MATH 151 Lab 4

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In [4]:
```
from sympy import *
from sympy.plotting import (plot,plot_parametric)
from sympy import Symbol, N
from sympy.plotting import (plot,plot_parametric)
```

Question 1

1a

In [13]:
```
#Solve using Strategy 1
a,x=symbols('a x') #Can also do each on a separate line
f=(2*x+1)/(x**2+2)
df=diff(f,x)
m=df.subs(x,2)
yval=f.subs(x,2)
# Using point-slope form, y - yval = m(x - xval), so y = yval + m(x - xval)
tanline=yval+m*(x-2)
print('The equation of the tangent line is y=',tanline)
```

```
The equation of the tangent line is y= 23/18 - 2*x/9
```

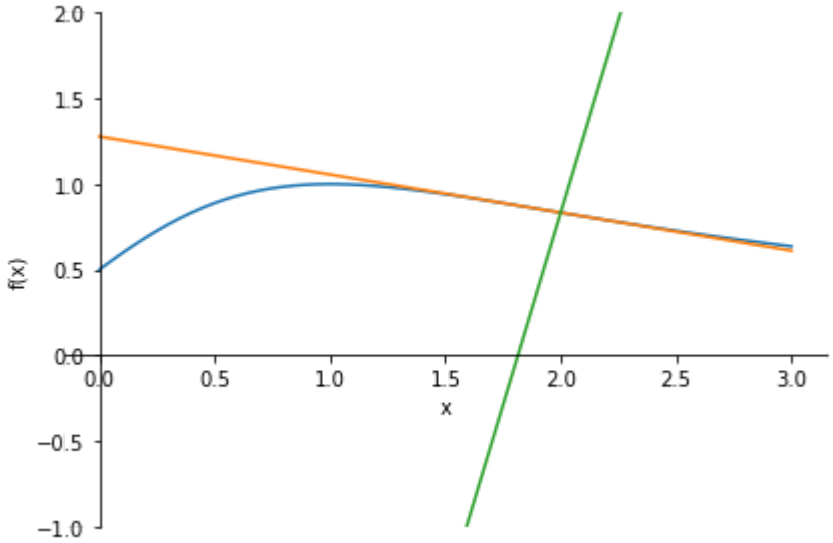
1b

In [14]:
```
normline=yval-(1/m)*(x-2)
print('The equation of the tangent line is y=',tanline)#normal line
```

```
The equation of the tangent line is y= 23/18 - 2*x/9
```

1c

In [16]:
```
#graph
plot((f,(x,0,3)),(tanline,(x,0,3)),(normline,(x,0,3)),ylim=[-1,2])
```

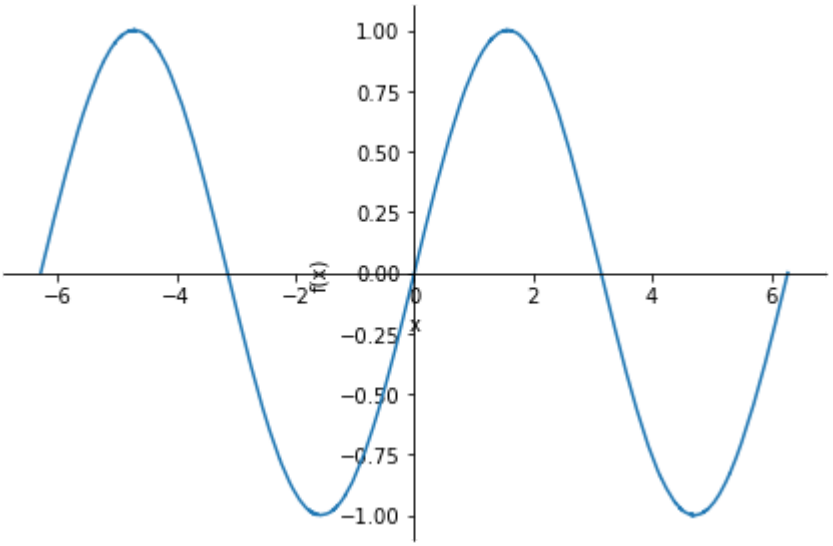


Out[16]: <sympy.plotting.plot.Plot at 0x1f970823c40>

Question 2

2a

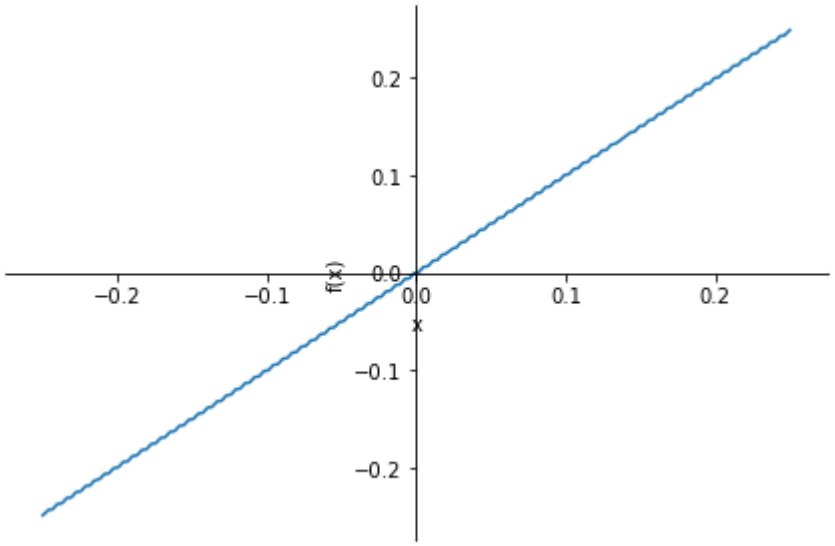
In [18]:
```
#[-2pi,2pi]
f = sin(x) - (1/1000)*sin(1000*x)
plot((f,(x,-2*pi,2*pi)))
print("I estimate the slope to be 1")
```



Out[18]: <sympy.plotting.plot.Plot at 0x1f96e389dc0>

2b

In [19]:
```
#[-0.25,0.25]
f = sin(x) - (1/1000)*sin(1000*x)
plot((f,(x,-.25,.25)))
print("I estimate the slope to be 1")
```




```
I estimate the slope to be 1
```

2c

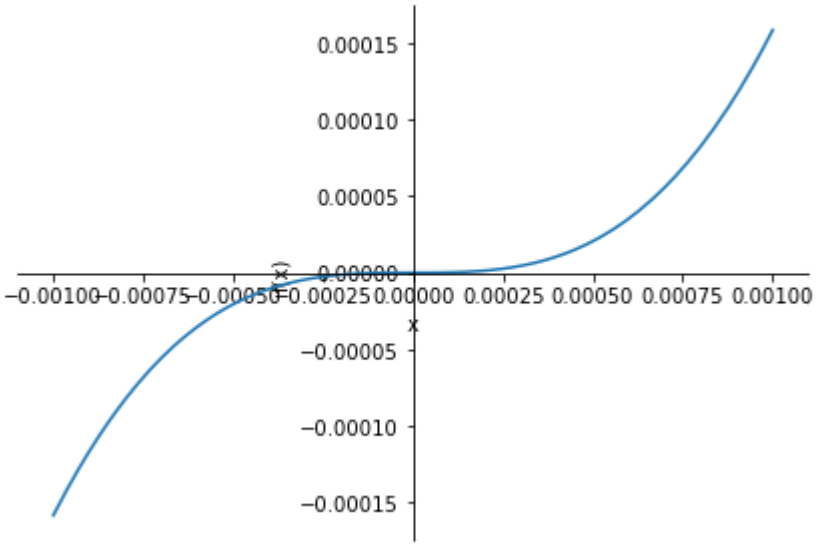
In [22]:
```
#Evaluate slope of tangent line
df=diff(f,x)

print("the slope of the line at f(x) where x = 0 is:", df.subs(x,0))
```

```
the slope of the line at f(x) where x = 0 is: 0
```

2d

In [23]:
```
#[-0.001,0.001]
f = sin(x) - (1/1000)*sin(1000*x)
plot((f,(x,-.001,.001)))
```



Out[23]: <sympy.plotting.plot.Plot at 0x1f97260f910>

Question 3

3a

In [37]:
```
#AROC
t =symbols('t')
v = 100000*(1-(t/60))**2
avgr = (-v.subs(t,0) + v.subs(t,10))/10
print("the average rate of change of V(t) over the interval [0,10] is:", avgr)
```

```
the average rate of change of V(t) over the interval [0,10] is: -27500/9
```

3b

In [33]:
```
#IROC
IROC = diff(v,t)
print(f"the instantaneous rate of change for the eqaution {v} is given by the for
```

```
the instantaneous rate of change for the eqaution 100000*(1 - t/60)**2 is given
by the formula with respect to t: 500*t/9 - 10000/3
```

3c

In [40]:
```
#relationship?
print(f"the IROC is of V(t) where t is 10 is {IROC.subs(t,10)}")

print("the rates/ slopes are different because the equation does not have a const
```

```
the IROC is of V(t) where t is 10 is -25000/9
the rates/ slopes are different because the equation does not have a constant s
lope
```

Question 4

4a

In [44]:
```
#8 derivatives
f = exp(x)*(1+x**2)

for i in range(1,9):
    print(f"the {i}th derrivative of {f} with respect to x is {diff(f,x,i)}")
```

```
the 1th derrivative of (x**2 + 1)*exp(x) with respect to x is 2*x*exp(x) + (x**
2 + 1)*exp(x)
the 2th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 4*x + 3)*
exp(x)
the 3th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 6*x + 7)*
exp(x)
the 4th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 8*x + 13)
*exp(x)
the 5th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 10*x + 2
1)*exp(x)
the 6th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 12*x + 3
1)*exp(x)
the 7th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 14*x + 4
3)*exp(x)
the 8th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 16*x + 5
7)*exp(x)
```

4b

In [51]:
```
n =symbols('n')
eq = (x**2 + 2*n*x + (n**2-(n-1)))*exp(x)
print(f"the formula for the derrivative of {f} to the nth is: {eq}")
```

```
the formula for the derrivative of (x**2 + 1)*exp(x) to the nth is: (n**2 + 2*n
*x - n + x**2 + 1)*exp(x)
```

4c

In [53]:
```
#50th
print(f"the {50}th derrivative of {f} with respect to x is {diff(f,x,50)}")
print(f"{eq} where n is substituted for 50 is {eq.subs(n,50)}")
```

```
the 50th derrivative of (x**2 + 1)*exp(x) with respect to x is (x**2 + 100*x +
2451)*exp(x)
(n**2 + 2*n*x - n + x**2 + 1)*exp(x) where n is substituted for 50 is (x**2 + 1
00*x + 2451)*exp(x)
```

In [ ]: