MATH 151 Lab 5

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In [12]:
```
from sympy import *
from sympy.plotting import (plot,plot_parametric)
```

Question 1

1a

In [13]:
```
#start code here
k, t, y = symbols('k t y')
y = cos(k * t)
dy = diff(y, t)
dy2 = diff(dy, t)
LHS = 4 * dy2 * 1/y
RHS = -25 * y * 1/y
#including the 1/y ensures I get the value of k properly
eq = Eq(LHS, RHS)
sol = solve(eq, k)
print(sol)
```

```
[-5/2, 5/2]
```

1b

In [14]:
```
#start code here
A, B, k, t, y = symbols('A B k t y')
y = A*sin(k*t) + B*cos(k*t)
dy = diff(y, t)
dy2 = diff(dy, t)
LHS = 4 * dy2 * 1/y
RHS = -25 * y * 1/y
#including the 1/y ensures I get the value of k properly
eq = Eq(LHS, RHS)
sol = solve(eq, k)
print(sol)
```

```
[-5/2, 5/2]
```

Question 2

2a

In [37]:
```
#start code here
import sympy as sp
import matplotlib.pyplot as plt

x, y = sp.symbols('x y',real =True)
equation = x**3 + y**3 - 12*x*y
print('(a) Find dy/dx')
```

```
dy_dx = sp.idiff(equation, y, x)
dy_dx
```

```
(a) Find dy/dx
```

Out[37]:
$$\frac{x^2 - 4y}{4x - y^2}$$

2b

In [40]:
```
#start code here
horizontal_points = sp.solve([x**2-4*y,equation],[x,y])
print("\nPart (b): Points where the graph has a horizontal tangent line:",horizontal_p
```

```
Part (b): Points where the graph has a horizontal tangent line: [(0, 0), (4*2**(1/3),
4*2**(2/3))]
```

2c

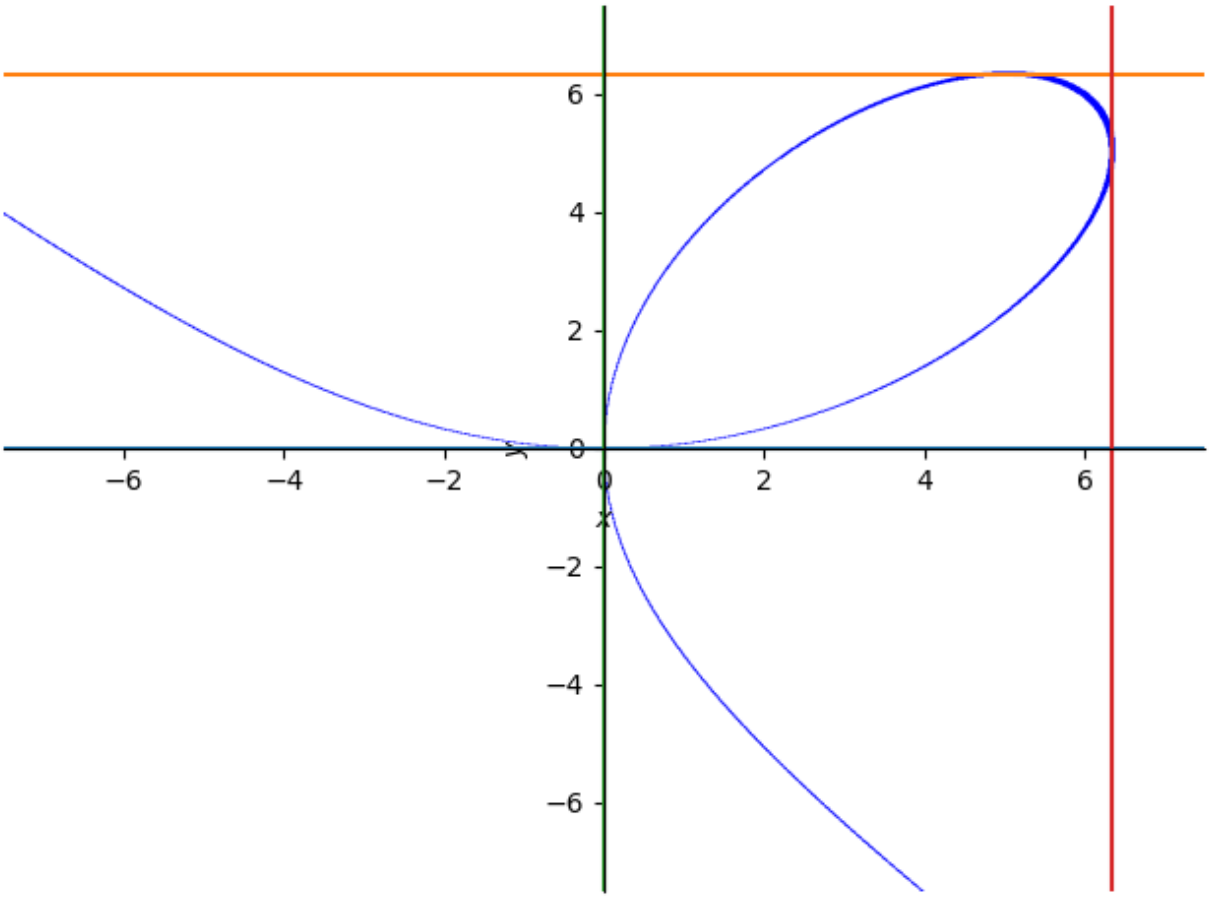
In [42]:
```
#start code here
vertical_points = sp.solve([4*x-y**2,equation], [x,y]) # The slope at a vertical tange
print("\nPart (c): Points where the graph has a vertical tangent line:",vertical_point
```

```
Part (c): Points where the graph has a vertical tangent line: [(0, 0), (4*2**(2/3), 4*
2**(1/3))]
```

2d

In [53]:
```
#start code here

x, y, t = sp.symbols('x y t')
f = x**3 + y**3 - 12*x*y
impPlot = sp.plot_implicit(f, (x, -7.5, 7.5),(y,-7.5,7.5), show=False)
horizLines = sp.plot(0,4*2**(2/3),(x, -7.5, 7.5), show=False)
vertLines = sp.plot_parametric((0,t),(4*2**(2/3),t), show=False)
impPlot.extend(horizLines)
impPlot.extend(vertLines)
impPlot.show()
```



Question 3

3a

In [19]:
```
#start code here
x=symbols('x')
y = (x**2)*((3+x)**(1-x**2))
logy=log(y)
logy=expand_log(logy,force= True)
print(logy)
```

```
(1 - x**2)*log(x + 3) + 2*log(x)
```

3b

In [20]:
```
#start code here
dlogydx = diff(logy,x)
print('Derivate of log y:')
dlogydx
```

```
Derivate of log y:
```

Out[20]:
$$-2x\log\left(x+3\right)+\frac{1-x^2}{x+3}+\frac{2}{x}$$

3c

In [21]:
```
#start code here
dlogydx = dlogydx*y
dlogydx
```

Out[21]:
$$x^2(x+3)^{1-x^2}\left(-2x\log(x+3)+\frac{1-x^2}{x+3}+\frac{2}{x}\right)$$

3d

In [22]:
```
#start code here
dydx = diff(y,x,1)
display(dydx)
print('Ansewr to 3c and 3d are the same')
```

$$x^2(x+3)^{1-x^2}\left(-2x\log(x+3)+\frac{1-x^2}{x+3}\right)+2x(x+3)^{1-x^2}$$

```
Ansewr to 3c and 3d are the same
```

In [ ]: