In [9]:
```
import numpy as np
import matplotlib.pyplot as plt
import math
```

In [4]:
```
h=1e-10
x=5
print("Estimate:", ((x+h)**2-x**2)/h)
print("True:",2*x)
```

```
Estimate: 10.00000082740371
True: 10
```

In [6]:
```
h=1e-10
x=2
print("Estimate:",((x+h)**3-x**3)/h)
print("True:",3*x**2)
```

```
Estimate: 12.000000992884452
True: 12
```

In [8]:
```
h=1e-10
x=1
print("Estimate:",(((1/(x+h))-1/x)/h))
print("True:",(-1/x**2))
```

```
Estimate: -1.000000082740371
True: -1.0
```

In [11]:
```
h=1e-10
x=5
print(f"Estimate: {((math.sqrt(x+h)-math.sqrt(x))/h)}")
print("True:", 1/(2*math.sqrt(x)))
```

```
Estimate: 0.22360779894370353
True: 0.22360679774997896
```

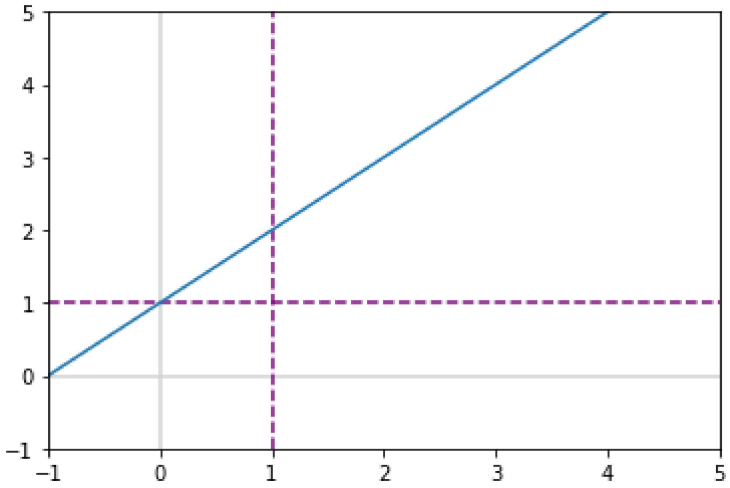
In [20]:
```
def my_fxn(my_x):
    my_y=(my_x**2-1)/(my_x-1)
    return my_y
```

In [26]:
```
my_fxn(2)
```

Out[26]:
```
3.0
```

In [21]:
```
x=np.linspace(-10,10,10000)
y=my_fxn(x)
```

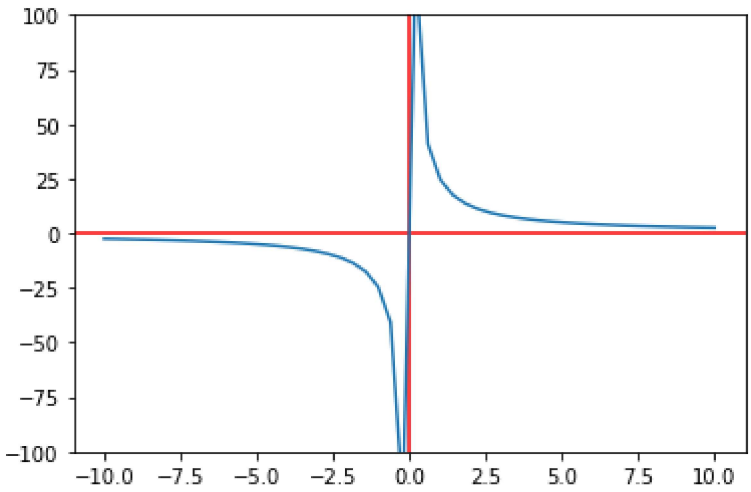
In [23]:
```
plt.axhline(y=0,color="lightgray")
plt.axvline(x=0,color="lightgray")
plt.xlim(-1,5)
plt.ylim(-1,5)
plt.axvline(x=1,color="purple",linestyle="--")
plt.axhline(y=1,color="purple",linestyle="--")
plt.plot(x,y)
plt.show()
```



In [28]:
```
def inf_fxn(my_x):
    my_y=25/my_x
    return my_y
```

In [29]:
```
x=np.linspace(-10,10)
y=inf_fxn(x)
```

In [38]:
```
plt.axhline(y=0,color="red")
plt.axvline(x=0,color="red")
plt.plot(x,y)
plt.ylim(-100,100)
plt.show()
```



In [66]:
```
m=(25/2-25/5)/(2-5)
```

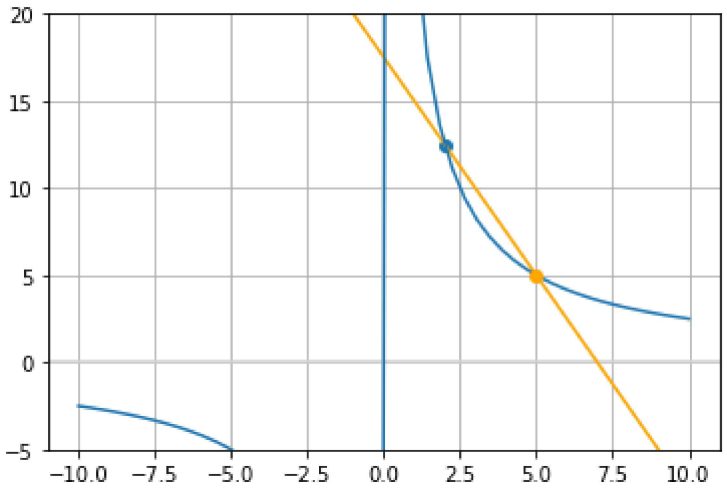
In [67]:
```
b=25/2-m*2
b
```

Out[67]:
```
17.5
```

In [68]:
```
line_y=m*x+b
```

In [72]:
```
fig, ax=plt.subplots()
plt.axvline(x=0, color="lightgray")
plt.axhline(y=0,color="lightgray")
```

```
plt.scatter(2,25/2)
plt.scatter(5,25/5,c="orange",zorder=3)
plt.ylim(-5,20)
plt.plot(x,line_y,c="orange")
_ =ax.plot(x,y)
plt.grid()
```



In [83]:
```
def f(x):
    return x**2+2*x+2
```

In [84]:
```
delta_x=0.000001
delta_x
```

Out[84]:
```
1e-06
```

In [85]:
```
x1=2
y1=10
```

In [86]:
```
#Rearranging x2 and x1 where delta_x=x2-x1 or x2=x1+delta_x
def diff_demo(my_f,my_x,my_delta):
    return (my_f(my_x+my_delta)-my_f(my_x))/my_delta
```

In [87]:
```
deltas=[1,0.1,0.01,0.001,0.0001,0.00001,0.000001]
```

In [88]:
```
deltas
```

Out[88]:
```
[1, 0.1, 0.01, 0.001, 0.0001, 1e-05, 1e-06]
```

In [91]:
```
for delta in deltas:
    print(diff_demo(f,2,delta))
```

```
7.0
6.099999999999994
6.009999999999849
6.000999999999479
6.000100000012054
6.000009999951316
6.000001000927568
```

In [81]:

In [ ]: