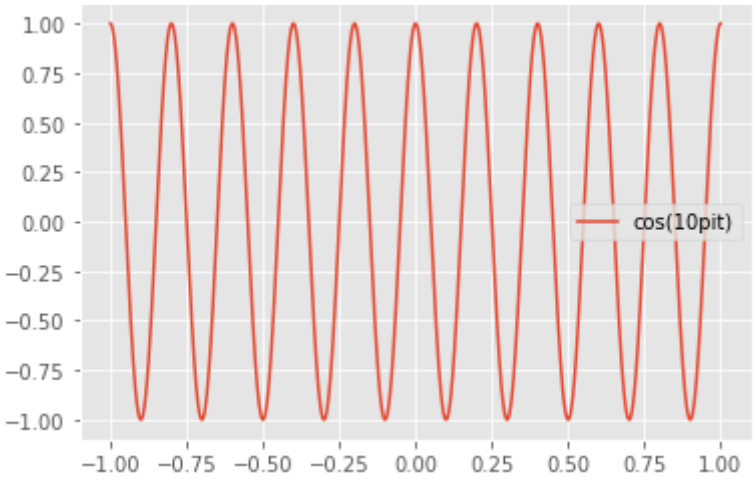
In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib import style
```

In [2]:
```
style.use('ggplot')
t = np.arange(-1, 1, 0.00001)
```

In [3]:
```
def x1(t):
    return np.cos(10 * np.pi * t)
```

1

In [4]:
```
plt.plot(t, x1(t), label="cos(10pit)")
plt.legend()
plt.show()
```

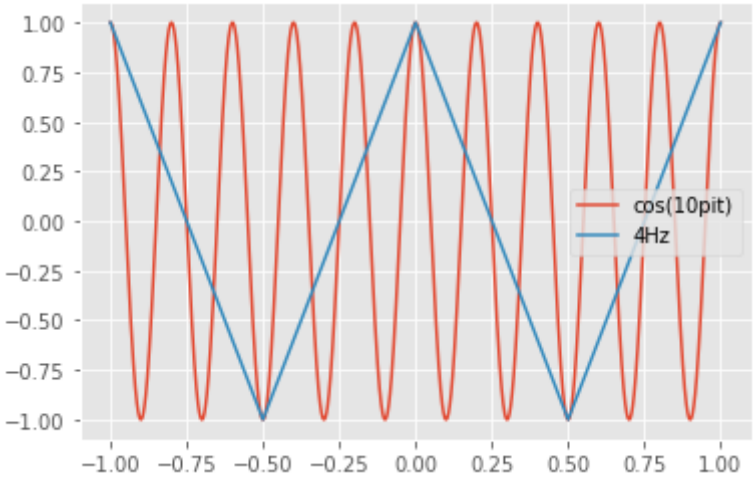


الف) تابع نمونه‌برداری

In [5]:
```
def sampling(input_signal,sampling_freq):
    time_s = 1 / sampling_freq
    ratio_s = int(time_s // 0.00001)
    sampled_signal = [input_signal[i * ratio_s] for i in range(int(len(input_si
    sampled_time =   [t[i * ratio_s] for i in range(int(len(t)//ratio_s)+1)]
    return sampled_signal,sampled_time
```

ب) با فرکانس ۴ هرتز نمایش داده شد

In [6]:
```
plt.plot(t, x1(t), label="cos(10pit)")
sampled_signal , sampled_t = sampling(x1(t),4)
plt.plot(sampled_t, sampled_signal, label='4Hz')
plt.legend()
plt.show()
```

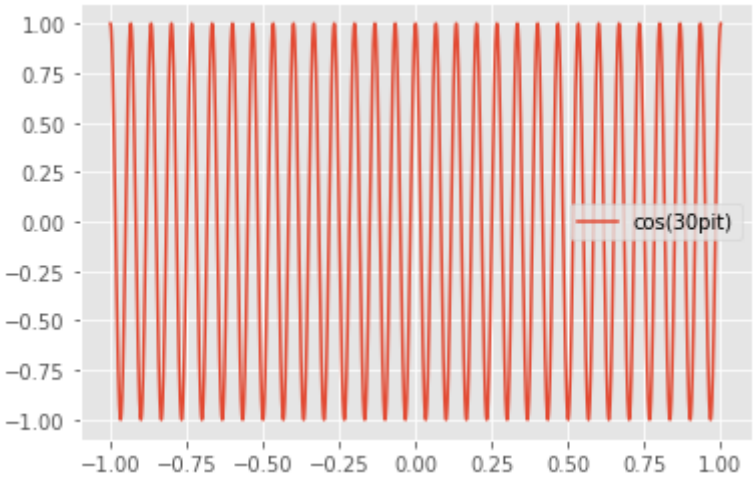


ج) خیر، مشاهده می‌کنیم بسیاری از نقاط نادیده گرفته شده‌اند

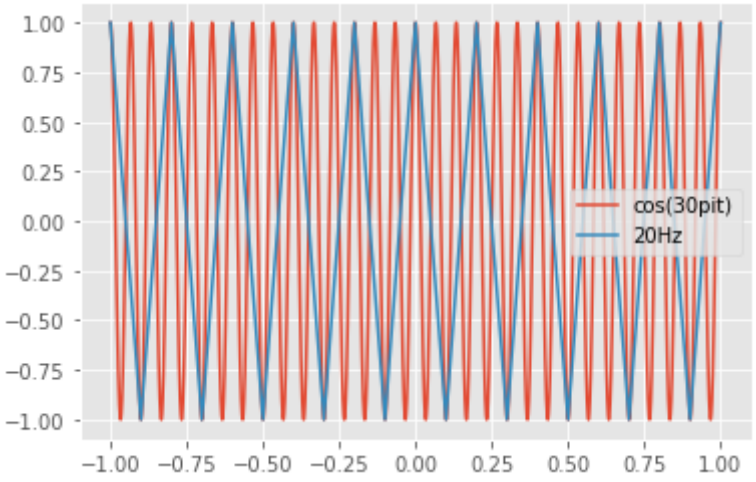
2

In [7]:
```
def x2(t):
    return np.cos(30 * np.pi*t)
```

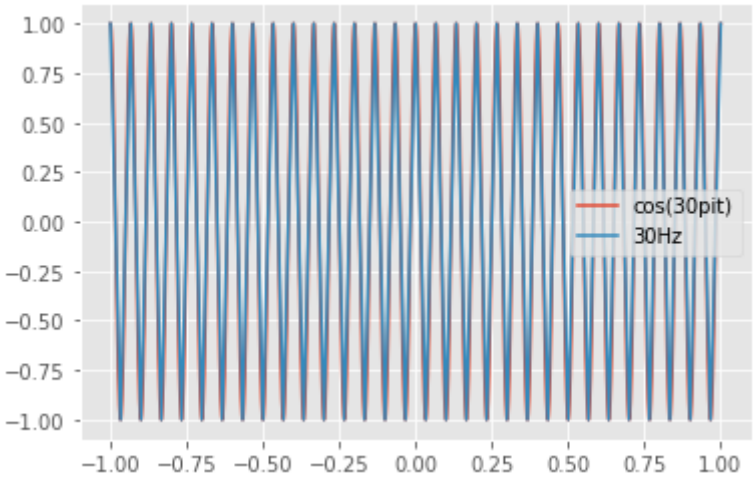
In [8]:
```
plt.plot(t, x2(t), label="cos(30pit)")
plt.legend()
plt.show()
```



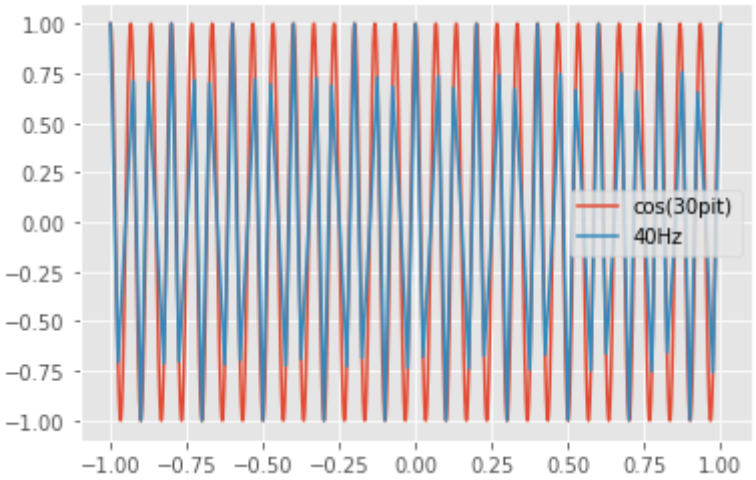
In [9]:
```
plt.plot(t, x2(t), label="cos(30pit)")
sampled_signal , sampled_t = sampling(x2(t),20)
plt.plot(sampled_t, sampled_signal, label='20Hz')
plt.legend()
plt.show()
```



In [10]:
```
plt.plot(t, x2(t), label="cos(30pit)")
sampled_signal , sampled_t = sampling(x2(t),30)
plt.plot(sampled_t, sampled_signal, label='30Hz')
plt.legend()
plt.show()
```



In [11]:
```
plt.plot(t, x2(t), label="cos(30pit)")
sampled_signal , sampled_t = sampling(x2(t),40)
plt.plot(sampled_t, sampled_signal, label='40Hz')
plt.legend()
plt.show()
```



مشاهده می‌کنیم نرخ ۳۰ هرتز منطبق بر روی شکل است بنابراین این نرخ مناسب است