Name	UIN
Huy Lai	132000359
Alex Nuccitelli	000000000
Cole Jahnke	530009075

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MATH 151-550

In [1]:
```
from sympy import *
from sympy.plotting import (plot, plot_parametric)
```

1a volume of ice cream in cone

In [2]:
```
h = 4
theta_rad = 30 * pi/180
r = h * sin(theta_rad/2)
vol_cone = 1/3 * pi * r**2 * h
vol_hemi = 2/3 * pi * r ** 3
vol = vol_cone + vol_hemi
vol.evalf()
```

Out[2]: 6.81348448286824

1b slant height needed for one cup

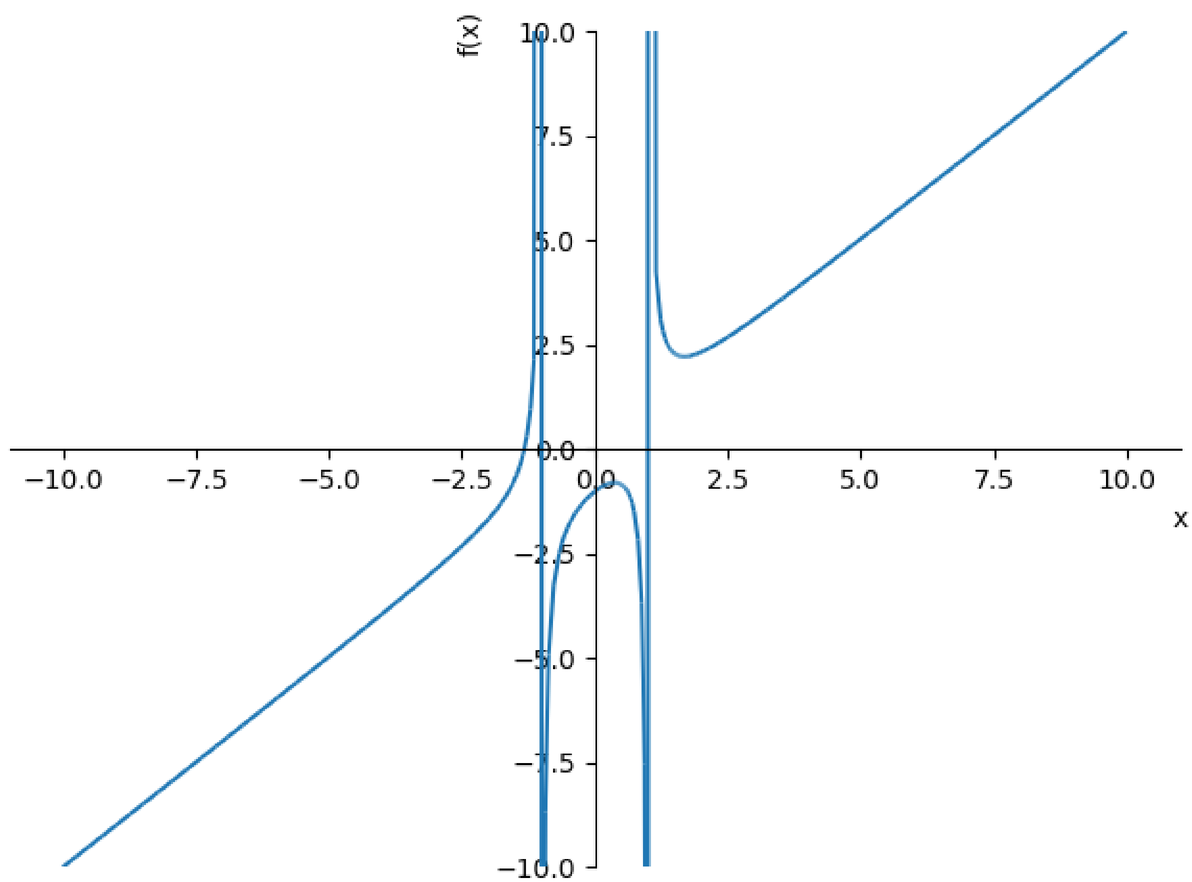
In [3]:
```
vol = 14.5
h = symbols('h')
r = h * sin(theta_rad/2)
vol_cone = 1/3 * pi * r**2 * h
vol_hemi = 2/3 * pi * r ** 3
solve(vol_cone + vol_hemi - vol, h)
```

Out[3]:
```
[5.14508911925964,
 -2.57254455962982 - 4.45577788201375*I,
 -2.57254455962982 + 4.45577788201375*I]
```

2a Plot of function

In [4]:
```
matplotlib notebook
```

In [10]:
```
x = symbols('x')
f = x + 1/(x**2 - 1)
plot(f, ylim=[-10,10]).show()
```


f(x)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0
x

2b Analysis of vertical asymptotes

In [6]:

```
print('The vertical asymptotes are \xb11')
print('As x approaches -1 from the left, f(x) approaches -∞')
print('As x approaches -1 from the right, f(x) approaches +∞')
print('As x approaches +1 from the left, f(x) approaches +∞')
print('As x approaches +1 from the right, f(x) approaches -∞')
```

```
The vertical asymptotes are ±1
As x approaches -1 from the left, f(x) approaches -∞
As x approaches -1 from the right, f(x) approaches +∞
As x approaches +1 from the left, f(x) approaches +∞
As x approaches +1 from the right, f(x) approaches -∞
```

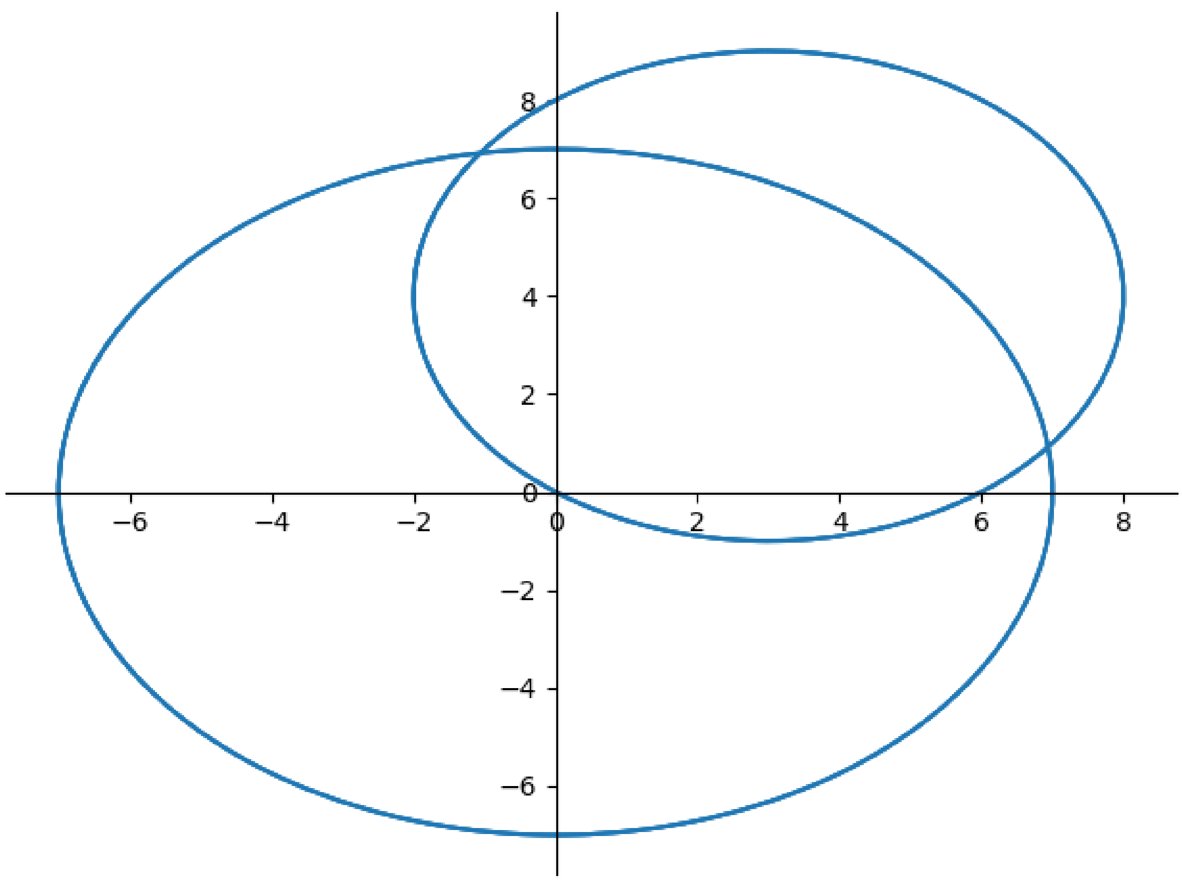
3a plots of circles

In [7]:

```
matplotlib notebook
```

In [8]:

```
t = symbols('t')
x1 = 0 + 7 * cos(t)
y1 = 0 + 7 * sin(t)
x2 = 3 + 5 * cos(t)
y2 = 4 + 5 * sin(t)
plot_parametric((x1, y1), (x2, y2))
```



Out[8]: <sympy.plotting.plot.Plot at 0x19ad5304580>

3b intersections of circles

In [9]:

```
s = symbols('s')
t = symbols('t')
x1 = 0 + 7 * cos(t)
y1 = 0 + 7 * sin(t)
x2 = 3 + 5 * cos(s)
y2 = 4 + 5 * sin(s)
eq_x = x1 - x2
eq_y = y1 - y2
sol = solve((eq_x, eq_y), (s, t))
s0 = sol[0][0]
s1 = sol[0][1]
t0 = sol[1][0]
t1 = sol[1][1]

# Verified using Desmos
print("circle 1: x=", x1.subs(t, t1).evalf())
print("circle 1: y=", y1.subs(t, t1).evalf())
print("circle 2: x=", x2.subs(s, s0).evalf())
print("circle 2: y=", y2.subs(s, s0).evalf())
```

```
circle 1: x= 6.93919991998400
circle 1: y= 0.920600060012003
circle 2: x= -1.05919991998400
circle 2: y= 6.91939993998800
```

In [ ]: