MATH 152 Lab 3

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

Question 1

1a

In [2]:
```
#start code here
x = symbols("x")
blue = x * E**(1 - x/2)
grey = x
green = (x**2) / 2

v = integrate(pi * 2**2, (x, 0, 2)) - integrate(pi * blue**2, (x, 0, 2))
print(f"{v} or {N(v)}")
```

```
-2*pi*exp(2) + 18*pi or 10.1218590498895
```

1b

In [3]:
```
#start code here
y = symbols("y")
expr = y - x * E**(1 - x/2)
invBlue = solve(expr, x)
v = pi * integrate(invBlue[0]**2, (y, 0, 2))
print(f"{v} or {N(v)}")
```

```
pi*(88 - 32*E) or 3.18865839034766
```

1c

In [4]:
```
v = integrate(pi * blue**2, (x, 0, 2)) - integrate(pi * grey**2, (x, 0, 2))
print(f"{v} or {N(v)}")
```

```
-38*pi/3 + 2*pi*exp(2) or 6.63330176925606
```

1d

In [5]:
```
v = 2 * pi * integrate( (2.5 - x) * (x - x**2/2) , (x, 0, 2) )
print(f"{v} or {N(v)}")
```

```
2.0*pi or 6.28318530717959
```

Question 2

2a

In [6]:
```
work = 9800 * integrate((15/2)*y * (3 - y), (y, 0, 2))
print(f"{work} newton meters of work")
```

```
245000.000000000 newton meters of work
```

2b

In [7]:
```
eq = Eq(9800 * integrate((15/2)*y * (3 - y), (y, x, 2)), 3*10**4)
height = solve(eq, x)

print(f"The remaining water is about {re(height[1])} meters deep.")
```

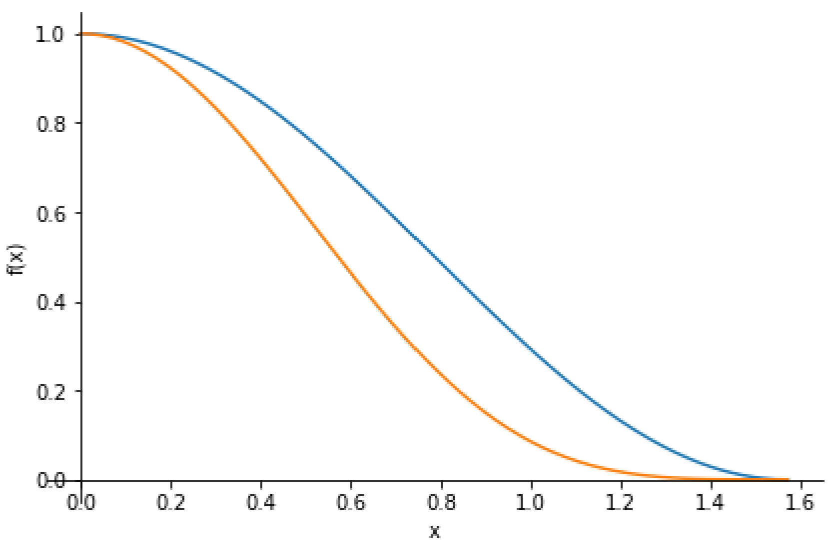
```
The remaining water is about 1.80424791991912 meters deep.
```

Question 3

3a

In [8]:
```
#start code here
fx = cos(x)**2
gx = cos(x)**4

plot(fx, gx, (x, 0, pi/2))
print(N(2*pi * integrate((pi/2 - x)*(fx - gx), (x, 0, pi/2)) ))
```




```
0.968946146259369
```

3b

In [9]:
```
area = integrate(fx, (x, 0, pi/2)) - integrate(gx, (x, 0, pi/2))
print(f"The area of the region is {area}")
```

```
The area of the region is pi/16
```

3c

In [10]:
```
xbar = integrate(x*(fx - gx), (x, 0, pi/2)) / (integrate(fx, (x, 0, pi/2)) - integrate
print(N(xbar))
print("The center of mass value makes sense because it looks like a reasonable midpoir
```

```
0.785398163397448
The center of mass value makes sense because it looks like a reasonable midpoint on t
he graph.
```

3d

In [11]:

```
distance = 2 * pi * (pi/2 - xbar)
print(f"The center of mass travels {distance} units far")
print(N(distance * area))
print("The distance traveled by the x coordinate of the center of mass multiplied by t
```

```
The center of mass travels pi**2/2 units far
0.968946146259369
The distance traveled by the x coordinate of the center of mass multiplied by the are
a is the same as the volume found in part A.
```

In [ ]: