MATH 152 Lab 5

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

Question 1

1a

In [38]:
```
# Start your code here

x, A ,B, C , D = sp.symbols('x A B C D')

equation = (x + 7) / (2*x**4+17*x**2+36)

bottom = (2*x**4+17*x**2+36)
bottom = bottom.factor()

factor = bottom.args
print('Factor the denominator:')
display(bottom)

left = (A*x + B) / (factor[1])
right = (C*x+D) / (factor[0])

print('Partial fraction format:')
partial = left +  right
display(partial)

print('Distribute and multiply: ')
top = sp.expand(((A*x + B)*(factor[1]))+ ((C*x+D)*(factor[0])))
sp.collect(top,x)

eq_1 = 4*A + 9*C - 1
eq_2 = A + 2*C
eq_3 = B + 2*D
eq_4 = 4*B + 9*D - 7

coeffs = sp.solve([eq_1,eq_2,eq_3,eq_4],[A,B,C,D])
print('Solution:')
display(coeffs)


final = left + right
f_integrate = final.subs(coeffs)
display(f_integrate)
```

```
Factor the denominator:
```

$$\left(x^2+4\right)\left(2x^2+9\right)$$

Partial fraction format:

$$\frac{Ax+B}{2x^2+9}+\frac{Cx+D}{x^2+4}$$

Distribute and multiply:

Solution:

{A: -2, B: -14, C: 1, D: 7}

$$\frac{-2x-14}{2x^2+9}+\frac{x+7}{x^2+4}$$

1b

In [39]:
```
# Start your code here
print('Using sp.apart command: ')
display(sp.apart(equation))
```

Using sp.apart command:

$$-\frac{2\left(x+7\right)}{2x^2+9}+\frac{x+7}{x^2+4}$$

1c

In [42]:
```
# Start your code here
with_command = sp.apart(equation)
final = sp.integrate(with_command)
display(final)
```

$$\frac{\log\left(x^2+4\right)}{2}-\frac{\log\left(x^2+\frac{9}{2}\right)}{2}+\frac{7\,\mathrm{atan}\left(\frac{x}{2}\right)}{2}-\frac{7\sqrt{2}\,\mathrm{atan}\left(\frac{\sqrt{2}x}{3}\right)}{3}$$

Question 2

2a

In [51]:
```
# Start your code here
x, a = sp.symbols('x a', positive = True)

eq = (x**2) / (x**5 + a**2)

expression  = sp.integrate(eq,(x,0,sp.oo))
expression1 = sp.Eq(expression,0.1)
result = sp.solve(expression1, a)
print("The Value of a is: ")
display(result[0])
```

The Value of a is:

$$10.5917306617767$$

2b

In [69]:
```
# Start your code here
eq2 = (x**6)*sp.exp(-x**7)

exp_1 = sp.integrate(eq2,(x,1,a))
exp_2 = sp.integrate(eq2,(x,a,sp.oo))

final = sp.solve((exp_1 - exp_2), a)

print('The value of a is', final[0].evalf())
```

```
The value of a is 1.07812886361817
```

2c

In [72]:
```
# Start your code here
value = 1.07812886361817
eq2 = (x**6)*sp.exp(-x**7)

exp_1 = sp.integrate(eq2,(x,1,value)) + sp.integrate(eq2,(x,value,sp.oo))
value2 = exp_1.evalf()

print('The value of the integral is: ', value2)
```

```
The value of the integral is:  0.0525542058816346
```

Question 3

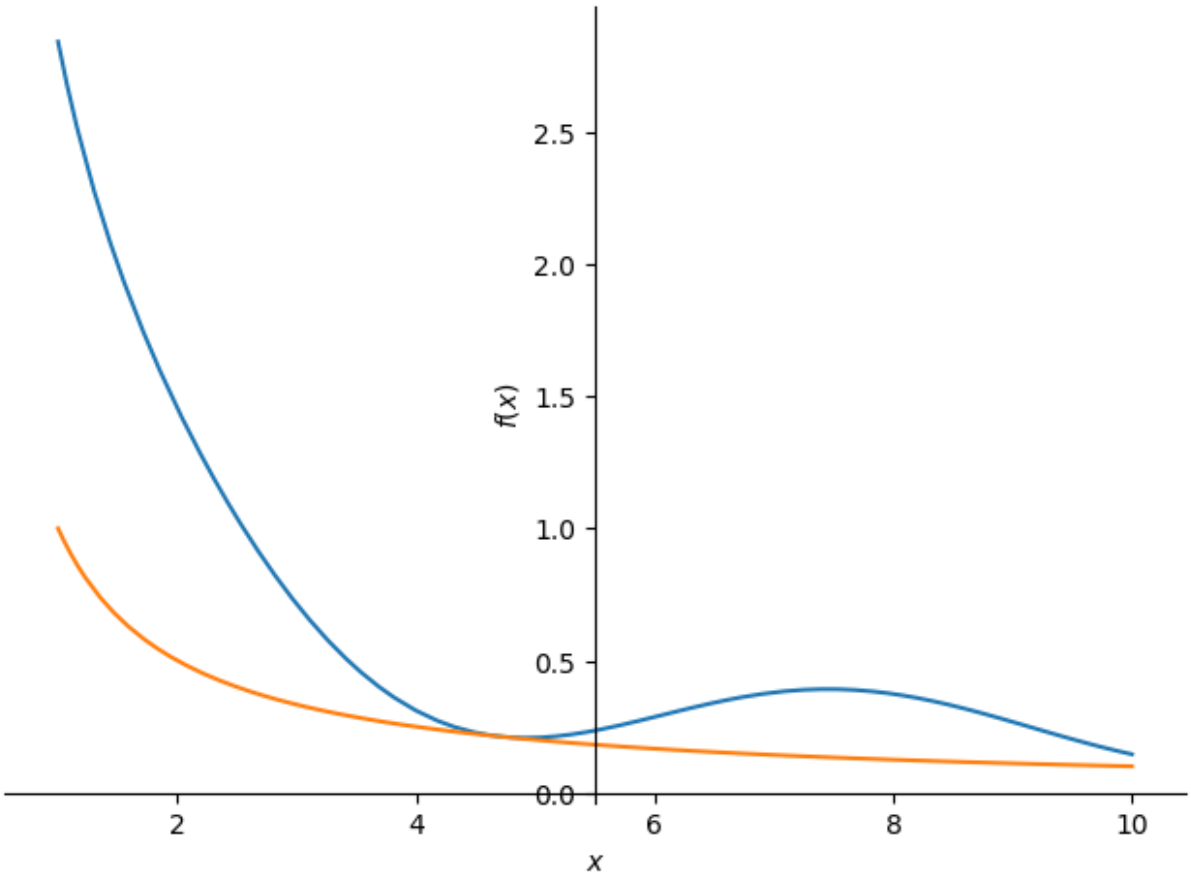
3a

In [75]:
```
# Start your code here

eq3 = (sp.sin(x) + 2) / x
eq4 = 1 / x

f = sp.integrate(eq4,(x,1,sp.oo))

lim = sp.limit(f,x,sp.oo)

if lim != sp.oo:
    print('g(x) converges because the limis is', lim)
else:
    print('g(x) diverges because the limit is', lim)
```

```
g(x) diverges because the limit is oo
```

3b

In [76]:
```
# Start your code here
plot1 = plot(eq3,eq4,(x,1,10), show = False)
plot1.show()
```



3c

In [79]:
```
# Start your code here
solve_fx = sp.integrate(eq3,(x,1,sp.oo))
display(solve_fx)
print('The integrals diverges for its limit is appraches infiity / DNE')
```

$$-\operatorname{Si}(1) + \infty$$

```
The integrals diverges for its limit is appraches infiity / DNE
```

3d

In [80]:
```
# Write your answer either in comments or in a print statement.
print('By using the p-series, we can determiend that since the coeefficient
```

```
By using the p-series, we can determiend that since the coeefficient of the
denominatos fall under the premise p <= 1, that the function diverges
```

In [ ]: