Math 152 – Python Lab 1

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0.1 MATH 152 Lab 1

MATH 152 Lab 1 Section Number: 571

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

0.1.1 Question 1

1a

[2]:
```python
a = 1.54
b = 3.78

e1 = ((sin(a) ** 2 + cos(a) ** 2) / (b ** 2 + 1)).simplify()

print(f"The evaluated expression (sin^2(a) + cos^2(a)) / (b^2 + a) where a is␣
↪{a} and b is {b} is {e1}")
```

```
The evaluated expression (sin^2(a) + cos^2(a)) / (b^2 + a) where a is 1.54 and b
is 3.78 is 0.0654090683132310
```

1b

[3]:
```python
e2 = (((sin(a) + cos(a)) ** 2) / (b ** 2 + 1)).simplify()

print(f"The evaluated expression ((sin(a) + cos(a))^2) / (b^2 + a) where a is␣
↪{a} and b is {b} is {e2}")

print(f"The answer from 1a is {e1} and the answer from 1b is {e2}. They are the␣
↪same: {e1 == e2}")
print(f"The difference between the two is {e1 - e2}")

print(f"For part 1a we can say that sin^2(a) + cos^2(a) is equal to 1.")
```

```
e3 = 1 / (b ** 2 + 1)

print(f"Using sin^2(a) + cos^2(a) = 1 we can simplify the expression to {e3}␣
↪which is still the same value from 1a: {e1 == e3}.")
```

```
The evaluated expression ((sin(a) + cos(a))^2) / (b^2 + a) where a is 1.54 and b
is 3.78 is 0.0694352396215374
The answer from 1a is 0.0654090683132310 and the answer from 1b is
0.0694352396215374. They are the same: False
The difference between the two is -0.00402617130830649
For part 1a we can say that sin^2(a) + cos^2(a) is equal to 1.
Using sin^2(a) + cos^2(a) = 1 we can simplify the expression to
0.06540906831323096 which is still the same value from 1a: True.
```

0.1.2 Question 2

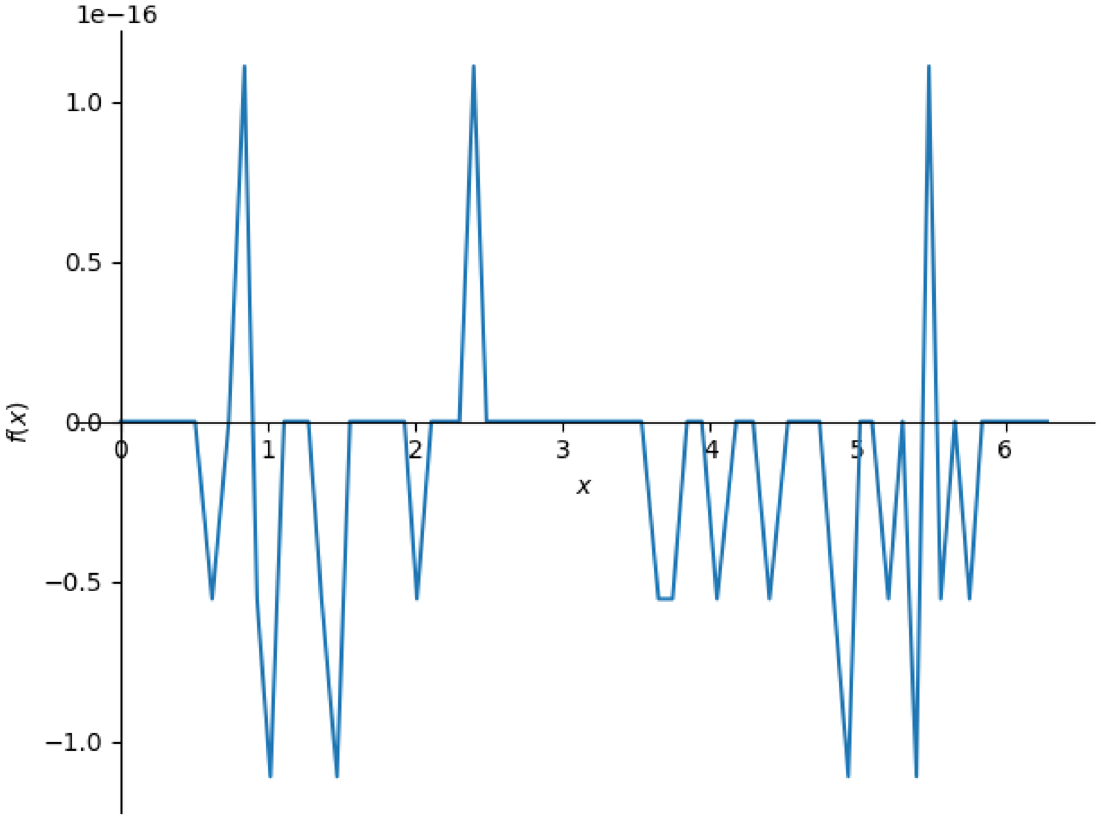
2a

[4]:
```
x = (3 * pi) / 4

e1 = (sin(x) ** 2)
e2 = (1 - cos(2 * x)) / 2

print(f"The evaluated expression sin^2(x) where x is {x} is {e1}")
print(f"The evaluated expression (1 - cos(2x)) / 2 where x is {x} is {e2}")
print(f"Both solutions are equal: {e1 == e2}")
```

```
The evaluated expression sin^2(x) where x is 3*pi/4 is 1/2
The evaluated expression (1 - cos(2x)) / 2 where x is 3*pi/4 is 1/2
Both solutions are equal: True
```

2b

[5]:
```
x = Symbol('x')
f = sin(x) ** 2 - (1 - cos(2 * x)) / 2
plot(f, (x, 0, 2 * pi))

print("Above is the graph of sin^2(x) - (1 - cos(2x)) / 2")
print("We are unable to get 0 at y = 0 because python is unable to calculate␣
↪the value of sin^2(x) - (1 - cos(2x)) / 2 at x = 0 without rounding errors")
```

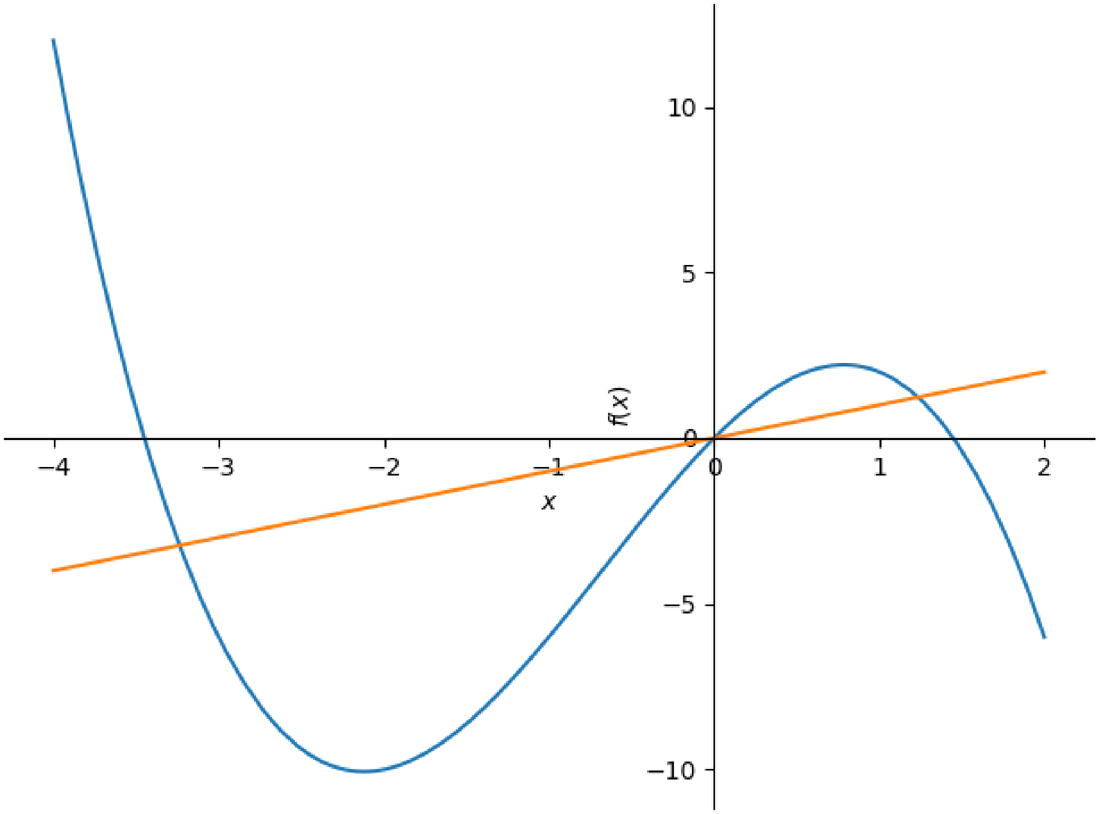



```
Above is the graph of sin^2(x) - (1 - cos(2x)) / 2
We are unable to get 0 at y = 0 because python is unable to calculate the value
of sin^2(x) - (1 - cos(2x)) / 2 at x = 0 without rounding errors
```

0.1.3 Question 3

3a

[6]:
```
x = Symbol('x')
f = -x ** 3 - 2* x ** 2 + 5 * x
g = x
plot(f, g, (x, -4, 2))
print("Above is the graph of -x^3 - 2x^2 + 5x and x")
print("There are 3 intersections between the two graphs")
```



Above is the graph of -x^3 - 2x^2 + 5x and x
There are 3 intersections between the two graphs

3b

[7]:
```
intercetions = solve(f - g)
intercetions.sort()
print(f"The intersections are at {intercetions}")

# Find the area of the lower half
area_f1 = integrate(f, (x, intercetions[0], intercetions[1]))
area_f2 = integrate(f, (x, intercetions[1], intercetions[2]))
area_g1 = integrate(g, (x, intercetions[0], intercetions[1]))
area_g2 = integrate(g, (x, intercetions[1], intercetions[2]))

e = area_g1 - area_f1 + area_f2 - area_g2
print(f"The area of the bounded region is {e.simplify()} which is approximately␣
↪{e.evalf()}")
```

```
The intersections are at [-sqrt(5) - 1, 0, -1 + sqrt(5)]
The area of the bounded region is 52/3 which is approximately 17.3333333333333
```

Question 4

0.1.4 4a

```
[8]: u_symbol, x = symbols('u x')
     u_value = x ** 3 - 7
     du = u_value.diff(x)
     dx = 1 / du

     f = 5 * x **2 * sqrt(x ** 3 - 7) # orginal function
     Fu = 5 * x ** 2 * sqrt(u_symbol) * dx # function with u substitution
     f = integrate(Fu)
     f_u_sub = f.subs(u_symbol, u_value)

     print(f"The integral of 5x^2sqrt(x^3 - 7) using u-sub is {f_u_sub}")
```

```
The integral of 5x^2sqrt(x^3 - 7) using u-sub is 10*(x**3 - 7)**(3/2)/9
```

0.1.5 4b

```
[9]: x = Symbol('x')
     F = 5 * x ** 2 * sqrt(x ** 3 - 7)
     f = integrate(F, x).simplify()

     print(f"The integral of 5x^2sqrt(x^3 - 7) using the built in method is {f}")
     print(f"The two solutions are equal: {f_u_sub == f}")
```

```
The integral of 5x^2sqrt(x^3 - 7) using the built in method is 10*(x**3 -
7)**(3/2)/9
The two solutions are equal: True
```

0.1.6 4c

```
[10]: f_u_sub = integrate(Fu, (u_symbol, u_value.subs(x, 2), u_value.subs(x, 3)))
      f_u_sub = f_u_sub.simplify()

      print(f"The integral of 5x^2sqrt(x^3 - 7) using u-sub from x = 2 to x = 3 is␣
       ↪{f_u_sub} which is approximately {f_u_sub.evalf()}")
```

```
The integral of 5x^2sqrt(x^3 - 7) using u-sub from x = 2 to x = 3 is -10/9 +
400*sqrt(5)/9 which is approximately 98.2696878888795
```

0.1.7 4d

```
[11]: f = integrate(F, (x, 2, 3))
      f = f.simplify()
```

```
print(f"The integral of 5x^2sqrt(x^3 - 7) using the built in method from x = 2␣
↪to x = 3 is {f} which is approximately {f.evalf()}")
print(f"The two solutions are equal: {f_u_sub == f}")
```

```
The integral of 5x^2sqrt(x^3 - 7) using the built in method from x = 2 to x = 3
is -10/9 + 400*sqrt(5)/9 which is approximately 98.2696878888795
The two solutions are equal: True
```