MATH 151 Lab 8

Put team members' names and section number here.

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Section number 576

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

Question 1

1a

In [2]:
```
x = symbols("x")
y = (1 + 26/x)**x

f = ln(1 + 26/x)
g = x**-1
```

1b

In [3]:
```
print(f"The limit of f as x approaches infinity is {limit(f, x, oo)}")
print(f"The limit of g as x approaches infinity is {limit(g, x, oo)}")
```

```
The limit of f as x approaches infinity is 0
The limit of g as x approaches infinity is 0
```

1c

In [4]:
```
print(f"The limit of y as x approaches infinity is {E**limit(diff(f, x)/diff(g, x), x,
```

```
The limit of y as x approaches infinity is exp(26)
```

1d

In [5]:
```
print(f"{limit(y, x ,oo)} is equal to {E**limit(diff(f, x)/diff(g, x), x, oo)}")
```

```
exp(26) is equal to exp(26)
```

Question 2

2a

In [6]:
```
print(f"The radius of the billboard would have to be {sqrt((50 + 10 + 10)**2 + (42 + 4
```

```
The radius of the billboard would have to be 5*sqrt(74) or 43.0116263352131 inches.
```

2b

In [7]:
```
frameWidth, frameHeight = symbols("frameWidth frameHeight")
Area = (frameWidth - 8) * (frameHeight - 20)
frameHeight = solve(frameWidth**2 + frameHeight**2 - (55 * 2)**2, frameHeight)[1]
criticalValue = solve(diff(Area, frameWidth))[0]
print(f"The dimensions a = {criticalValue - 8} and b = {frameHeight.subs(frameWidth, c
```

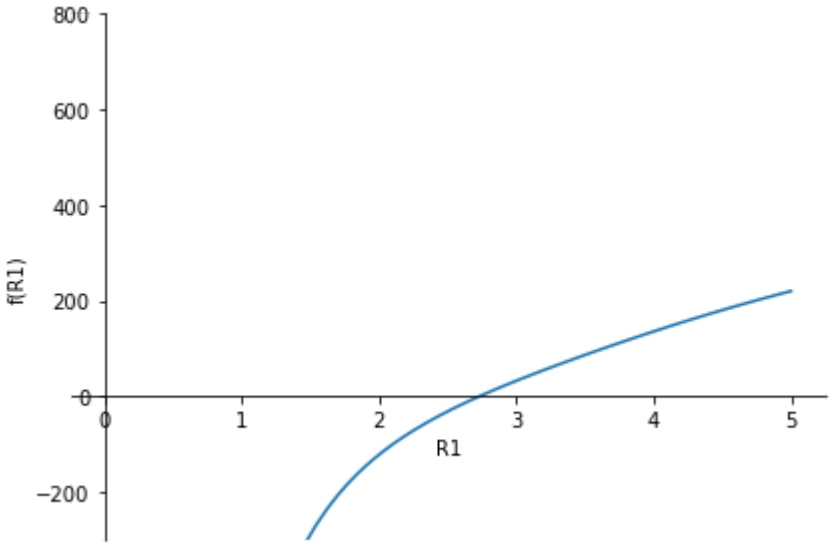
```
The dimensions a = 12 and b = -20 + 30*sqrt(13) would maximize the area of the pictur
e in the frame.
```

Question 3

3a

In [8]:
```
R1, R2, h = symbols('R1 R2 h')
Vh = 1770/(math.pi*(R1**2+R2**2+R1*R2))
SA = math.pi*(R1 + R2)*sqrt((R2 - R1)**2 + h**2) + math.pi*(R1**2 + R2**2)
SA = SA.subs(h, Vh)
SA = SA.subs(R2, 2*R1)
dSA = diff(SA, R1)
mini = solve(dSA, R1)

plot(dSA, (R1,0,5), ylim = (-300,800))
```



Out[8]:
```
<sympy.plotting.plot.Plot at 0x2ae27348490>
```

3b

In [9]:
```
print(f"There is a minimum on SA at R1 = {mini[0]} because because f' = 0 and f'' > 0'
print(f'R1 = {mini[0]}')
print(f'R2 = {2*mini[0]}')
print(f'h = {Vh.subs([(R1, mini[0]),(R2,2*mini[0])])}')
```

```
There is a minimum on SA at R1 = 2.73235307040265 because because f' = 0 and f'' > 0
R1 = 2.73235307040265
R2 = 5.46470614080531
h = 10.7808181056803
```

Question 4

4a

In [10]:
```
x = symbols("x")
f2dx = 5 / (x + 1) ** 2

fdx = integrate(f2dx, x) + 3 - integrate(f2dx, x).subs(x, 0)
print(f"f'(x) = {fdx}")
fx = integrate(fdx, x) + 9 - integrate(fdx, x).subs(x, 0)
print(f"f(x) = {fx}")
```

```
f'(x) = 8 - 5/(x + 1)
f(x) = 8*x - 5*log(x + 1) + 9
```

4b

In [11]:
```
c1, c2 = symbols("c1 c2")
fdx = integrate(f2dx, x) + c1
fx = integrate(fdx, x) + c2
solns = list(linsolve([fx.subs(x, 1) - 10, fx.subs(x, 4) - 10], (c1, c2)))[0]
print(solns)
print(f"f(x) = {fx.subs([(c1, solns[0]), (c2, solns[1])])}")
```

```
(-5*log(2)/3 + 5*log(5)/3, -5*log(5)/3 + 20*log(2)/3 + 10)
f(x) = x*(-5*log(2)/3 + 5*log(5)/3) - 5*log(x + 1) - 5*log(5)/3 + 20*log(2)/3 + 10
```