homework 2 interpolation sls 3.8

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In [36]:
```
import numpy as np
from scipy.optimize import fsolve
import pandas as pd

temps = np.array([350,400])
h_hat = np.array([3167.7,3271.9])

H = np.interp(370, temps, h_hat)
H
```

Out[36]:
```
3209.38
```

In [37]:
```
data = {
    'T': [200, 250, 300, 350, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300],
    'V': [0.4249, 0.4744, 0.5226, 0.5701, 0.6173, 0.7109, 0.8041, 0.8969, 0.9896, 1.0822, 1.1747, 1.2672, 1.3596, 1.4521],
    'U': [2642.9, 2723.5, 2802.9, 2882.6, 2963.2, 3128.4, 3299.6, 3477.5, 3662.1, 3853.6, 4051.8, 4256.3, 4466.8, 4682.5],
    'H': [2855.4, 2960.7, 3064.2, 3167.7, 3271.9, 3483.9, 3701.7, 3925.9, 4156.9, 4394.7, 4639.1, 4889.9, 5146.6, 5408.6],
    'S': [7.0592, 7.2709, 7.4599, 7.6329, 7.7938, 8.0873, 8.3522, 8.5952, 8.8211, 9.0329, 9.2328, 9.4224, 9.6029, 9.7749]
}

df = pd.DataFrame(data).set_index('T')
df
```

Out[37]:

T	V	U	H	S
200	0.4249	2642.9	2855.4	7.0592
250	0.4744	2723.5	2960.7	7.2709
300	0.5226	2802.9	3064.2	7.4599
350	0.5701	2882.6	3167.7	7.6329
400	0.6173	2963.2	3271.9	7.7938
500	0.7109	3128.4	3483.9	8.0873
600	0.8041	3299.6	3701.7	8.3522
700	0.8969	3477.5	3925.9	8.5952
800	0.9896	3662.1	4156.9	8.8211
900	1.0822	3853.6	4394.7	9.0329
1000	1.1747	4051.8	4639.1	9.2328
1100	1.2672	4256.3	4889.9	9.4224
1200	1.3596	4466.8	5146.6	9.6029
1300	1.4521	4682.5	5408.6	9.7749

In [50]:
```
def sls38(T):
    U = np.interp(T, df.index, df['U'])
    V = np.interp(T, df.index, df['V'])

    return ((3209.38 - U) / V) + (0.516422*2582.8 - 0.516422*3209.38)

T = fsolve(sls38, 200)[0]
print(f'calc temp: {T:.3f}')

V = np.interp(T, df.index, df['V'])
print(f'calc V_hat: {V:.5f}')

print(f'calc m: {1/V:.3f}')
```

```
calc temp: 423.753
calc V_hat: 0.63953
calc m: 1.564
```