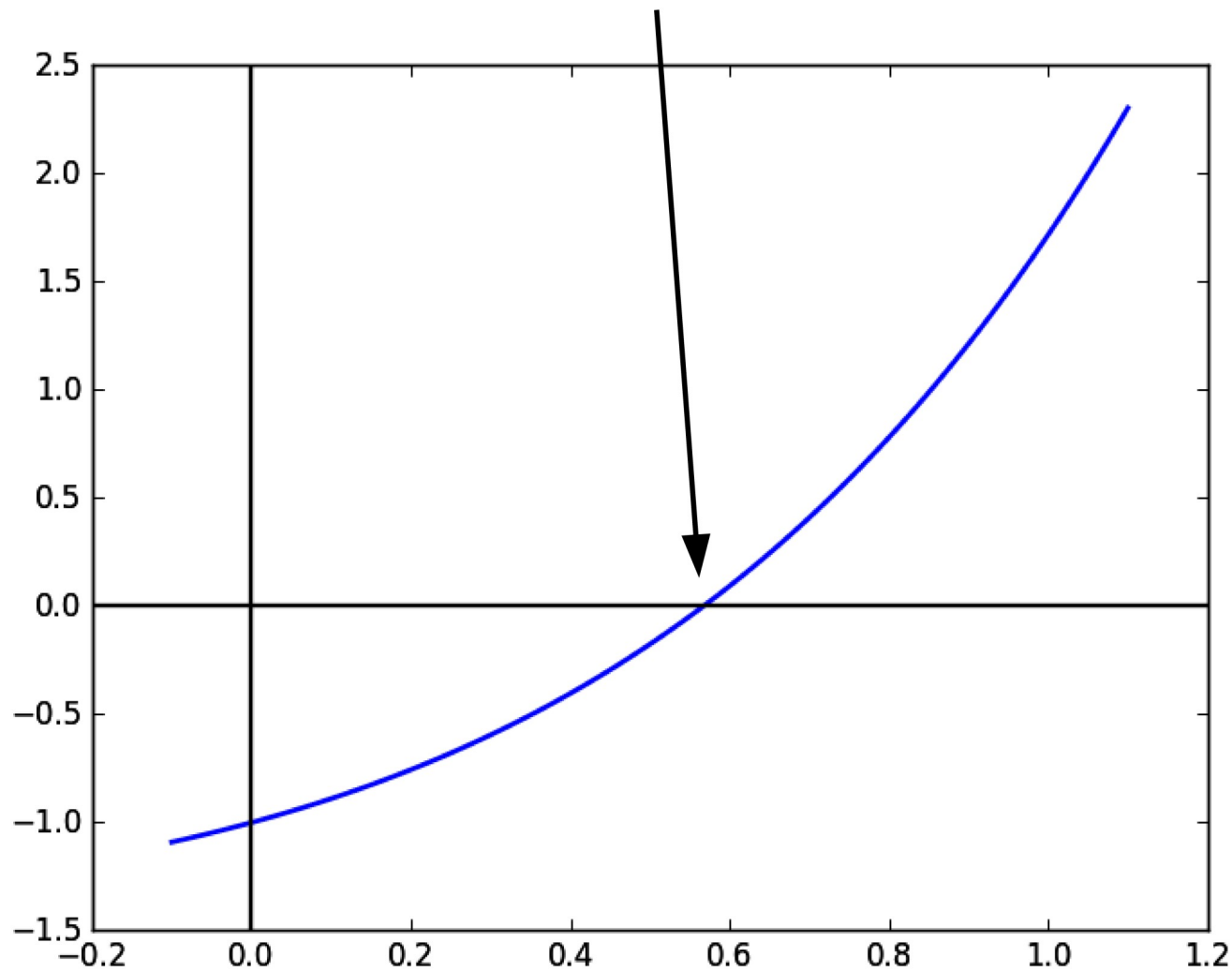# Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

$$x^{(k+1)} = \phi(x^{(k)}) \;,\;\; k = 0, 1, ...$$

$$x = \phi_1(x) \quad \text{with} \quad \phi_1(x) = e^{-x}$$

$$x = \phi_2(x) \quad \text{with} \quad \phi_2(x) = \frac{x^2 e^x + 1}{e^x(1 + x)}$$

$$x = \phi_3(x) \quad \text{with} \quad \phi_3(x) = x - xe^x + 1$$

Fixpunktiterationen

$$f(x) = xe^x - 1 \stackrel{!}{=} 0$$
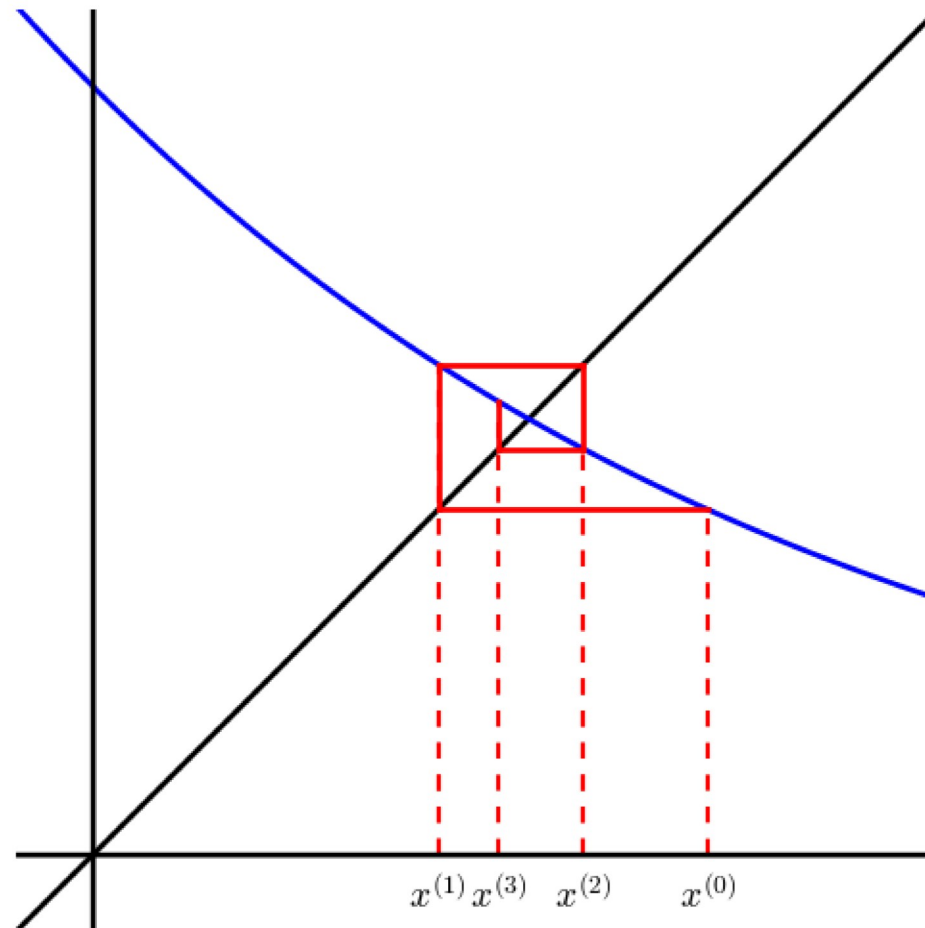
$$x^{(k+1)} = \phi(x^{(k)}) \ , \ k = 0, 1, \dots$$

k	ϕ_1	ϕ_2	ϕ_3
0	0.8000000	0.9000000	0.6000000
1	0.4493290	0.6402998	0.5067287
2	0.6380562	0.5713091	0.6656338
3	0.5283184	0.5671575	0.3704946
4	0.5895956	0.5671433	0.8338514
5	0.5545515	0.5671433	-0.0858149
...	...	...	...

Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

$$x = \phi_1(x) \quad \text{with} \quad \phi_1(x) = e^{-x}$$
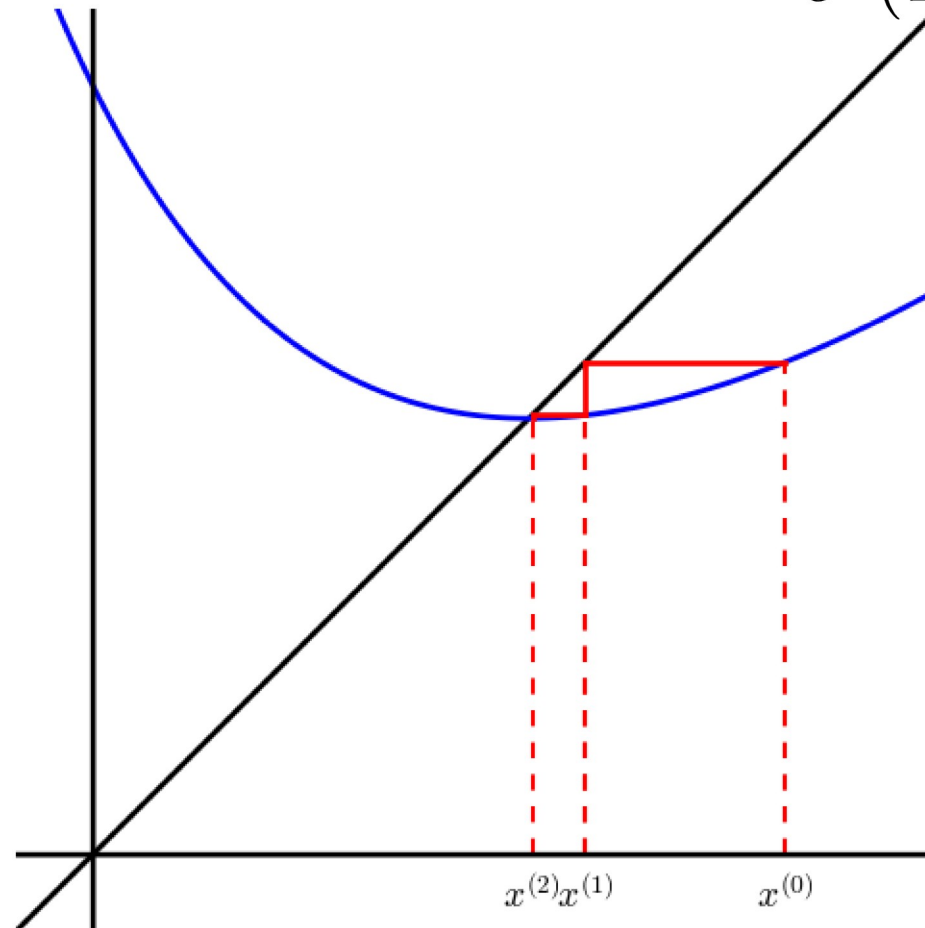

$$x^{(1)} \ x^{(3)} \quad x^{(2)} \qquad x^{(0)}$$

Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

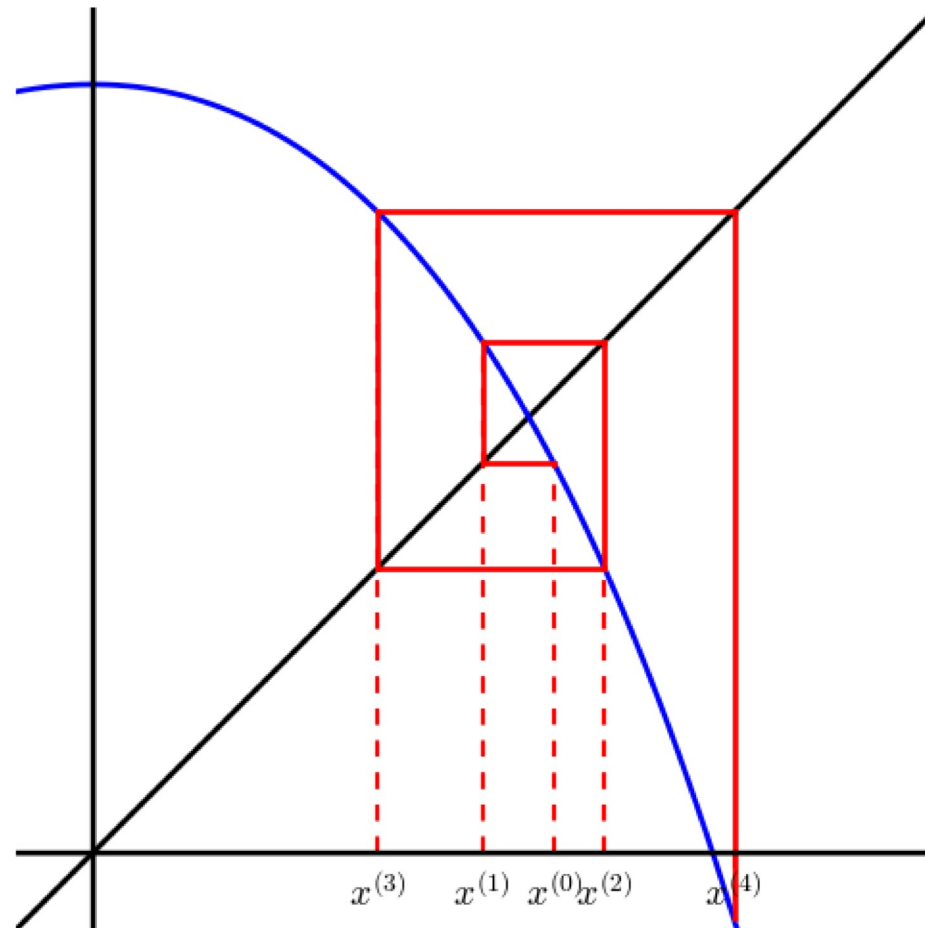$$x = \phi_2(x) \quad \text{with} \quad \phi_2(x) = \frac{x^2 e^x + 1}{e^x(1 + x)}$$

Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

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Fixpunktiterationen

$$f(x) = xe^x - 1 \overset{!}{=} 0$$

$$x = \phi_1(x) \quad \text{with} \quad \phi_1(x) = e^{-x}$$

k	$x^{(k)}$	$\epsilon^{(k)}$	p	C
0	0.8000000	2.3285671e-01	-	-
1	0.4493290	1.1781433e-01	0.7451165	0.3489721
2	0.6380562	7.0912876e-02	1.1866067	0.8971140
3	0.5283184	3.8824901e-02	0.9091583	0.4305099
4	0.5895956	2.2452316e-02	1.0560201	0.6937276
5	0.5545515	1.2591794e-02	0.9697282	0.4999380
6	0.5743298	7.1865021e-03	1.0176407	0.6165178
7	0.5630821	4.0611662e-03	0.9901489	0.5382915
8	0.5694512	2.3079464e-03	1.0056361	0.5862095
9	0.5658359	1.3074270e-03	0.9968194	0.5556549

Fixpunktiterationen

$$f(x) = xe^x - 1 \stackrel{!}{=} 0$$

$$x = \phi_2(x) \quad \text{with} \quad \phi_2(x) = \frac{x^2 e^x + 1}{e^x(1 + x)}$$

k	$x^{(k)}$	$\epsilon^{(k)}$	p	C
0	0.8000000	3.3285671e-01	-	-
1	0.4493290	7.3156531e-02	1.8914068	0.5859477
2	0.6380562	4.1658100e-03	1.9832614	0.7450448
3	0.5283184	1.4171777e-05	1.9994808	0.8143094
4	0.5895956	1.6449608e-10	1.2503362	0.0001899
5	0.5545515	1.1102230e-16	-	-

Das Newton-Verfahren

$$f_1(x_1, x_2) = x_1^2 + x_2 - 2 \quad = 0$$
$$f_2(x_1, x_2) = x_2 e^{x_1} - 2 \quad = 0$$
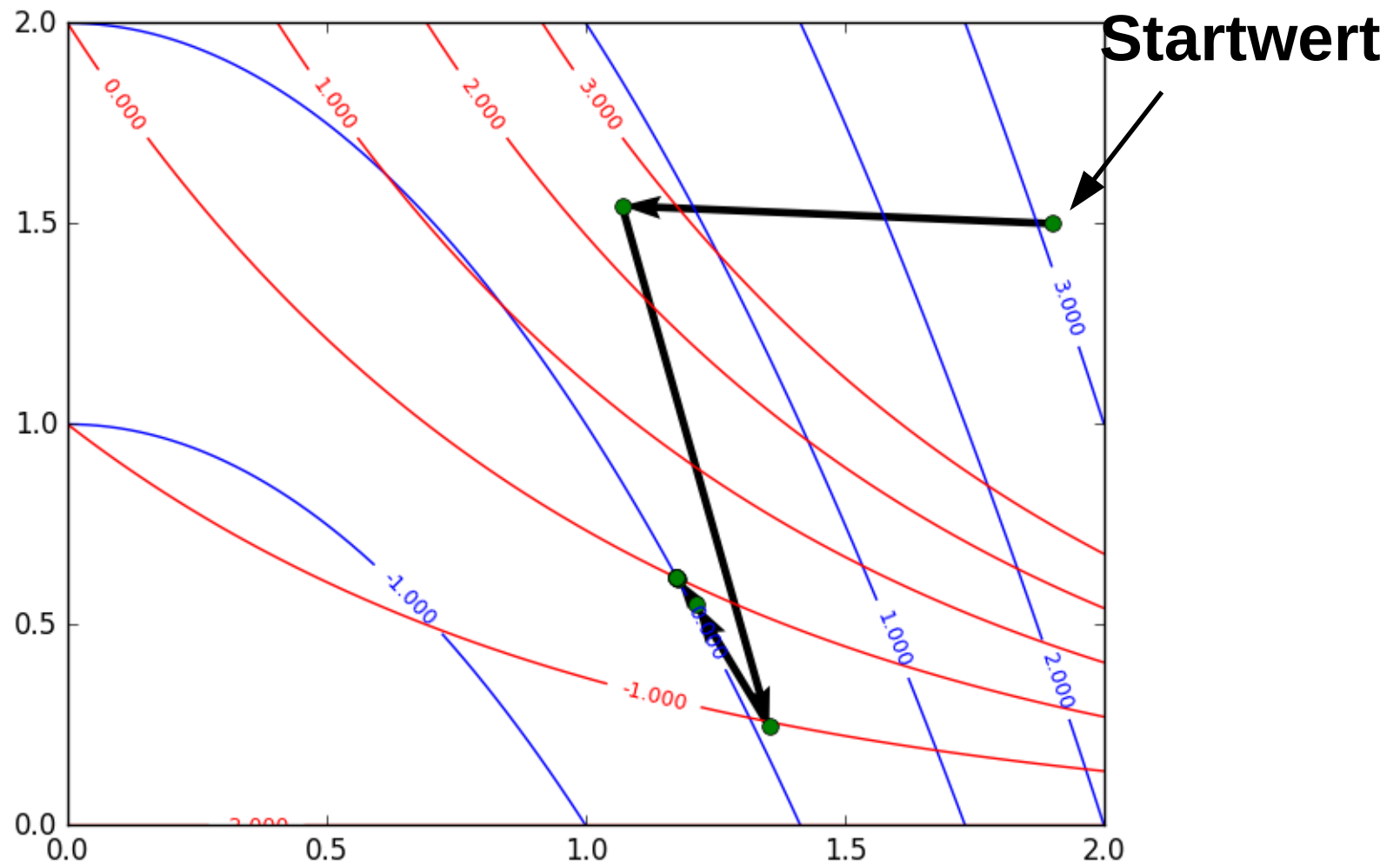
Bsp. (3)

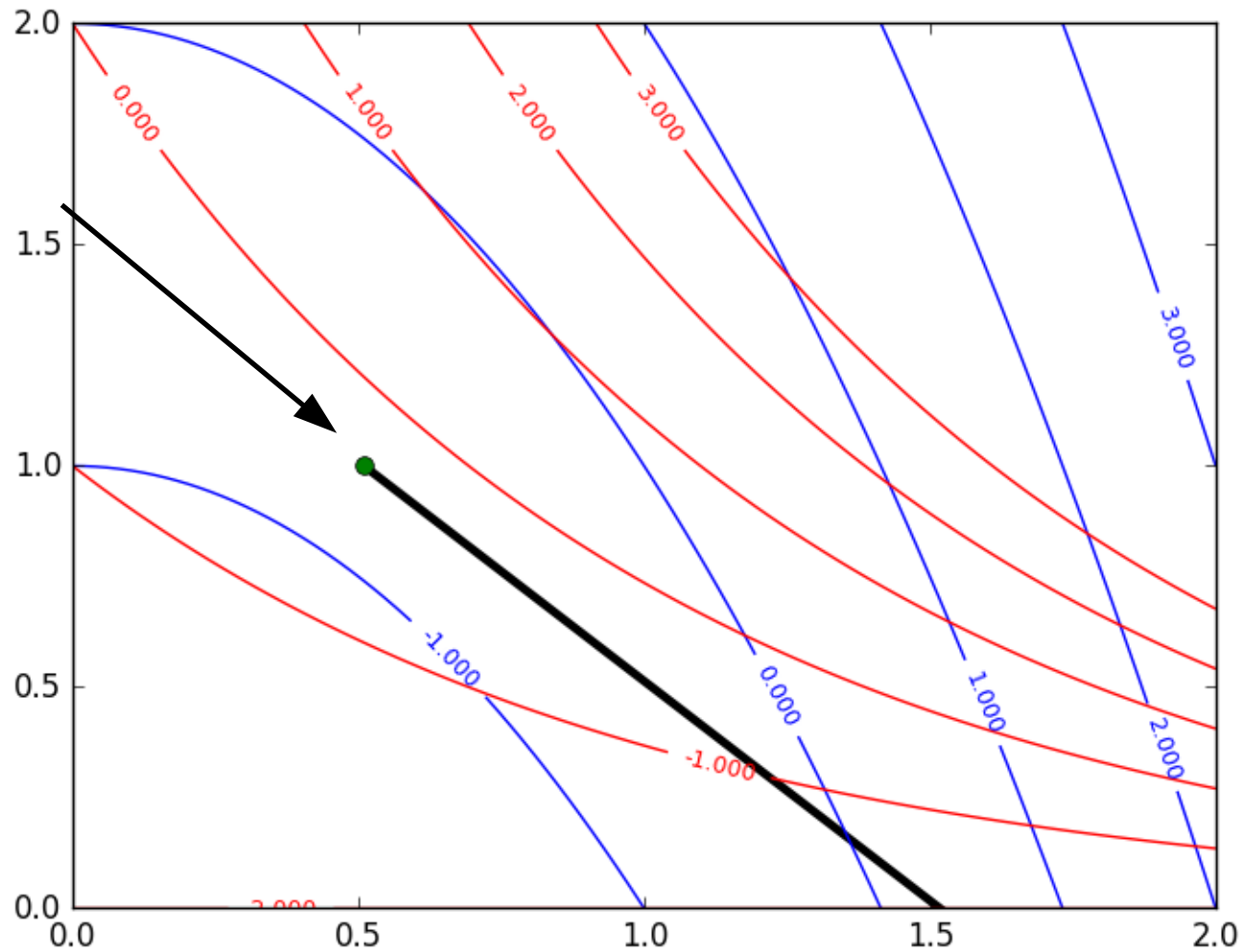# Das Newton-Verfahren

Höhenlinien

$$f_1(x_1, x_2) = x_1^2 + x_2 - 2$$

$$f_2(x_1, x_2) = x_2 e^{x_1} - 2$$

Bsp. (4)

Das Newton-Verfahren

Startwert

$$f_1(x_1, x_2) = x_1^2 + x_2 - 2 \qquad f_2(x_1, x_2) = x_2 e^{x_1} - 2$$

Das Newton-Verfahren

Startwert

$$\mathrm{f}_1(x_1, x_2) = x_1^2 + x_2 - 2$$

$$f_2(x_1, x_2) = x_2 e^{x_1} - 2$$