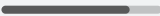



# Wiederholung

- numpy
- Generating Sine Waves

```
In [14]: sr = 44100  
freq = 300  
time = np.linspace(0, 2, int(sr * 2))  
x = np.sin(freq * 2 * np.pi * time)  
  
display(Audio(x, rate=sr))
```

▶ 0:00 / 0:02   ⋮

- MIDI <-> Frequency

```
In [11]: def midi_to_frequency(p):  
         return (2 ** ((p - 69) / 12)) * 440  
  
         def frequency_to_midi(f):  
             # return np.round(12 * np.log2(f / 440) + 69)  
             return 12 * np.log2(f / 440) + 69  
  
         print('Pitch: %d, Frequency: %.2f' % (68, midi_to_frequency(68)))  
         print('Pitch: %d, Frequency: %.2f' % (69, midi_to_frequency(69)))  
         print('Pitch: %d, Frequency: %.2f' % (70, midi_to_frequency(70)))  
  
         print('Frequency: %.2f, Pitch: %.2f' % (400, frequency_to_midi(400)))  
         print('Frequency: %.2f, Pitch: %.2f' % (440, frequency_to_midi(440)))  
         print('Frequency: %.2f, Pitch: %.2f' % (550, frequency_to_midi(550)))
```

```
Pitch: 68, Frequency: 415.30  
Pitch: 69, Frequency: 440.00  
Pitch: 70, Frequency: 466.16  
Frequency: 400.00, Pitch: 67.35  
Frequency: 440.00, Pitch: 69.00  
Frequency: 550.00, Pitch: 72.86
```