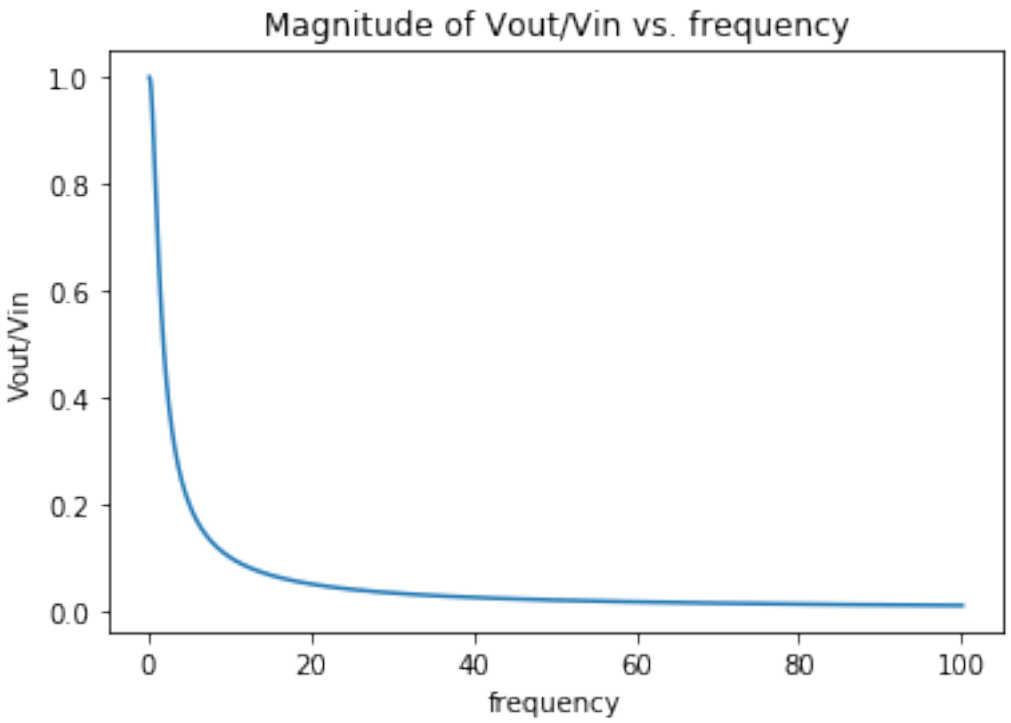
Phy482 Hw5 Prob 4 Wood

February 16, 2018

In [1]:
```
import matplotlib.pyplot as plt
from math import *
from math import pi
```

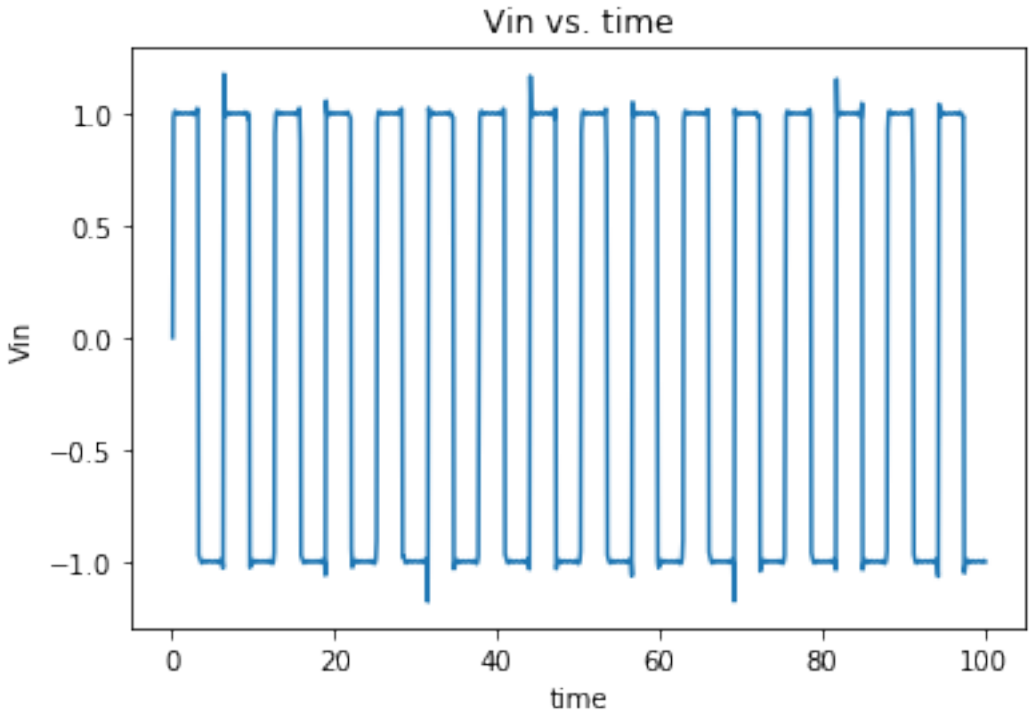
In [2]:
```
w = 0.0
dw = 0.1
wf = 100.0

R = 1.0
L = 1.0

frequency = []
VRatio = []

while w < wf:
    Vratio = R/sqrt(R**2+w**2*L**2)
    w = w + dw
    frequency.append(w)
    VRatio.append(Vratio)

plt.plot(frequency, VRatio)
plt.xlabel('frequency')
plt.ylabel('Vout/Vin')
plt.title('Magnitude of Vout/Vin vs. frequency')
plt.show()
```



Thus, it looks like the resistor is a low-pass filter, which I already expected from my written homework.

In [3]:
```
w = 1.0

t = 0.0
dt = 0.1
tf = 100.0

time = []
VIn = []

R = 1.0
L = 1.0

dk = 1.0
kf = 100.0

while t < tf:
    Vin = 0.0
    k = 1.0

    while k < kf:
        Vin = Vin + (4/pi)*(sin((2*k-1)*w*t))/(2*k-1)
        k = k + dk
```

```
        t = t + dt
        time.append(t)
        VIn.append(Vin)

plt.plot(time, VIn)
plt.xlabel('time')
plt.ylabel('Vin')
plt.title('Vin vs. time')
plt.show()
```



I think Vout should look similar to Vin but shifted (and possibly a different amplitude). I can't figure out how to find Vout though. I don't think phasors work simply here since it's a complicated sum. I think it works to say Vout = Vin - L(dI/dt) but I don't know much about I. I can't figure out what the hint means, that "All the equations are linear, so if the input square wave is constructed from the sum of sinusoidal functions, what does the output look like?" I don't know which equations are linear, so I'm not sure what this tells me.