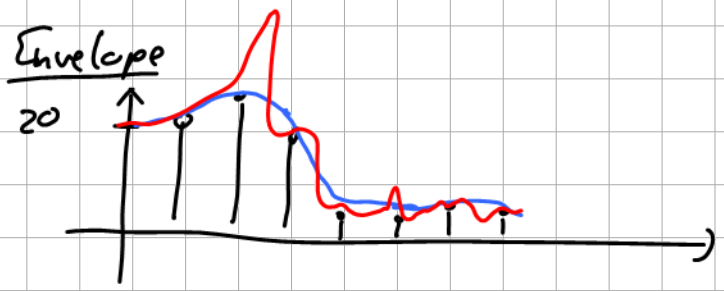
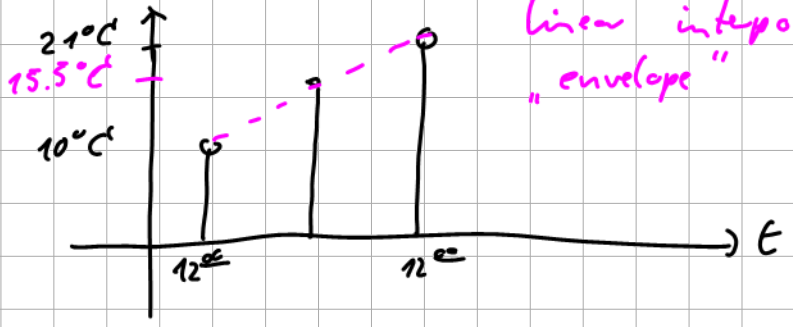
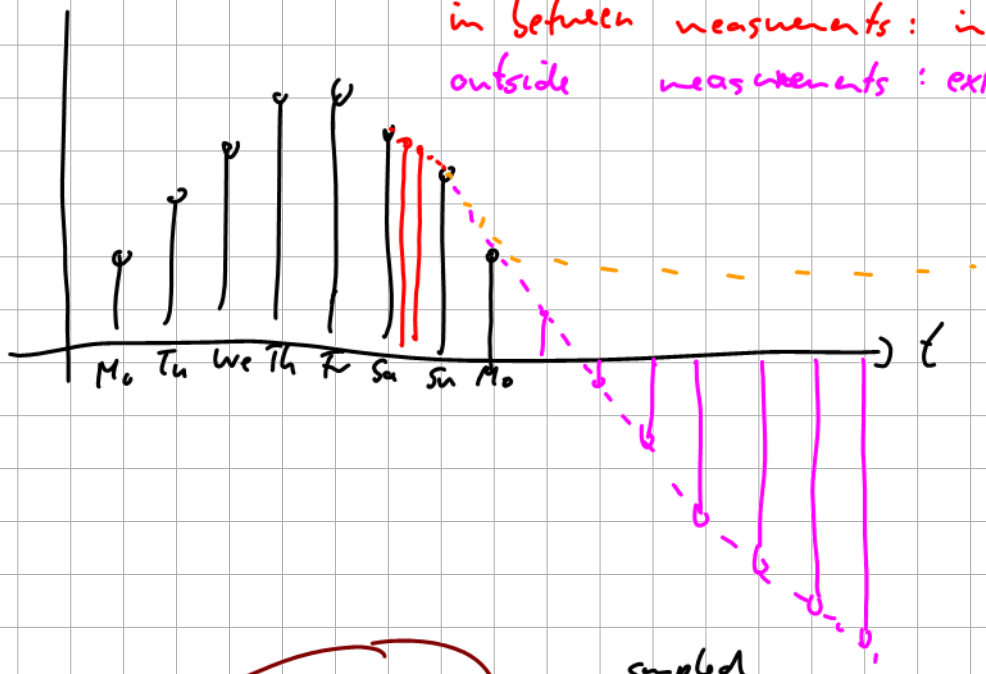



Envelope: eg. circus tent

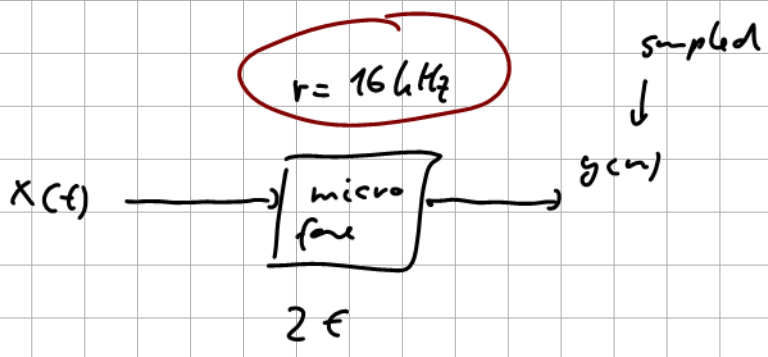
smooth connection of measurement points



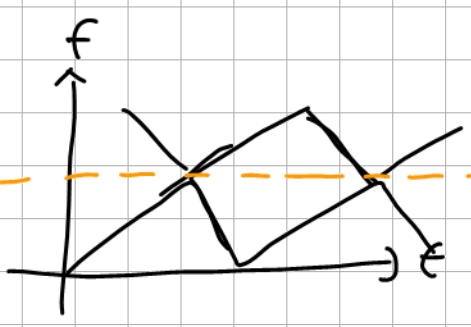

linear interpolation
„envelope"

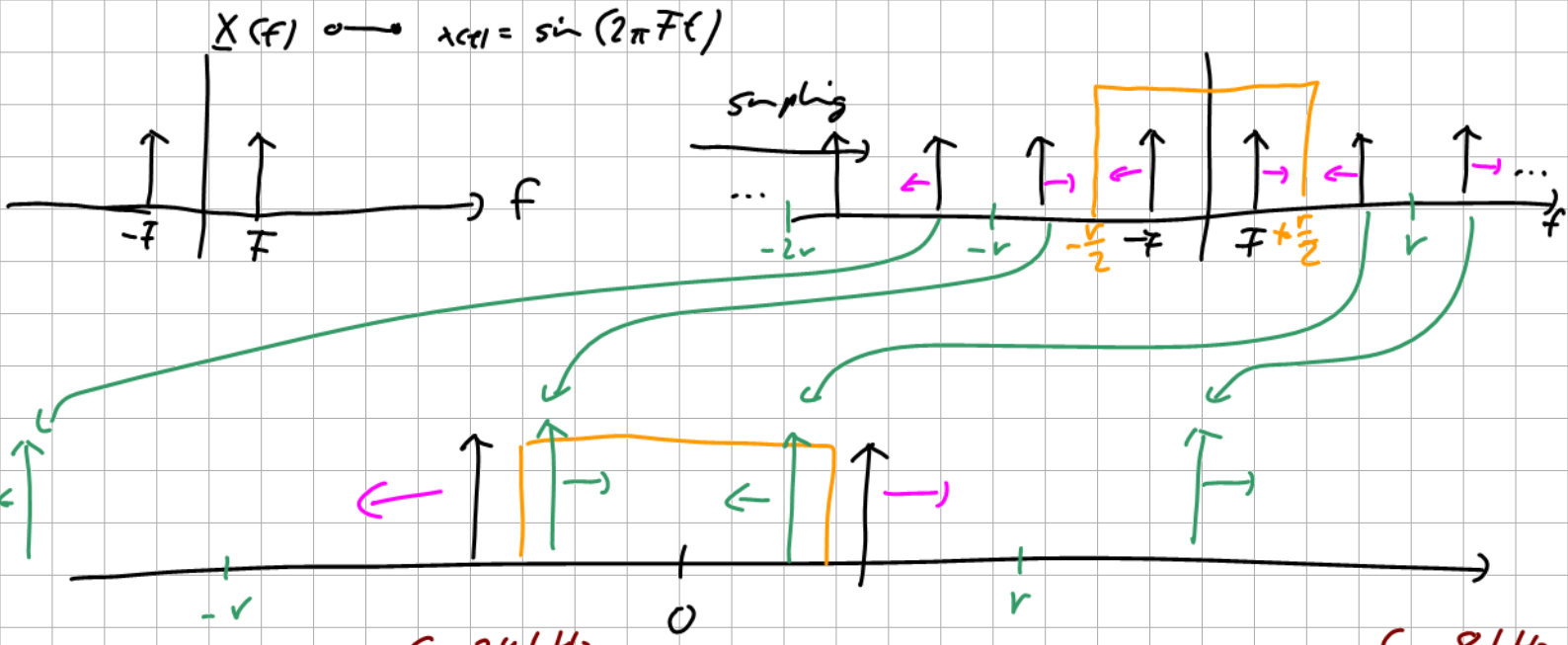



in between measurements: interpolation
outside measurements: extrapolation







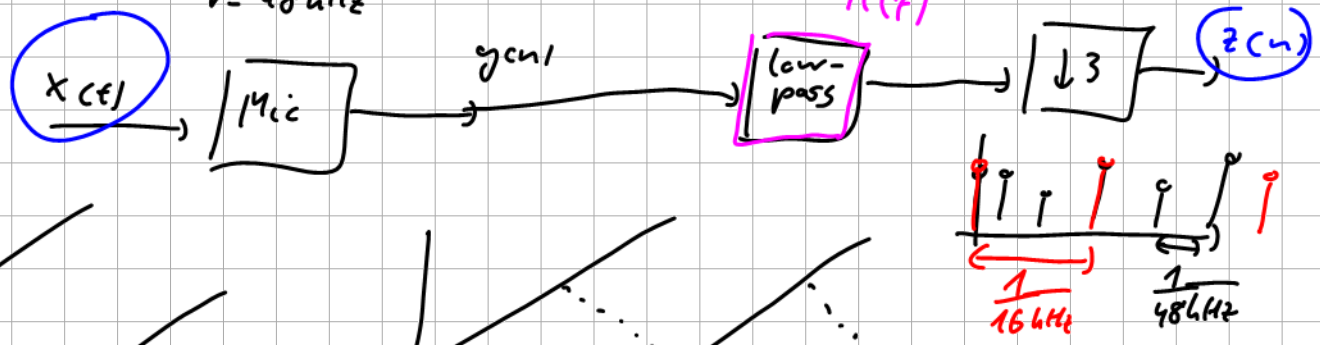




$f_c = 24\,kHz$

$r = 48\,kHz$

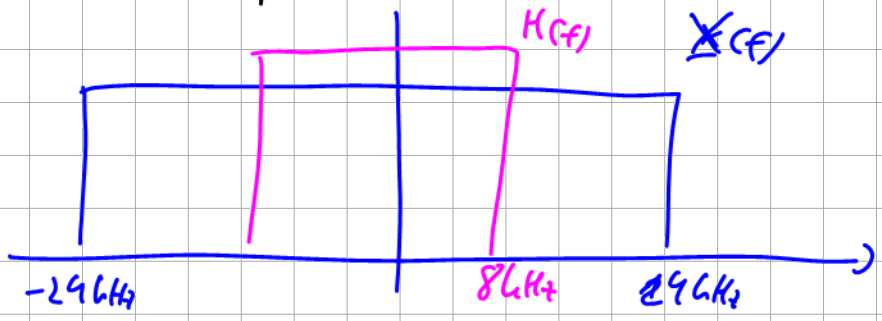
$f_c = 8\,kHz$

$r = 16\,kHz$





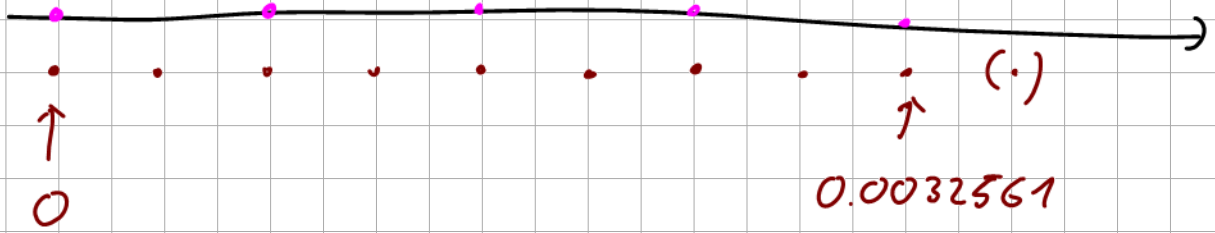





$$T = \frac{1}{48000}$$

t vecta

Upsampling of 2

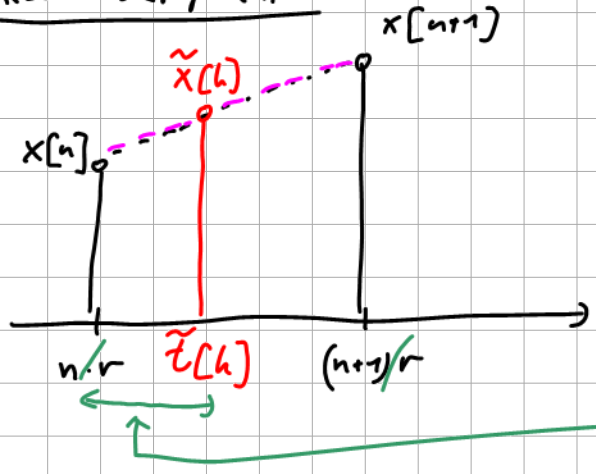



old length · 2 − 1 = 510

0 T 2T 3T

SCIPY
0.00032562

## linear interpolation




$$m = \frac{x[n+1] - x[n]}{(n+1)/r - n/r} = \frac{x[n+1] - x[n]}{1/r}$$

$$\tilde{x}[k] = m \cdot (\tilde{t}[k] - n \cdot r) + x[n]$$

---

Exam: 5 Tasks each Task 10 Points

1) Python: write the construct for the given class.
   ...
   ...

2) 3) chapter 2
4) chapter 3
5) chapter 4

} exam preparations

---

$$std = \sqrt{\frac{1}{N-1} \sum_{n=0}^{N-1} (x-\mu)^2}$$

$$\varphi = \frac{\Sigma (x-\mu_x)(y-\mu_y)}{\sqrt{\left[\Sigma (x-\mu_x)^2\right] \cdot \left[\Sigma (y-\mu_y)^2\right]}} \leftarrow \text{mean}$$

$$\frac{1}{\sqrt{N}} \cdot \frac{1}{\sqrt{N}}$$

$x[n] \quad 0 \le n < N$

$$t1 = \sum_{n=0}^{N-1} x[n] \qquad t1 = np.sum(x)$$

$t_2 = \frac{1}{N} \sum_{n=0}^{N-1} x(n)$ $\quad$ $t_2 = np.mean(x)$

$t_3 = \sqrt{t_2}$ $\quad$ $t_3 = np.sqrt(t_2)$

$$\varphi = \frac{\sum_n (x - \mu_x)(y - \mu_y)}{\quad}$$

```
mx = np.mean(x)
...
numerator = np.sum((x - mx) * (y - my))
```

$t_4 = \sum_n x^2$ $\quad$ $t_4 = np.sum(x**2)$

$x = [3 \quad 5 \quad 7 \quad 9 \quad 6]$ $\quad$ 3 .. 9 ↓ 0 .. 1

$x - 3 : \quad x_1 = [0 \quad 2 \quad 4 \quad 6 \quad 3]$

$x1 = x - min(x)$

$x_2 = (x - min(x)) \cdot \frac{(max - min)}{6}$

$x_2 = (0 \quad 12 \quad 24 \quad 36 \quad 18)$

$x_3 = (x - min(x)) / (max - min)$

$= (0 \quad \frac{1}{3} \quad \frac{2}{3} \quad 1 \quad \frac{1}{2})$

$min(x) = np.amin(x)$

$np.amax(x)$

Gaussian Normalization

x[cm] → y[cm]