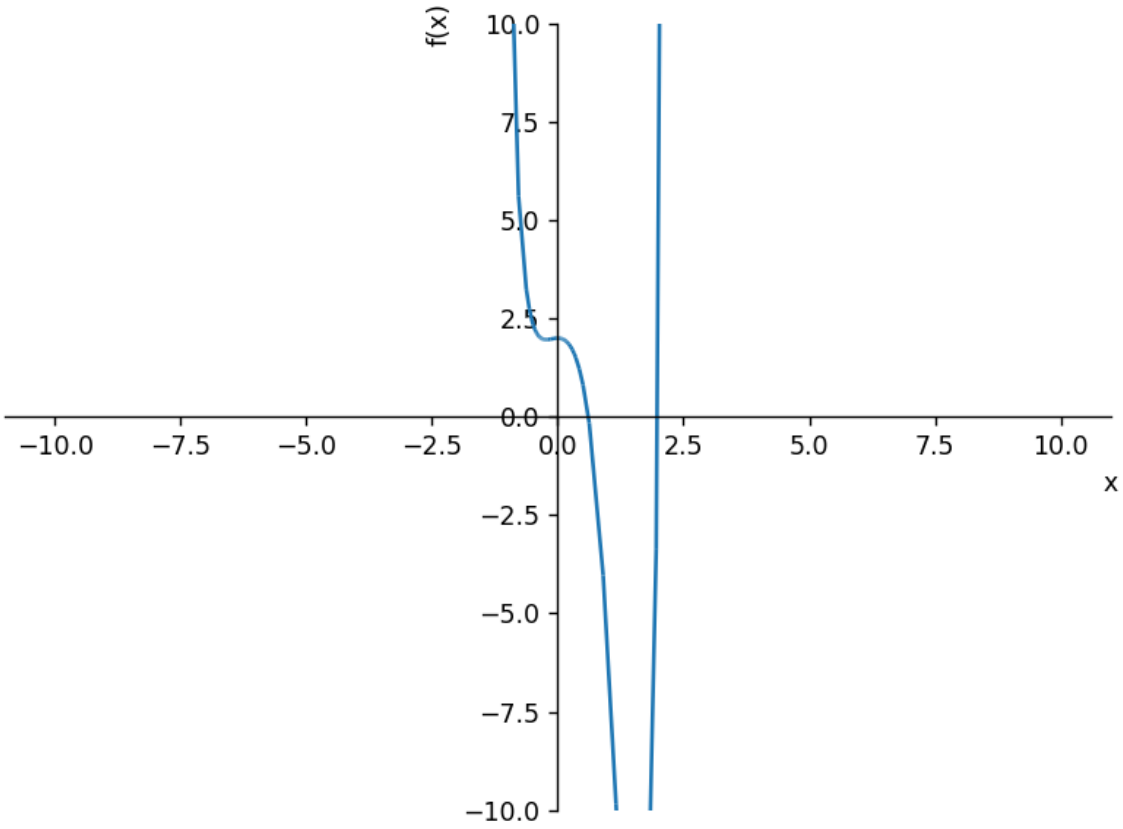
In [1]:
```
from sympy import *
from sympy.plotting import (plot, plot_parametric)
```

#1a Plot in standard domain

In [72]:
```
matplotlib notebook
```

In [73]:
```
x = symbols('x', real=True)
f= 3*x**6-5*x**5+x**4-5*x**3-2*x**2+2
plot(f,(x,-10,10),ylim=[-10,10])
print("there appear to be 2 inflection points and 2 local extrema.")
```




```
there appear to be 2 inflection points and 2 local extrema.
```

#1b First derivative and critical values

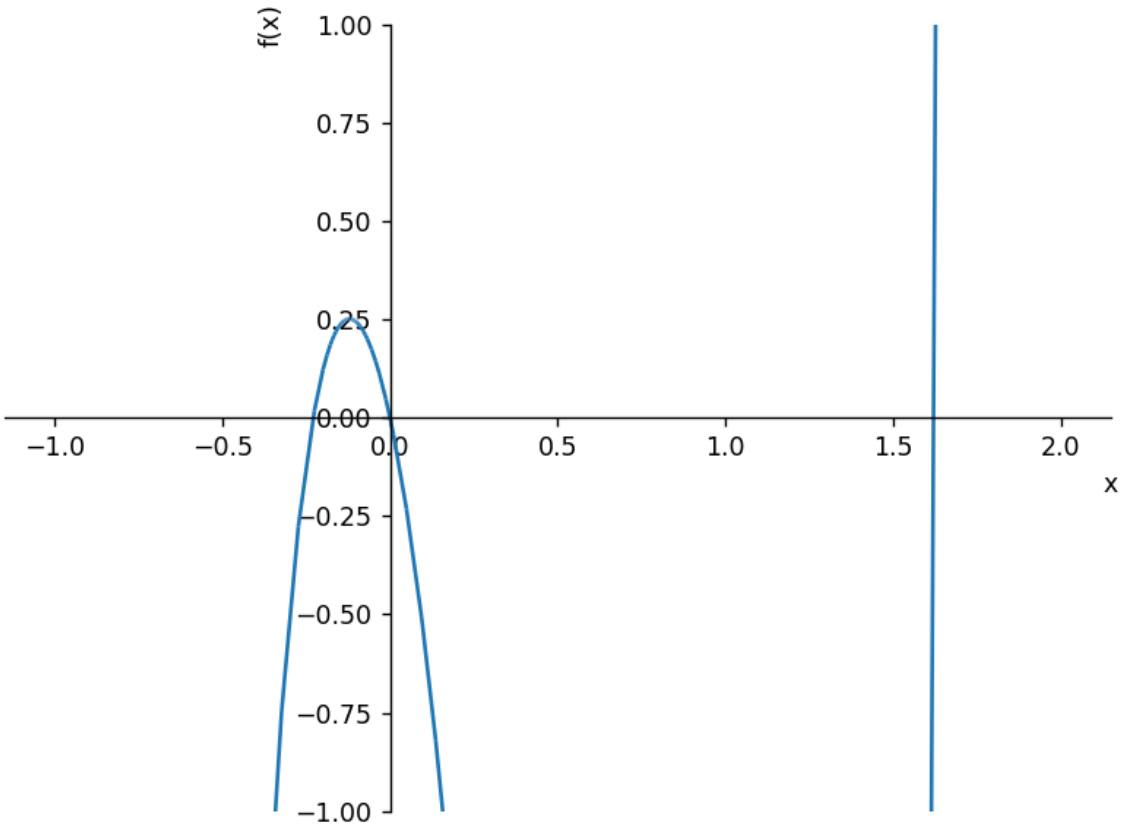
In [74]:
```
fp = diff(f,x)
cvals = solve(fp,x)
cvals_float=[i.evalf() for i in cvals]
print("The critical values are:", cvals_float[0:2],"and", cvals_float[4])
```

```
The critical values are: [0, 1.62108028476560] and -0.229254671831237
```

#1c Graphical or numerical test of intervals

In [75]:
```
matplotlib notebook
```

In [76]:
```
plot(fp,(x,-1,2),ylim=[-1,1])
print("The intervals where f is increasing are approximately: (-0.229, 0)U(1.
print("The intervals where f is decreasing are approximately: (-infinity, -0.
```




```
The intervals where f is increasing are approximately: (-0.229, 0)U(1.621,
infinity)
The intervals where f is decreasing are approximately: (-infinity, -0.229)U
(0, 1.621)
```

#1d Second derivative and possible inflection points

In [77]:
```
fp2 = diff(fp,x)
ivals = solve(fp2,x)
ivals_float=[i.evalf() for i in ivals]
print("The inflection values are:", ivals_float[0], "and", ivals_float[3])
```

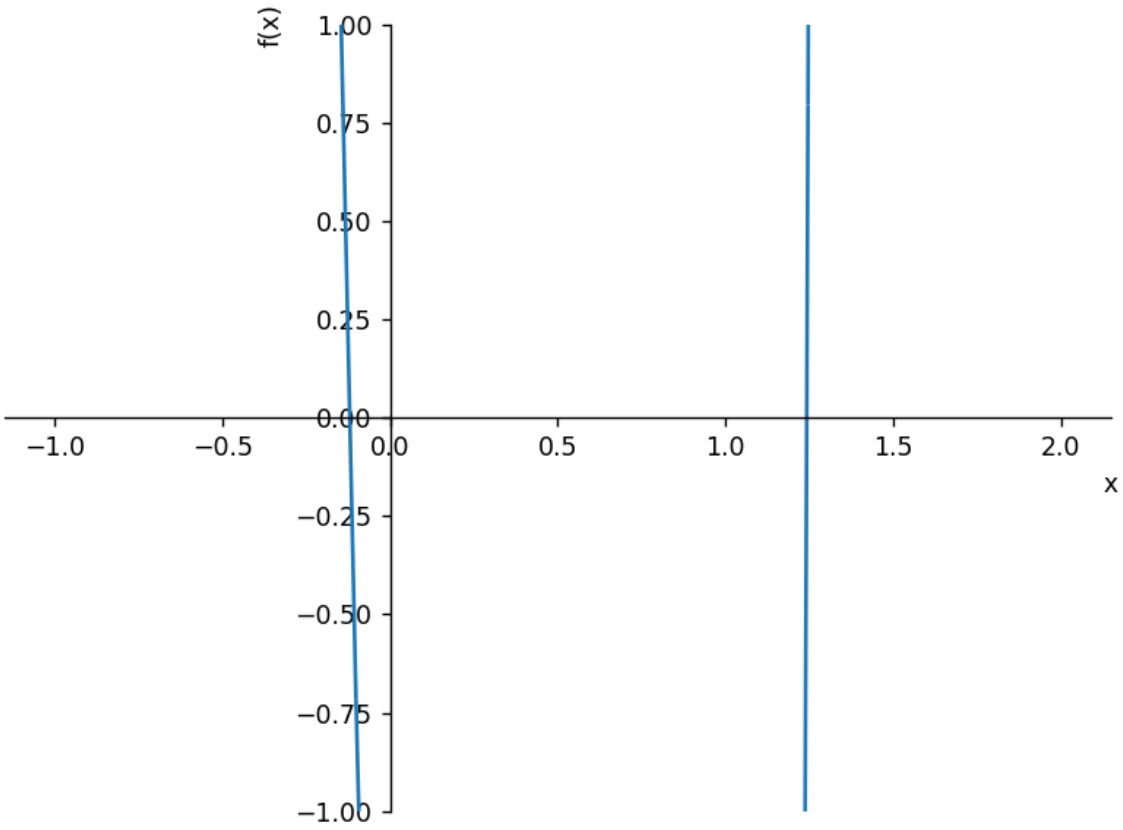
```
The inflection values are: 1.24279404763448 and -0.120943571077641
```

#1e Test values in between for concavity

In [78]:
```
matplotlib notebook
```

In [80]:

```
plot((fp2,(x,-1,2)),ylim=[-1,1])
print("The intervals where f is concave up are approximately: (-infinity, -0.
print("The interval where f is concave down is approximately: (-0.121, 1.243)
```

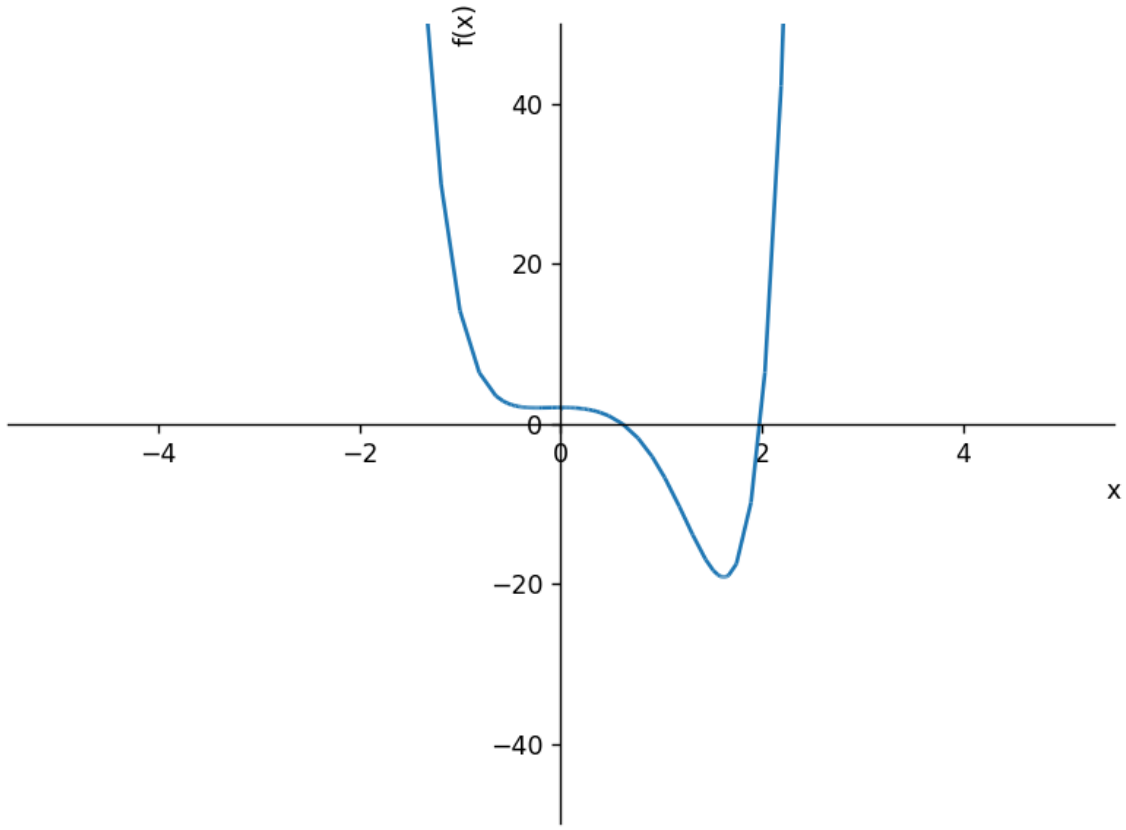


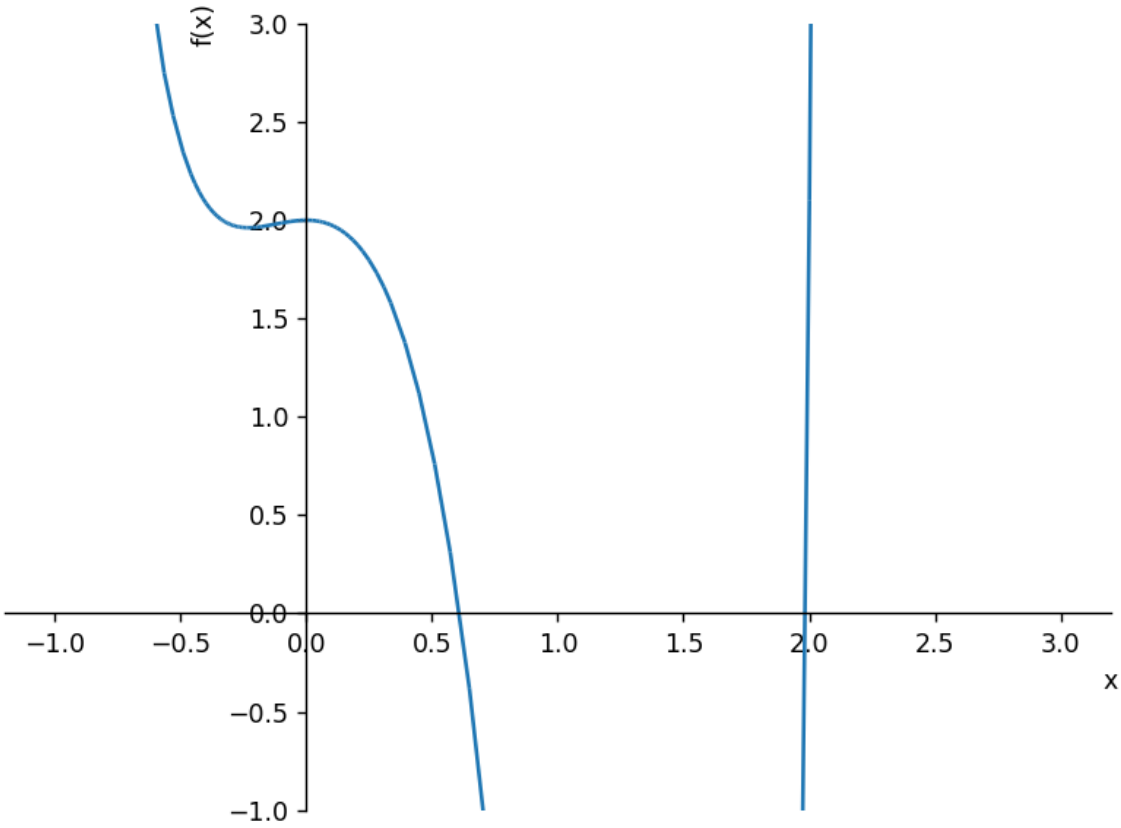

```
The intervals where f is concave up are approximately: (-infinity, -0.121)U
(1.243, infinity)
The interval where f is concave down is approximately: (-0.121, 1.243)
```

#1f Conclusion and accurate graph window

In [92]:

```
plot(f,(x,-5,5),ylim=[-50,50])
plot(f,(x,-1,3),ylim=[-1,3])
print("There actually are 3 local extrema and 2 inflection points.")
```






```
There actually are 3 local extrema and 2 inflection points.
```

#2a Plot family of curves (based on parameter c) on the same axes

In [ ]:

#2b Find critical values in terms of c and indicate which values of c give real number answers

In [ ]:

#2c Analyze what happens as c --> oo

In [ ]:

#2d inflection points in terms of c and indicate which values of c give real number answers

In [ ]:

#2e Values of c where inflection points are +/-1 and values of c where critical values are +/-1 and

plots

In [ ]:
```
matplotlib notebook
```

In [ ]:

#3 Equation of the line through the inflection points and graph

In [ ]:

In [ ]:
```
matplotlib notebook
```

In [ ]: