BA'ZI FUNKSIYALARNING TO'G'RI BURCHAKLI TESKARI KOORDINATALAR SISTEMASIDAGI GRAFIKLARI

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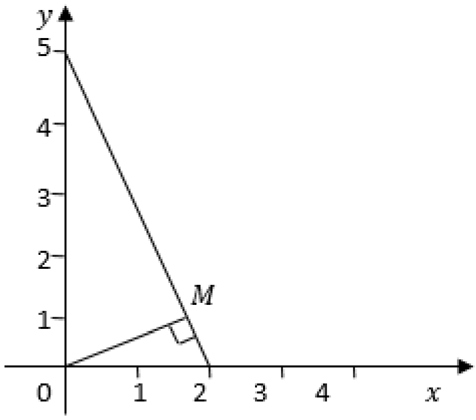
To'g'ri burchakli teskari koordinatalar sistemasida nuqtaning koordinatalarini aniqlash tartibi quyidagicha bo'ladi: ikkita o'zaro perpendikulyar koordinata o'qlari mavjud bo'ladi. Berilgan nuqtadan va koordinatalar boshidan ya'ni, o'qlar kesishgan nuqtadan o'tuvchi to'g'ri chiziq chiziladi. Bu to'g'ri chiziqqa perpendikulyar to'g'ri chiziq chiziladi. Hosil bo'lgan to'g'ri chiziqning koordinata o'qlarini kesishidan hosil bo'lgan nuqtalar berilgan nuqtaning koordinatalari deb qabul qilinadi.



Quyidagi rasmda M nuqtaning to'g'ri burchakli teskari koordinatalar sistemasidagi koordinatalarini $(2,5)$ ekanligini ko'rish mumkin.

Agar perpendikulyar to'g'ri chiziq koordinata o'qlarining birortasiga paralell bo'lib qolsa, nuqtaning shu o'qqa mos koordinatasi ∞ ga teng bo'ladi.

Dekart koordinatalar sistemasidan to'g'ri burchakli teskari koordinatalar sistemasiga o'tish uchun quyidagi

$$\begin{cases} x = x_d + \dfrac{y_d^2}{x_d} = \dfrac{x_d^2 + y_d^2}{x_d} \\ y = y_d + \dfrac{x_d^2}{y_d} = \dfrac{x_d^2 + y_d^2}{y_d} \end{cases} \quad (1)$$

formuladan foydalaniladi. Bu yerda (x, y) nuqtaning to‘g‘ri burchakli teskari koordinatalar sistemasidagi koordinatalari, (x_d, y_d) esa Dekart koordinatalar sistemasidagi koordinatalari.

Agar nuqtaning koordinatalari to‘g‘ri burchakli teskari koordinatalar sistemasida berilgan bo‘lsa, uning dekart koordinatalar sistemasidagi koordinatalarini quyidagi formula yordamida hisoblash mumkin

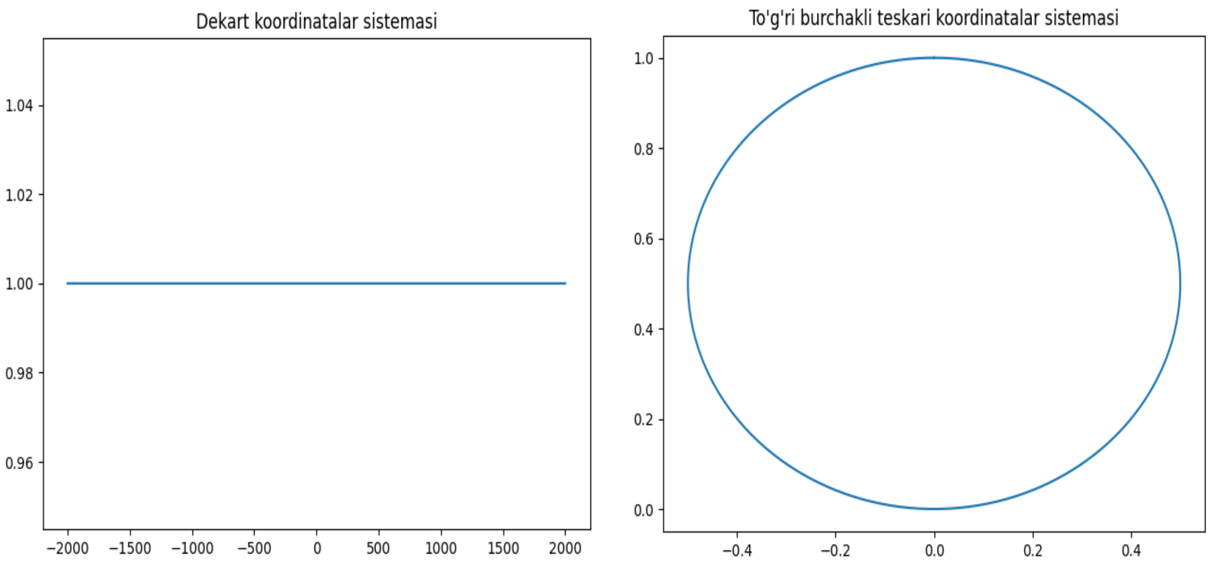
$$\begin{cases} x_d = \dfrac{xy^2}{x^2 + y^2} \\ y_d = \dfrac{x^2 y}{x^2 + y^2}. \end{cases} \quad (2)$$

(2) formuladan foydalanib Python dasturida $y = f(x)$ funksiyaning grafigini to‘g‘ri burchakli teskari koordinatalar sistemasida chizish dasturini tuzamiz. Dasturda eng avval x argumentning $x_1, x_2, \dots, x_n$ qiymatlari uchun y funksiyaning $y_1, y_2, \dots, y_n$ mos qiymatlarini hisoblab olamiz. So’ngra (2) formula bo‘yicha (x, y) mosliklarni (x_d, y_d) mosliklarga $ToX(x, y)$ va $ToY(x, y)$ funksiyalar yordamida akslantiramiz.

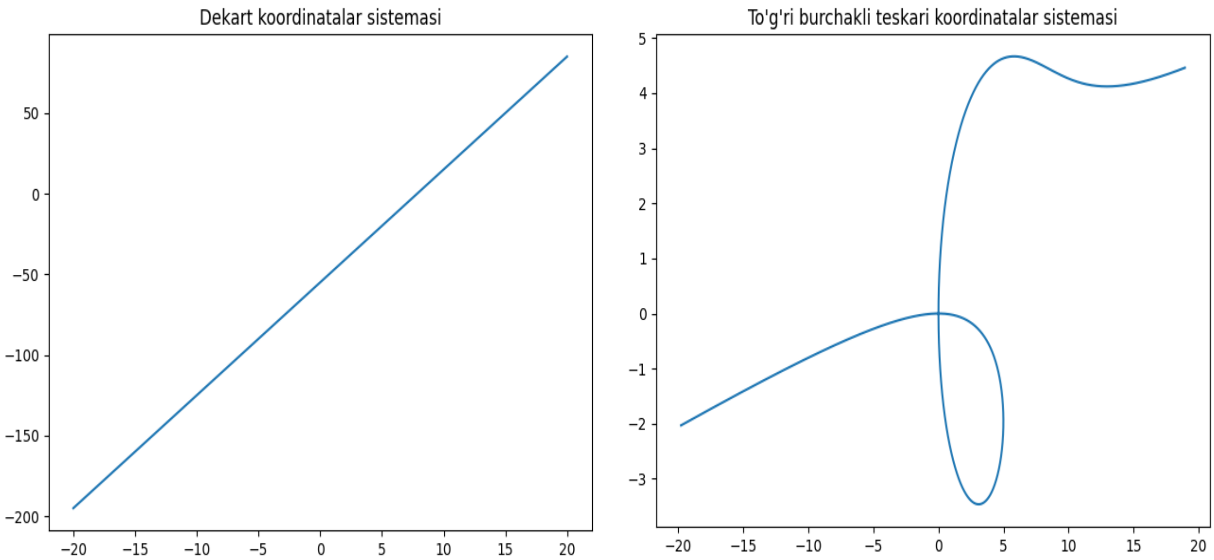
```
import numpy as np
import matplotlib.pyplot as plt
import math
def ToX(x,y): return (x*y**2)/(x**2 + y**2)
def ToY(x,y): return (x**2*y)/(x**2 + y**2)
def f(x): return x**2 + 5*x - 3 #Funksiyaning analitik ko’rinishi beriladi
xd=[]
yd=[]
for i in range(-1000,1000):
    xd.append(i*0.1)
    yd.append(f(i*0.1))
X=[]
Y=[]
for i in range(0,2000):
    X.append(ToX(xd[i], yd[i]))
    Y.append(ToY(xd[i], yd[i]))
plt.figure(dpi=100)
x= np.array(X)
y= np.array(Y)
plt.plot(x,y)
plt.title("To'g'ri burchakli teskari koordinatalar sistemasi")
plt.show()
```

Tuzilgan dastur yordamida ayrim funksiyalarning Dekart koordinatalar sistemasidagi va to‘g‘ri burchakli teskari koordinatalar sistemasidagi grafiklarini chizib ko‘ramiz.

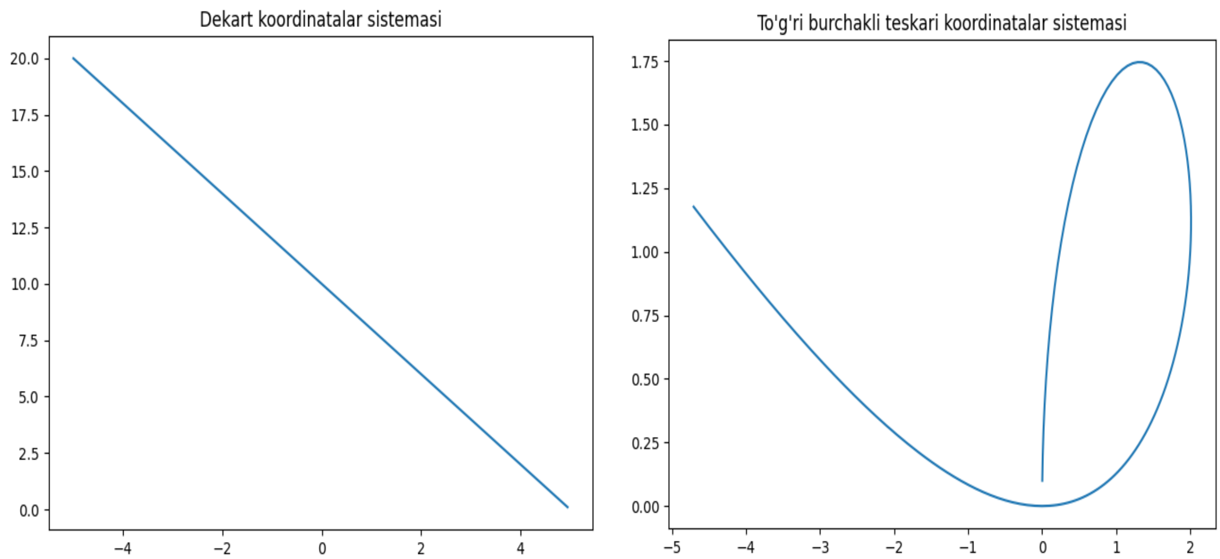
$f(x) = 1$ funksiya garfigi.



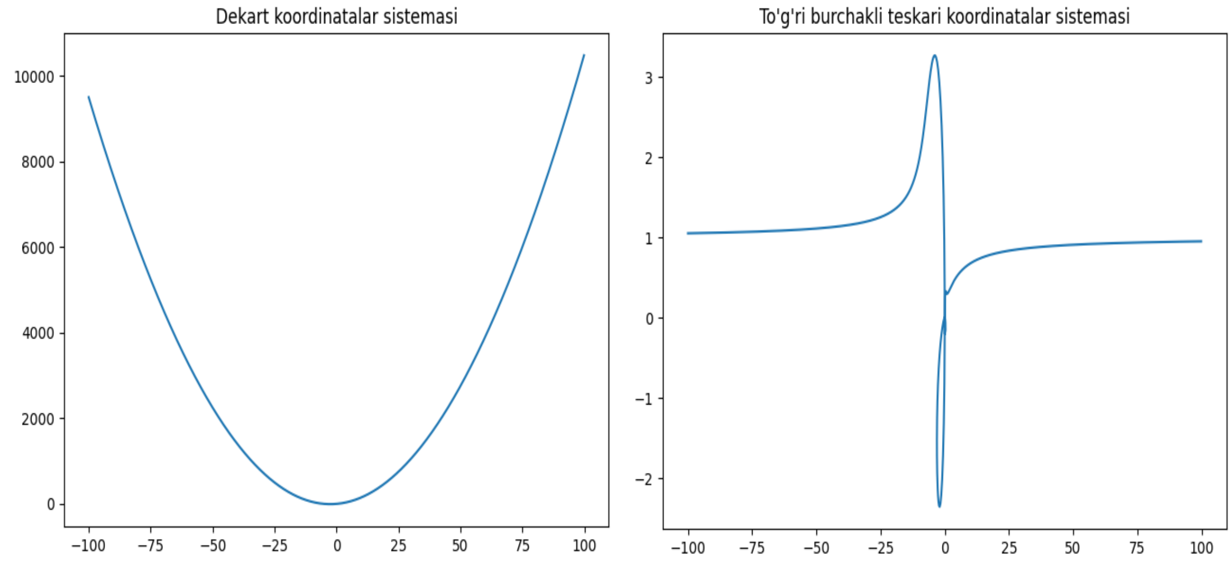
$f(x) = 7x - 55$ **funksiya garfigi.**



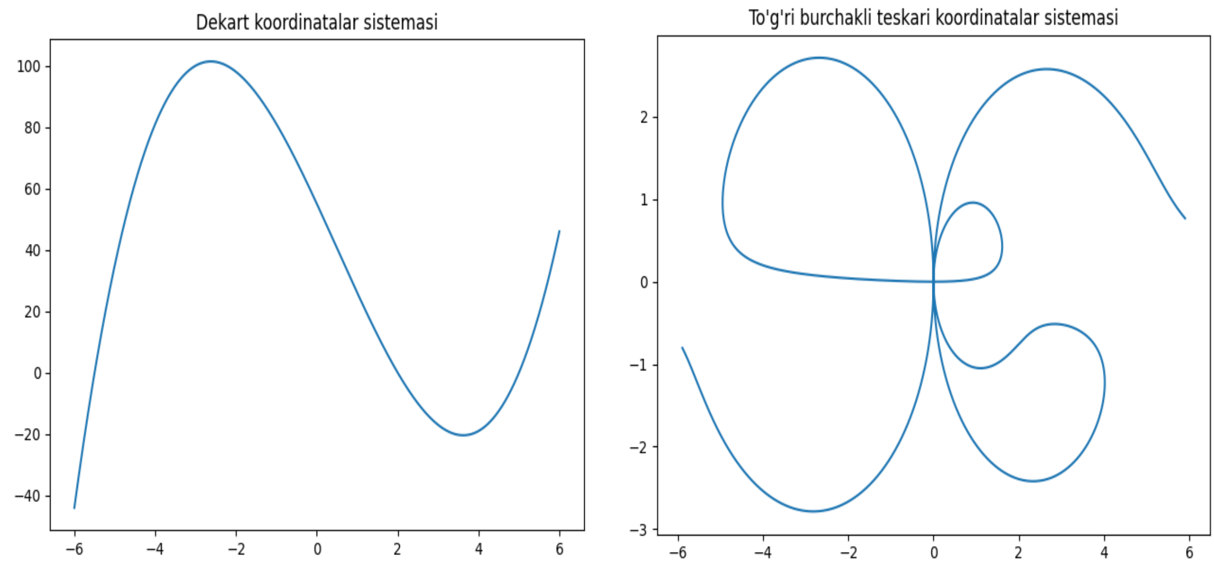
$f(x) = -2x + 10$ **funksiya garfigi.**



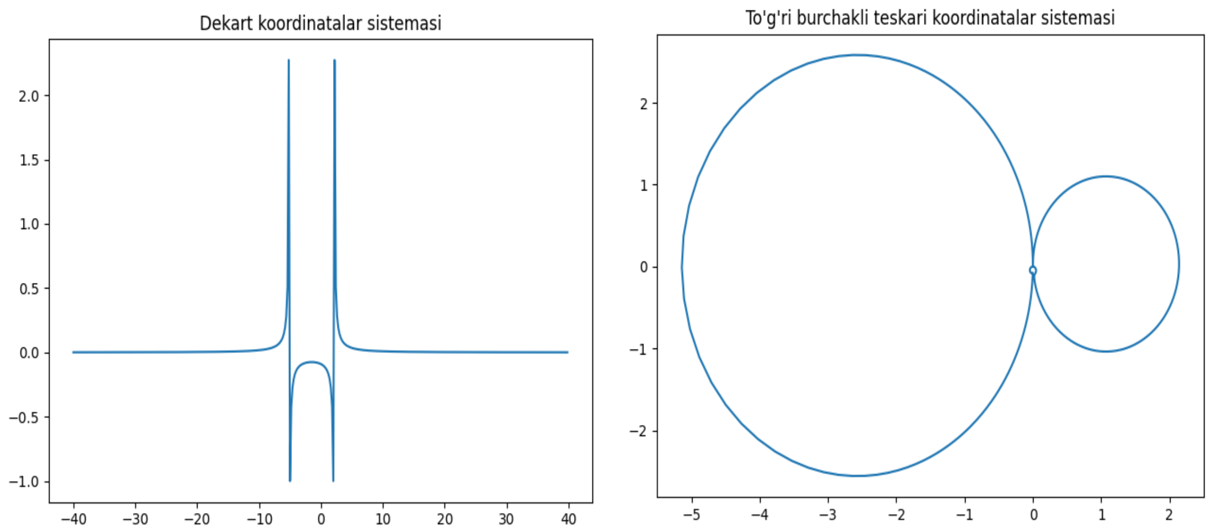
$f(x) = x^2 + 5x - 3$ **funksiya garfigi.**



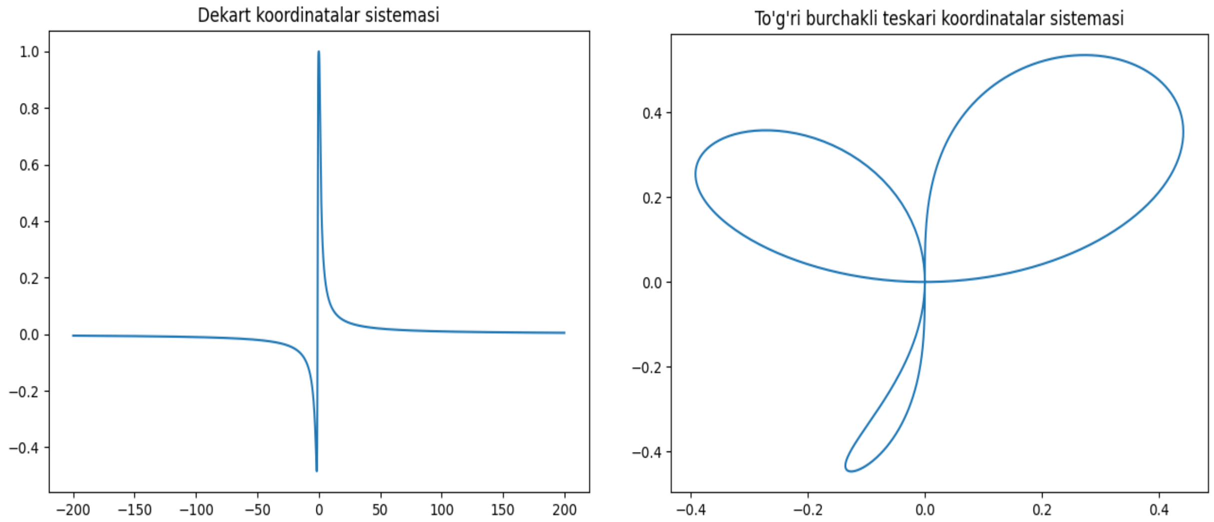
$f(x) = x^3 - \frac{3x^2}{2} - \frac{57x}{2} + 55$ **funksiya garfigi.**



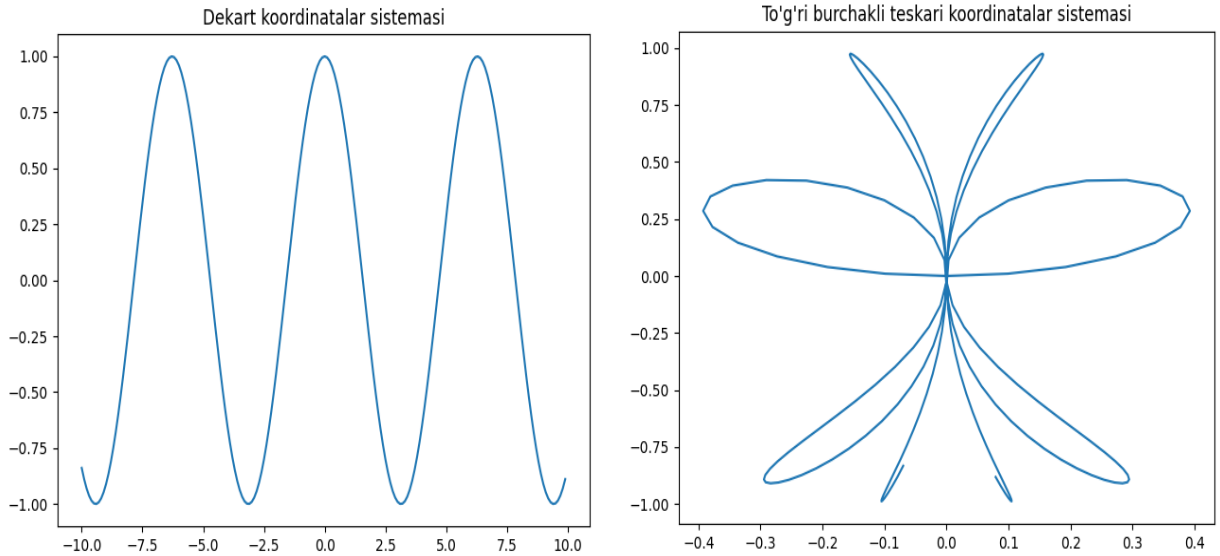
$f(x) = \frac{1}{x^2+3x-11}$ **funksiya garfigi.**



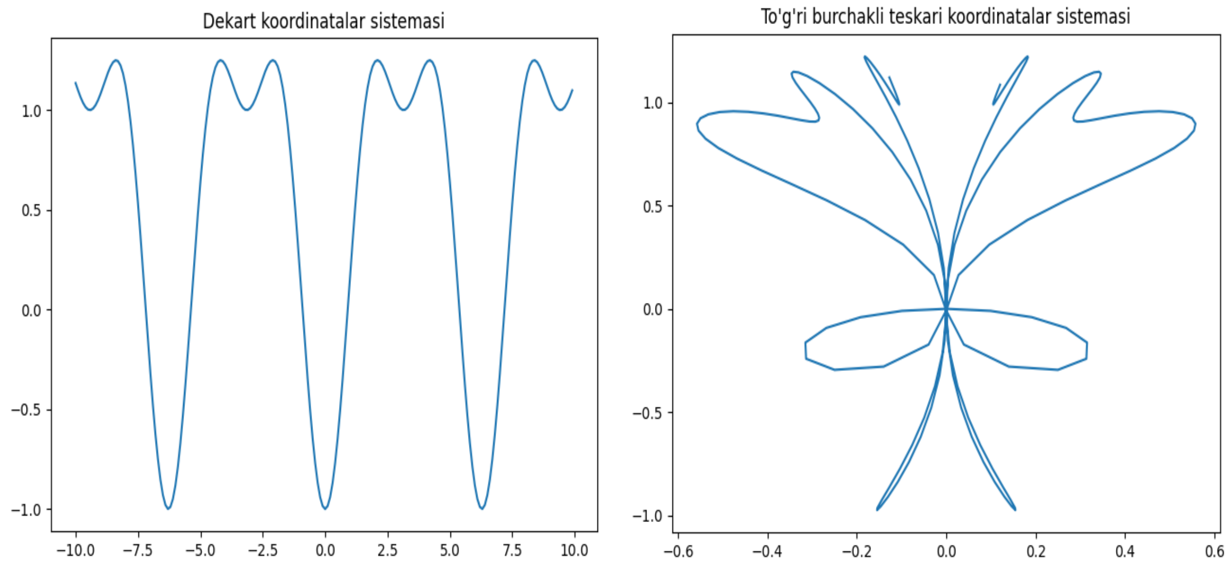
$f(x) = \frac{x^3+x^2+x+1}{x^4+x^3+x^2+x+1}$ **funksiya garfigi.**



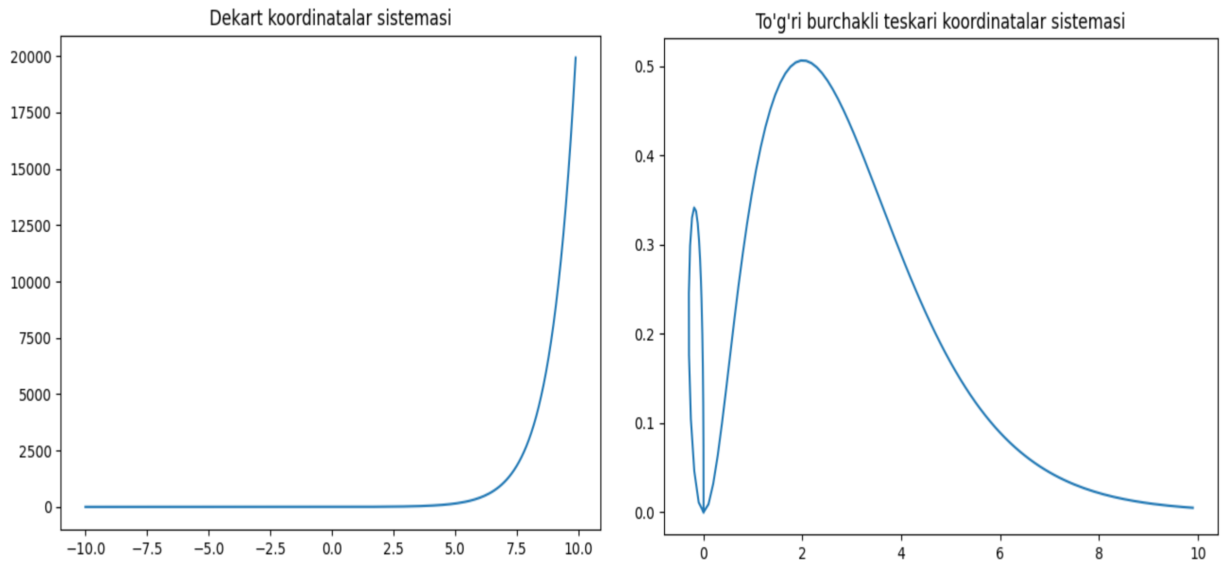
$f(x) = cos(x)$ **funksiya garfigi.**



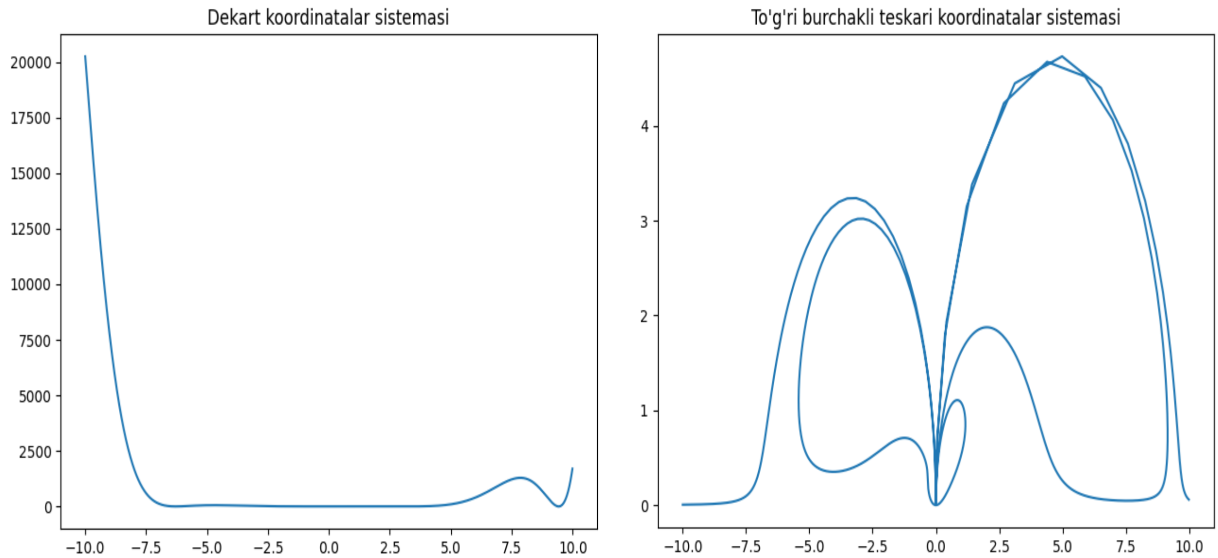
$f(x) = sin^2(x) - cos(x)$ **funksiya garfigi.**



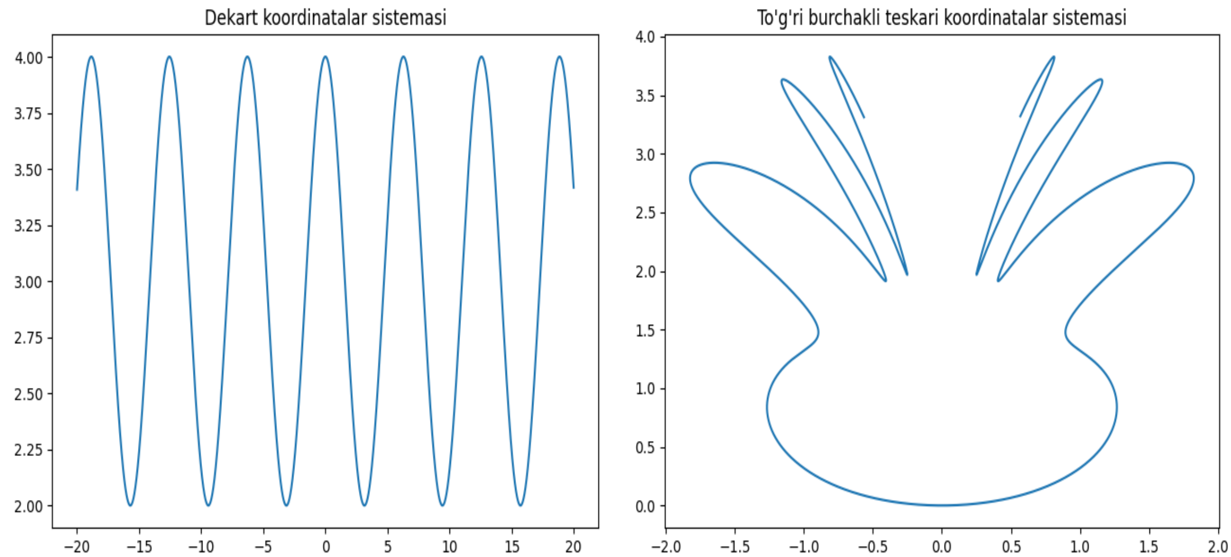
$f(x) = e^x$ **funksiya garfigi.**



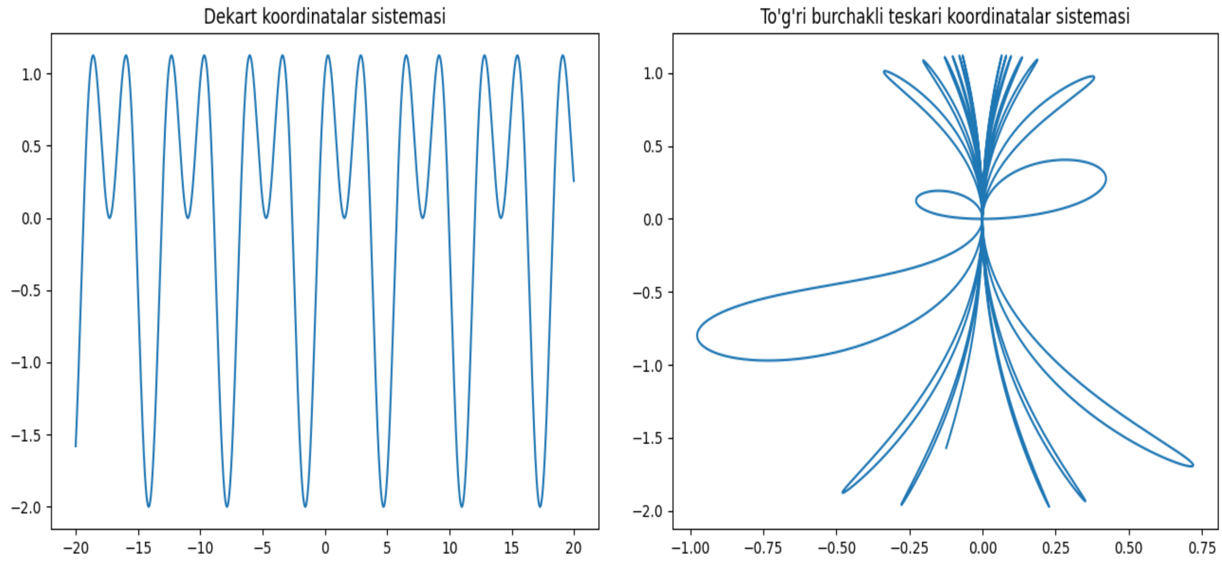
$f(x) = \cosh x + \sinh x \cdot \cos x$ **funksiya garfigi.**



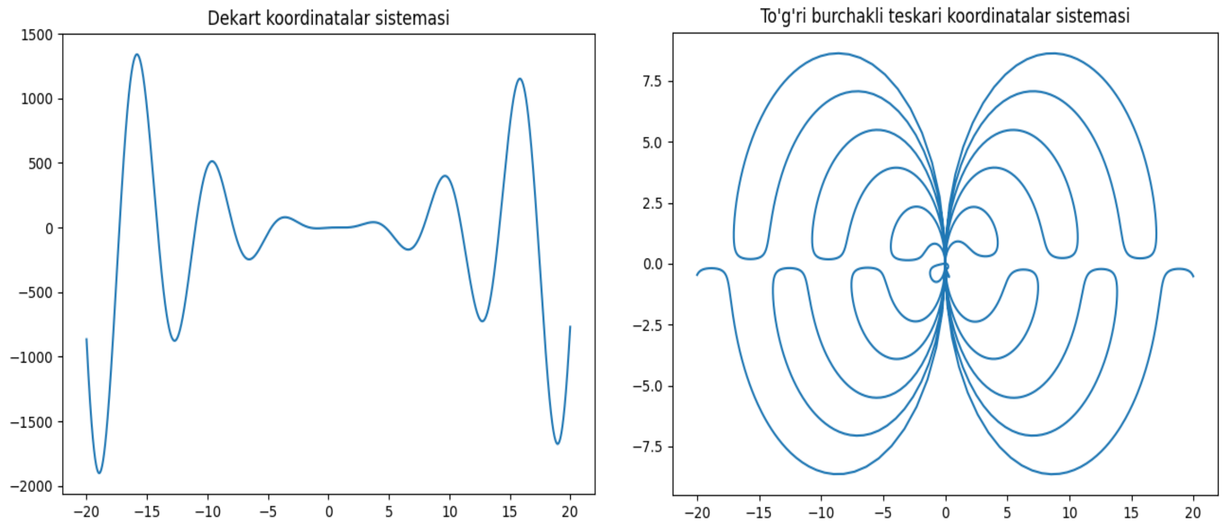
$f(x) = 3 + \cos x$ **funksiya garfigi.**



$f(x) = \cos^2 x - \sin^2 x + \sin x$ **funksiya garfigi.**



$f(x) = (-5x^2 + 6x - 2) \cdot \cos x$ **funksiya garfigi.**



Yuqoridagi grafiklardan shuni hulosa qilish mumkinki, $y = f(x)$ funksiyaning $x \in [a, b]$ kesmadagi grafigi koordinata boshini ya'ni, (0,0) nuqtani vertikal yo'nalishda necha marta kesib o'tsa $f(x) = 0$ tenglama $[a, b]$ kesmada shuncha ildizga ega bo'ladi.

Foydalanilgan adabiyotlar:

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