin(t) + 6\cos(t) + \left(8\sin(t)\cos(t)^5 + 48\cos(t)^6 - 56\sin(t)\cos(t)^3 - 76\cos(t)^4 + 34\cos(t)\sin(t) + 16 + 9\right)^{1/2}\right)$$

> R2:=subs(t=Pi*i/6,R);

> R2:=subs(t=Pi*i/6,R);

$$R2 := \frac{1}{\left(2\cos\left(\frac{\pi i}{6}\right)^2 - 1\right)^2}\left(4\sin\left(\frac{\pi i}{6}\right)\cos\left(\frac{\pi i}{6}\right)^2 + 4\cos\left(\frac{\pi i}{6}\right)^3 - 2\sin\left(\frac{\pi i}{6}\right) - 2\cos\left(\frac{\pi i}{6}\right) + 9\sqrt{\left(2\cos\left(\frac{\pi i}{6}\right)^2 - 1\right)^2\left(2\cos\left(\frac{\pi i}{6}\right)\sin\left(\frac{\pi i}{6}\right) + 1\right)}\right)$$

> rf:=seq([evalf(R2),Pi*i/6],i=1..16); #rf[1];

$$rf := \left[2. + 6.92\,I, \frac{\pi}{6}\right], \left[35.3, \frac{\pi}{3}\right], \left[7.00, \frac{\pi}{2}\right], \left[3.90, \frac{2\pi}{3}\right], \left[2.4, \frac{5\pi}{6}\right], [2. + 1.73\,I, \pi], \left[-2. + 6.92\,I, \frac{7\pi}{6}\right], \left[-1.5, \frac{4\pi}{3}\right], \left[-1.00, \frac{3\pi}{2}\right], \left[-0.90, \frac{5\pi}{3}\right], \left[-1.6, \frac{11\pi}{6}\right], [-2. + 1.73\,I, 2\pi], \left[2. + 6.92\,I, \frac{13\pi}{6}\right], \left[35.3, \frac{7\pi}{3}\right], \left[7.00, \frac{5\pi}{2}\right], \left[3.90, \frac{8\pi}{3}\right]$$

> Nuqtalar:=pointplot([rf[1],rf[2],rf[3],rf[4],rf[5], rf[6],rf[7],rf[8],rf[9],rf[10],rf[11],rf[12],rf[13], rf[14],rf[15],rf[16]],color=blue,thickness=5,

symbol = box, symbolsize = 25,coords=polar):

Error, (in plots:-pointplot) incorrect specification of points data (qutb o'qi bilan kesishmaydi)

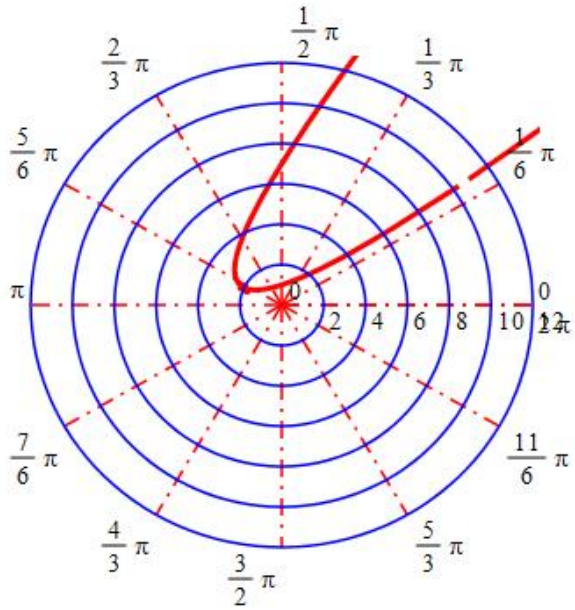
Qutb koordinata sistemasida hosil bo'lgan R=R(t) tenglamasi bo'yicha qurish:

> with(plots):

> P:= plot(R,t=0..2*Pi,thickness=3, color=red, coords=polar):

> Qks:=coordplot(polar,[0..12,0..2*Pi], labelling=true):

> display([P,Qks],view=[-12..12,-12..12]); (3–rasm)



3–rasm.

3. $x^2 - xy + y^2 - 4x + 4y - 77 = 0$ egri chiziqni aniqlash va shaklini qurish uchun dastur tuzamia.

M a p l e d a s t u r i:

> restart; with(plots): with(geometry):

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> Digits:=3:

Tarqaluvchi egri chiziq(4–rasm):

> A:=1: B:=-1:C:=1: D1:=-4:E:=4:F:=-77:

Egri chiziqning umumiy tenglamasi:

> UMT:=A*x^2+2*B*x*y+C*y^2+D1*x+E*y+F=0;

$$UMT := x^2 - 2xy + y^2 - 4x + 4y - 77 = 0$$

> with(Student[Precalculus]):

> KT:=CompleteSquare(UMT,[x,y]);

$$KT := (y - x + 2)^2 + (x - 2)^2 - 81 - \frac{(-2x + 4)^2}{4} = 0$$

Egri chiziqning qutb koordinata sistemasidagi tenglamasi:

> subs(x=r*cos(t),y=r*sin(t),UMT);

$$r^2\cos(t)^2 - 2r^2\cos(t)\sin(t) + r^2\sin(t)^2 - 4r\cos(t) + 4r\sin(t) - 77 = 0$$

> R1:=solve(%,r): R:=R1[1]: R:=simplify(%);

$$R := \frac{1}{(2\cos(t)^2 - 1)^2}\left(4\sin(t)\cos(t)^2 + 4\cos(t)^3 - 2\sin(t) - 2\cos(t) + 9\sqrt{(2\cos(t)^2 - 1)^2(2\cos(t)\sin(t) + 1)}\right)$$

> R2:=subs(t=Pi*i/6,R);

$$R2 := \frac{1}{\left(2\cos\left(\frac{\pi i}{6}\right)^2 - 1\right)^2}\left(4\sin\left(\frac{\pi i}{6}\right)\cos\left(\frac{\pi i}{6}\right)^2 + 4\cos\left(\frac{\pi i}{6}\right)^3 - 2\sin\left(\frac{\pi i}{6}\right) - 2\cos\left(\frac{\pi i}{6}\right) + 9\sqrt{\left(2\cos\left(\frac{\pi i}{6}\right)^2 - 1\right)^2\left(2\cos\left(\frac{\pi i}{6}\right)\sin\left(\frac{\pi i}{6}\right) + 1\right)}\right)$$

> #[seq([Pi*t/6,R2],t=1..16)]: rf:=seq([Pi*t/6,evalf(R2)],t=1..16);

> #[seq([R,Pi*t/6],t=1..16)]:

> rf:=seq([evalf(R2),Pi*i/6],i=1..16);

$$rf := \left[30.1, \frac{\pi}{6}\right], \left[19.1, \frac{\pi}{3}\right], \left[7., \frac{\pi}{2}\right], \left[5.16, \frac{2\pi}{3}\right], \left[5.16, \frac{5\pi}{6}\right], [7., \pi], \left[19.1, \frac{7\pi}{6}\right], \left[30.1, \frac{4\pi}{3}\right], \left[11., \frac{3\pi}{2}\right], \left[8.08, \frac{5\pi}{3}\right], \left[8.08, \frac{11\pi}{6}\right], [11., 2\pi], \left[30.1, \frac{13\pi}{6}\right], \left[19.1, \frac{7\pi}{6}\right], \left[7., \frac{5\pi}{2}\right], \left[5.16, \frac{8\pi}{3}\right]$$

> Nuqtalar:=pointplot([rf[1],rf[2],rf[3],rf[4],rf[5], f[6],rf[7],rf[8],rf[9],rf[10],rf[11],rf[12],rf[13], rf[14],rf[15],rf[16]],color=blue, thickness=5,

symbol = box, symbolsize = 25,coords=polar):

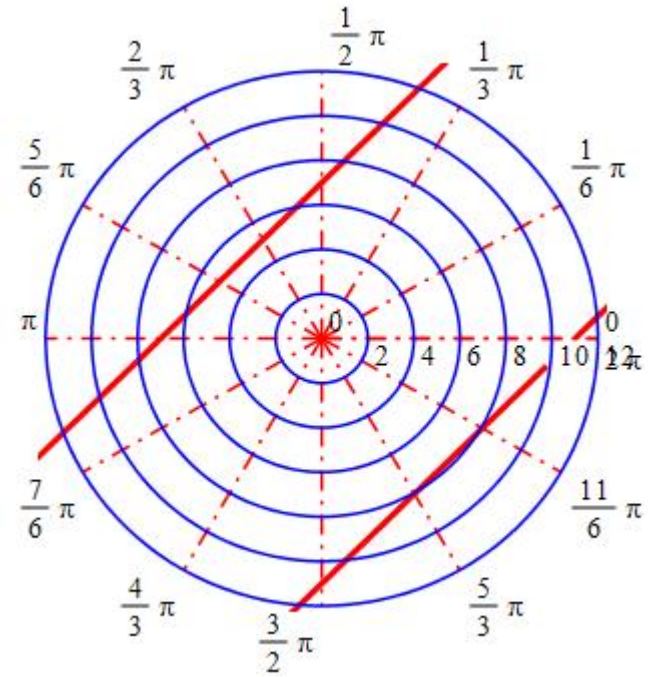
Qutb koordinata sistemasida hosil bo‘lgan R=R(t) tenglamasi bo‘yicha qurish:

> with(plots):

> P:= plot(R,t=0..2*Pi,thickness=3, color=red, coords=polar):

> Qks:=coordplot(polar,[0..12,0..2*Pi], labelling=true):

> display([P,Qks],view=[-12..12,-12..12]); (4–rasm)



4–rasm.

OLINGAN NATIJALARNI TAHLIL QILISH. Malpe tizimi Oliy matematikaning analitik geometriya va matematik analiz sohalarida masalalarni tez, aniq va sifatli yechish uchun ishlatilishi mumkin, shuningdek, 2D va 3D formatlarida animatsion grafikalar va raqamlarni o'z ichiga olgan muhandislik masalalarini hal qilish imkonini beradi [1,2,3].

XULLOSA. Bugungi kunda kompyuter yordamida ko‘plab masalalarni, matematik modulini tuzishda va bu masalalarni katta tezlikda hal qilishga xizmat qiluvchi Maple matematik paketi mavjud bo‘lib, murakkab geometri shaki va grafiklarni 2D va 3D farmatlarida tez, aniq va sifatli tasvirlashda Maple tizimi dasturlaridan foydalanish qulay va samarali ekanligi ko‘ramiz[7,8].

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