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MATH 151-550

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

1a Find the limit

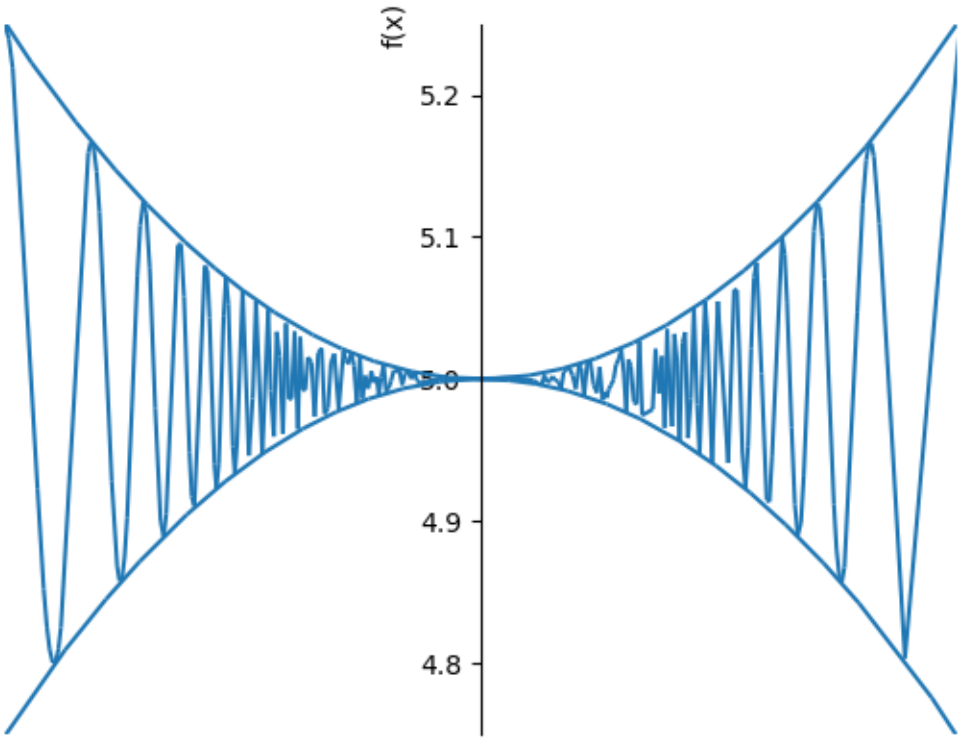
In [16]:
```
x = symbols('x')
g = 5 + x**2 * cos(pi/(x**2))
limit(g,x,0)
```

Out[16]: 5

1b Illustrate Squeeze Theorem

In [3]:
```
matplotlib notebook
```

In [17]:
```
f = 5 - x**2
h = 5 + x**2
plot(f, g, h, xlim=[-.5,.5], ylim=[4.75,5.25])
```



Out[17]: <sympy.plotting.plot.Plot at 0x1b8de1aa0a0>

2a Plot V(d)

In [5]:
```
matplotlib notebook
```

In [6]:
```
d = symbols('d')
M = 0.1
p_w = 1000.0
C = 1.0
theta = 10.0
beta = 10.0
g = 9.81
theta *= pi/180
beta *= pi/180
V = (sqrt((16 * M * g)/(pi * C * p_w * d**2)))/(sqrt(1 - (8 * M * tan(beta)**2)/(pi * d
plot(V, xlim = [.05, .1], ylim = [.7, .9])
```

Out[6]: <sympy.plotting.plot.Plot at 0x1b8dce5b850>

2b Theorem to find solution to V(d)=0.8

In [7]:
```
a = .09
b = .095

print("Using the Intermediate Value Theorm")
print("a =", a)
print("b =", b)
```

```
Using the Intermediate Value Theorm
a = 0.09
b = 0.095
```

2c Numerical Solution

In [8]:
```
print(nsolve(V-.8, a))
```

```
0.0911416689546582
```

3a List Comprehension

In [9]:
```
x = symbols('x')
```

```
f = sqrt(2 * x**2 + 1) / (3 * x - 5)
print([f.subs(x, float(i)) for i in [10, 50, 100]])
print([f.subs(x, float(i)) for i in [-10, -50, -100]])
```

```
[0.567097875150313, 0.487708612641025, 0.479406412633974]
[-0.405069910821652, -0.456243540857733, -0.463688169596795]
```

3b Compute Limits

In [10]:

```
pos_inf = limit(f, x, oo)
neg_inf = limit(f, x, -oo)

print(neg_inf)
print(pos_inf)
print(float(neg_inf))
print(float(pos_inf))
```

```
-sqrt(2)/3
sqrt(2)/3
-0.4714045207910317
0.4714045207910317
```

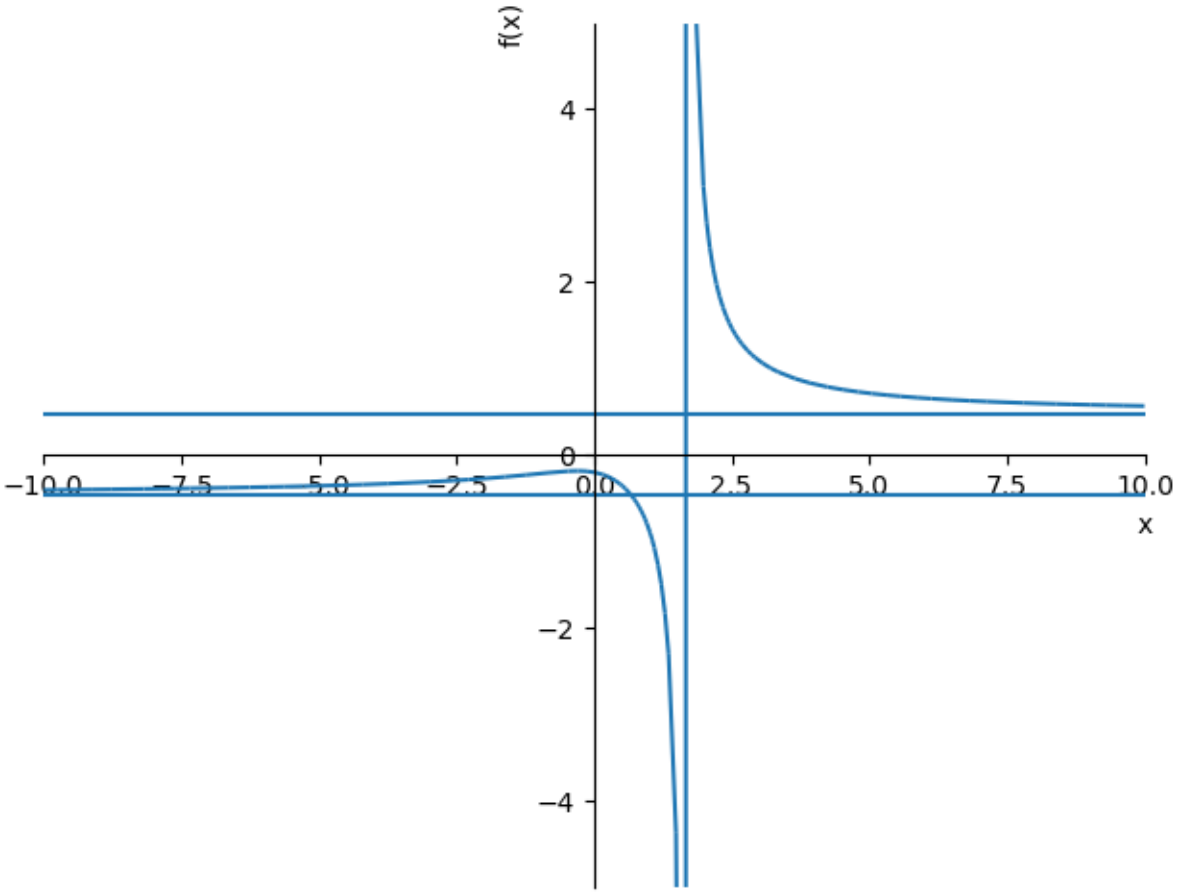
3c Plot function and Horizontal Asymptotes

In [11]:

```
matplotlib notebook
```

In [12]:

```
plot(f, pos_inf, neg_inf, xlim = [-10,10], ylim = [-5,5])
```

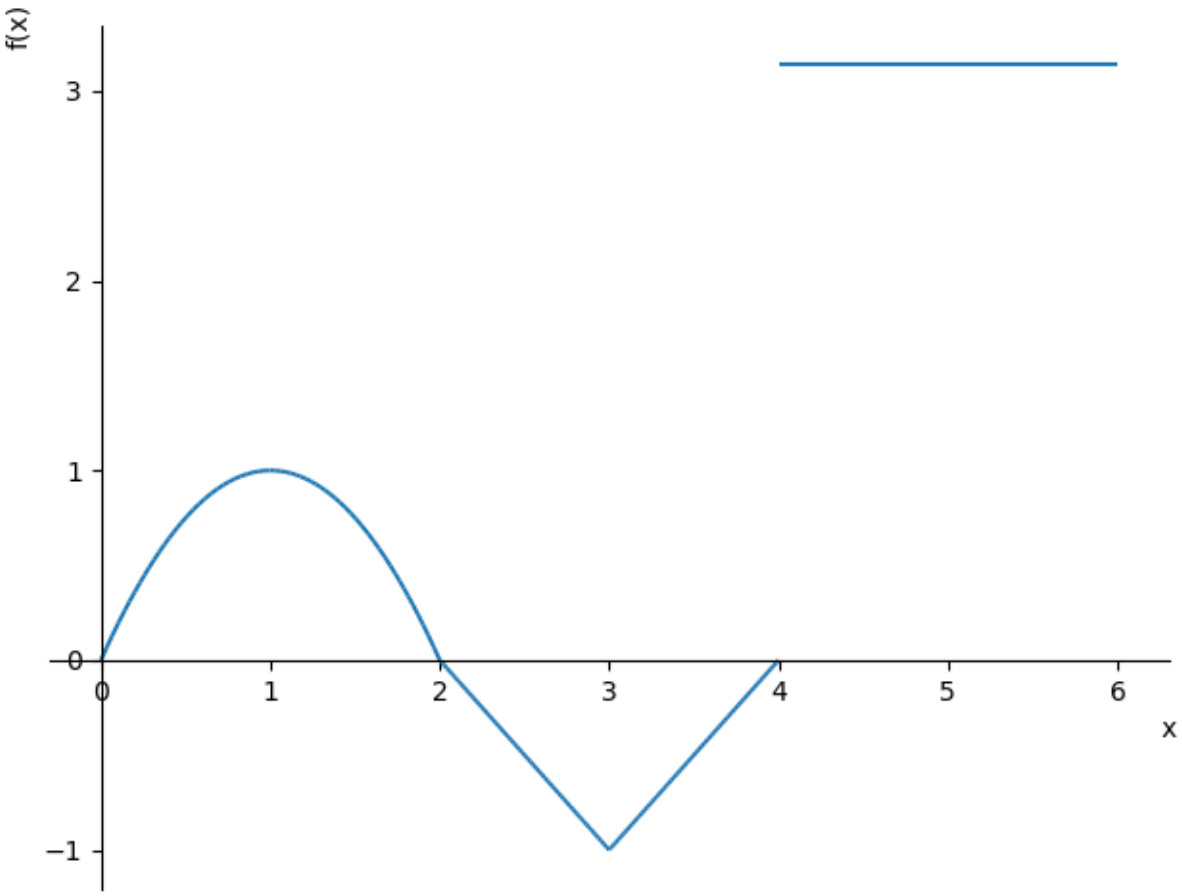


Out[12]: <sympy.plotting.plot.Plot at 0x1b8dddea640>

4a Graph of piecewise function

In [13]:
```
matplotlib notebook
```

In [14]:
```
x=symbols('x')
fa=2*x-x**2
fb=2-x
fc=(x**2 -7*x+12)/(x-3)
fd= pi
plot((fa,(x, 0,2)),(fb,(x, 2,3)),(fc,(x, 3,4)),(fd,(x, 4,6)))
# f is continuous at 2 and 3 but not 4
```



Out[14]: <sympy.plotting.plot.Plot at 0x1b8dc516b50>

4b Left and Right Hand Limits at 2, 3, and 4

In [15]:
```
lim_2l = limit(fa,x,2)
lim_2r = limit(fb,x,2)
print("Left hand limit at 2: ", lim_2l)
print("Right hand limit at 2: ",lim_2r)
lim_3l = limit(fb,x,3)
lim_3r = limit(fc,x,3)
print("Left hand limit at 3: ", lim_3l)
print("Right hand limit at 3: ",lim_3r)
lim_4l = limit(fc,x,4)
lim_4r = limit(fd,x,4)
print("Left hand limit at 4: ", lim_4l)
print("Right hand limit at 4: ", lim_4r)
```

```
Left hand limit at 2:  0
Right hand limit at 2:  0
Left hand limit at 3:  -1
Right hand limit at 3:  -1
Left hand limit at 4:  0
Right hand limit at 4:  pi
```