

# Funktionsgraphen

## Aufgaben und Lösungen

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## 1 Eigene Aufgaben lösen

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Um eigene Aufgaben zu lösen, klicken Sie hier: [Funktionsgraphen](#)

## 2 Exponentialfunktionen

### 2.1 Aufgaben

- |                                       |                               |
|---------------------------------------|-------------------------------|
| (1) $e^x$                             | (12) $x^2 \cdot e^x$          |
| (2) $e^x + 1$                         | (13) $x^3 \cdot e^x$          |
| (3) $e^{x-2} + 1$                     | (14) $x^4 \cdot e^x$          |
| (4) $e^{-x}$                          | (15) $x \cdot e^{-x}$         |
| (5) $e^{-x} + 3$                      | (16) $x^2 \cdot e^{-x}$       |
| (6) $e^{2 \cdot x}$                   | (17) $x^3 \cdot e^{-x}$       |
| (7) $e^{\frac{1}{2} \cdot x - 1} + 1$ | (18) $x^4 \cdot e^{-x}$       |
| (8) $2 \cdot e^{x-2} + 1$             | (19) $(x - 1) \cdot e^{-x}$   |
| (9) $\frac{1}{3} \cdot e^{-x}$        | (20) $(x^2 - 4) \cdot e^{-x}$ |
| (10) $-2 \cdot e^{-x} + 3$            | (21) $(x^3 - 1) \cdot e^{-x}$ |
| (11) $x \cdot e^x$                    | (22) $(x^4 - 1) \cdot e^{-x}$ |

## 2.2 Lösungen

Aufgabe (1)

• Gegeben die Funktion:  $f(x) = e^x$

• Kurvendiskussion

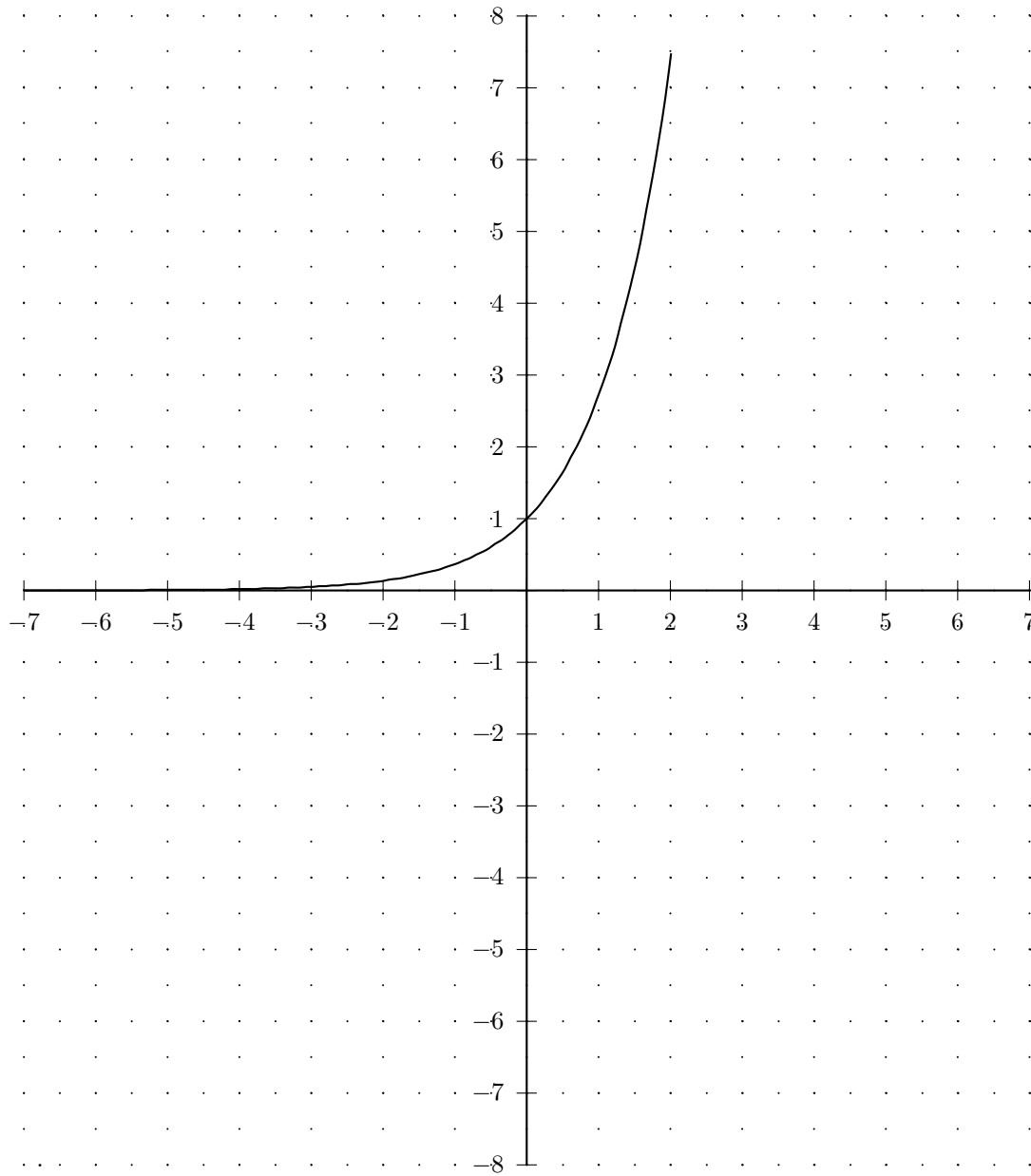
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,001	0,001	0,001
$-6\frac{1}{2}$	0,002	0,002	0,002
-6	0,002	0,002	0,002
$-5\frac{1}{2}$	0,004	0,004	0,004
-5	0,007	0,007	0,007
$-4\frac{1}{2}$	0,011	0,011	0,011
-4	0,018	0,018	0,018
$-3\frac{1}{2}$	0,03	0,03	0,03
-3	0,05	0,05	0,05
$-2\frac{1}{2}$	0,082	0,082	0,082
-2	0,135	0,135	0,135
$-1\frac{1}{2}$	0,223	0,223	0,223
-1	0,368	0,368	0,368
$-\frac{1}{2}$	0,607	0,607	0,607
0	1	1	1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	1	1
$\frac{1}{2}$	1,649	1,649	1,649
1	2,718	2,718	2,718
$1\frac{1}{2}$	4,482	4,482	4,482
2	7,389	7,389	7,389
$2\frac{1}{2}$	12,182	12,183	12,183
3	20,086	20,086	20,086
$3\frac{1}{2}$	33,115	33,116	33,116
4	54,598	54,599	54,599
$4\frac{1}{2}$	90,017	90,019	90,018
5	148,413	148,417	148,415
$5\frac{1}{2}$	244,692	244,697	244,695
6	403,429	403,438	403,433
$6\frac{1}{2}$	665,142	665,157	665,149
7	1096,633	1096,658	1096,646

•Graph der Funktion  $f(x) = e^x$



## Aufgabe (2)

• Gegeben die Funktion:  $f(x) = e^x + 1$

• Kurvendiskussion

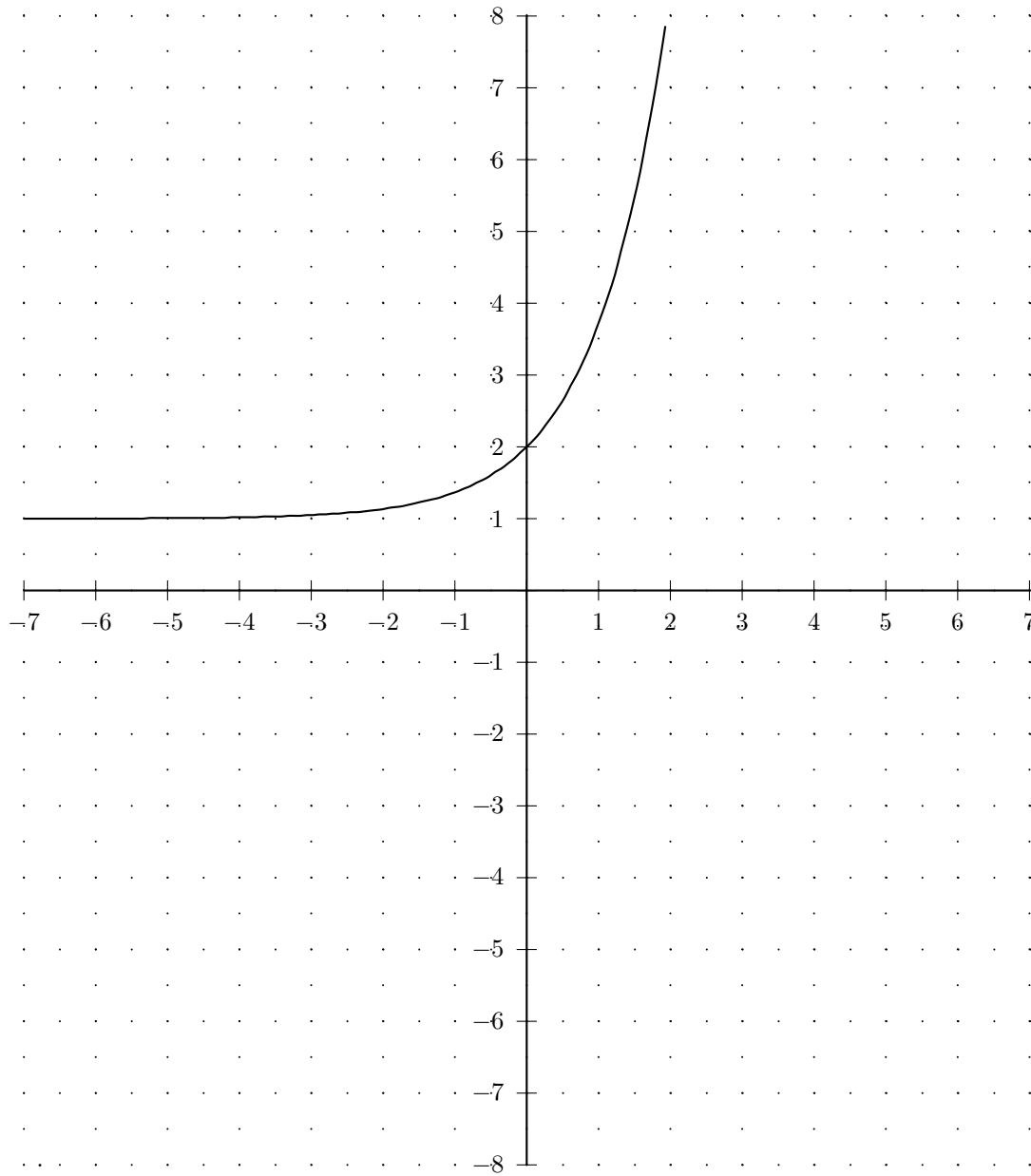
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,001	0,001	0,001
$-6\frac{1}{2}$	1,002	0,002	0,002
-6	1,002	0,002	0,002
$-5\frac{1}{2}$	1,004	0,004	0,004
-5	1,007	0,007	0,007
$-4\frac{1}{2}$	1,011	0,011	0,011
-4	1,018	0,018	0,018
$-3\frac{1}{2}$	1,03	0,03	0,03
-3	1,05	0,05	0,05
$-2\frac{1}{2}$	1,082	0,082	0,082
-2	1,135	0,135	0,135
$-1\frac{1}{2}$	1,223	0,223	0,223
-1	1,368	0,368	0,368
$-\frac{1}{2}$	1,607	0,607	0,607
0	2	1	1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	2	1	1
$\frac{1}{2}$	2,649	1,649	1,649
1	3,718	2,718	2,718
$1\frac{1}{2}$	5,482	4,482	4,482
2	8,389	7,389	7,389
$2\frac{1}{2}$	13,182	12,183	12,183
3	21,086	20,086	20,086
$3\frac{1}{2}$	34,115	33,116	33,116
4	55,598	54,599	54,599
$4\frac{1}{2}$	91,017	90,019	90,018
5	149,413	148,417	148,415
$5\frac{1}{2}$	245,692	244,697	244,695
6	404,429	403,438	403,433
$6\frac{1}{2}$	666,142	665,157	665,149
7	1097,633	1096,658	1096,646

•Graph der Funktion  $f(x) = e^x + 1$



## Aufgabe (3)

• Gegeben die Funktion:  $f(x) = e^{x-2} + 1$

• Kurvendiskussion

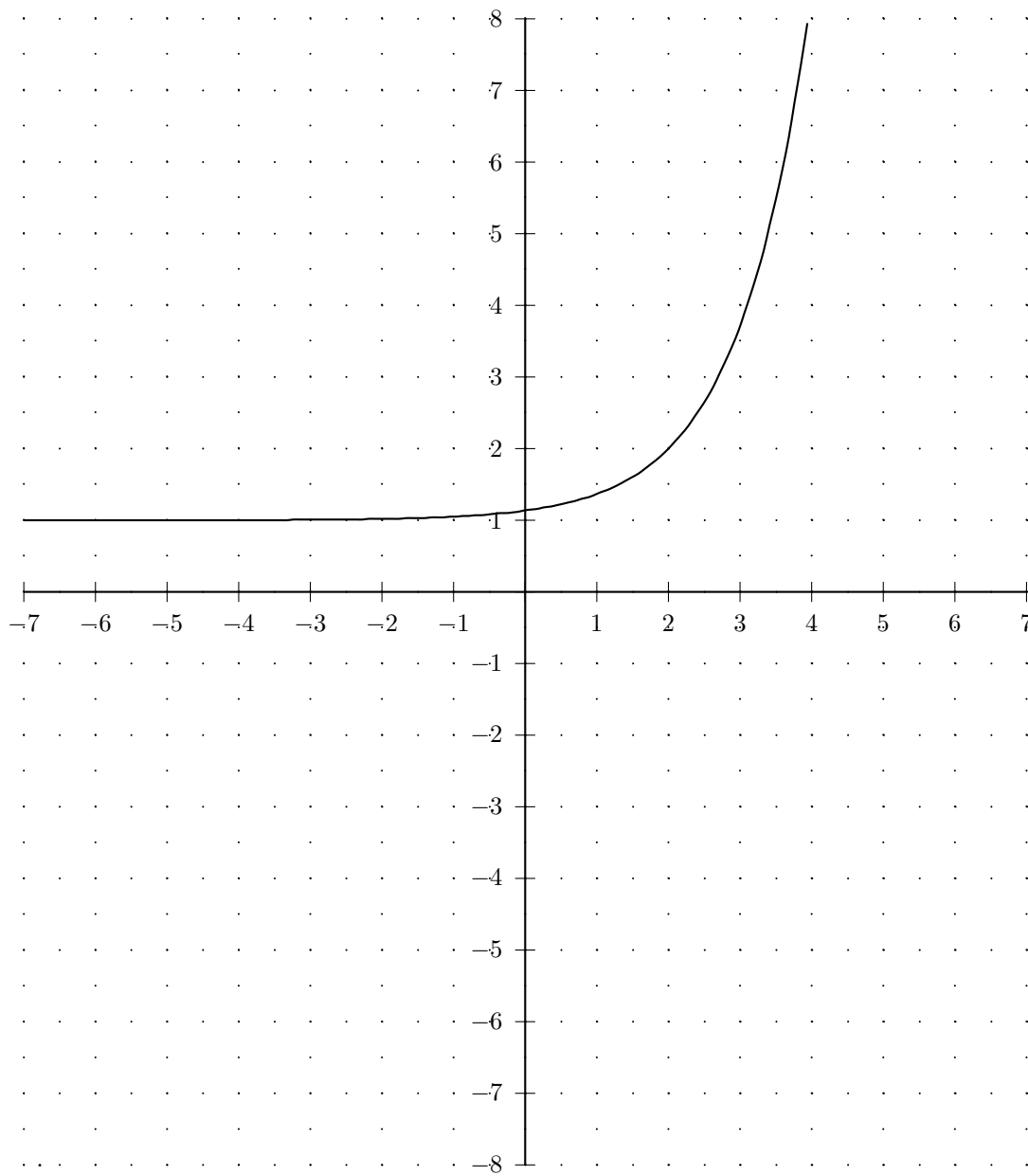
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1	0	0
$-6\frac{1}{2}$	1	0	0
-6	1	0	0
$-5\frac{1}{2}$	1,001	0,001	0,001
-5	1,001	0,001	0,001
$-4\frac{1}{2}$	1,002	0,002	0,002
-4	1,002	0,002	0,002
$-3\frac{1}{2}$	1,004	0,004	0,004
-3	1,007	0,007	0,007
$-2\frac{1}{2}$	1,011	0,011	0,011
-2	1,018	0,018	0,018
$-1\frac{1}{2}$	1,03	0,03	0,03
-1	1,05	0,05	0,05
$-\frac{1}{2}$	1,082	0,082	0,082
0	1,135	0,135	0,135

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1,135	0,135	0,135
$\frac{1}{2}$	1,223	0,223	0,223
1	1,368	0,368	0,368
$1\frac{1}{2}$	1,607	0,607	0,607
2	2	1	1
$2\frac{1}{2}$	2,649	1,649	1,649
3	3,718	2,718	2,718
$3\frac{1}{2}$	5,482	4,482	4,482
4	8,389	7,389	7,389
$4\frac{1}{2}$	13,182	12,183	12,183
5	21,086	20,086	20,086
$5\frac{1}{2}$	34,115	33,116	33,116
6	55,598	54,599	54,599
$6\frac{1}{2}$	91,017	90,019	90,018
7	149,413	148,417	148,415

•Graph der Funktion  $f(x) = e^{x-2} + 1$



## Aufgabe (4)

• Gegeben die Funktion:  $f(x) = e^{-x}$

• Kurvendiskussion

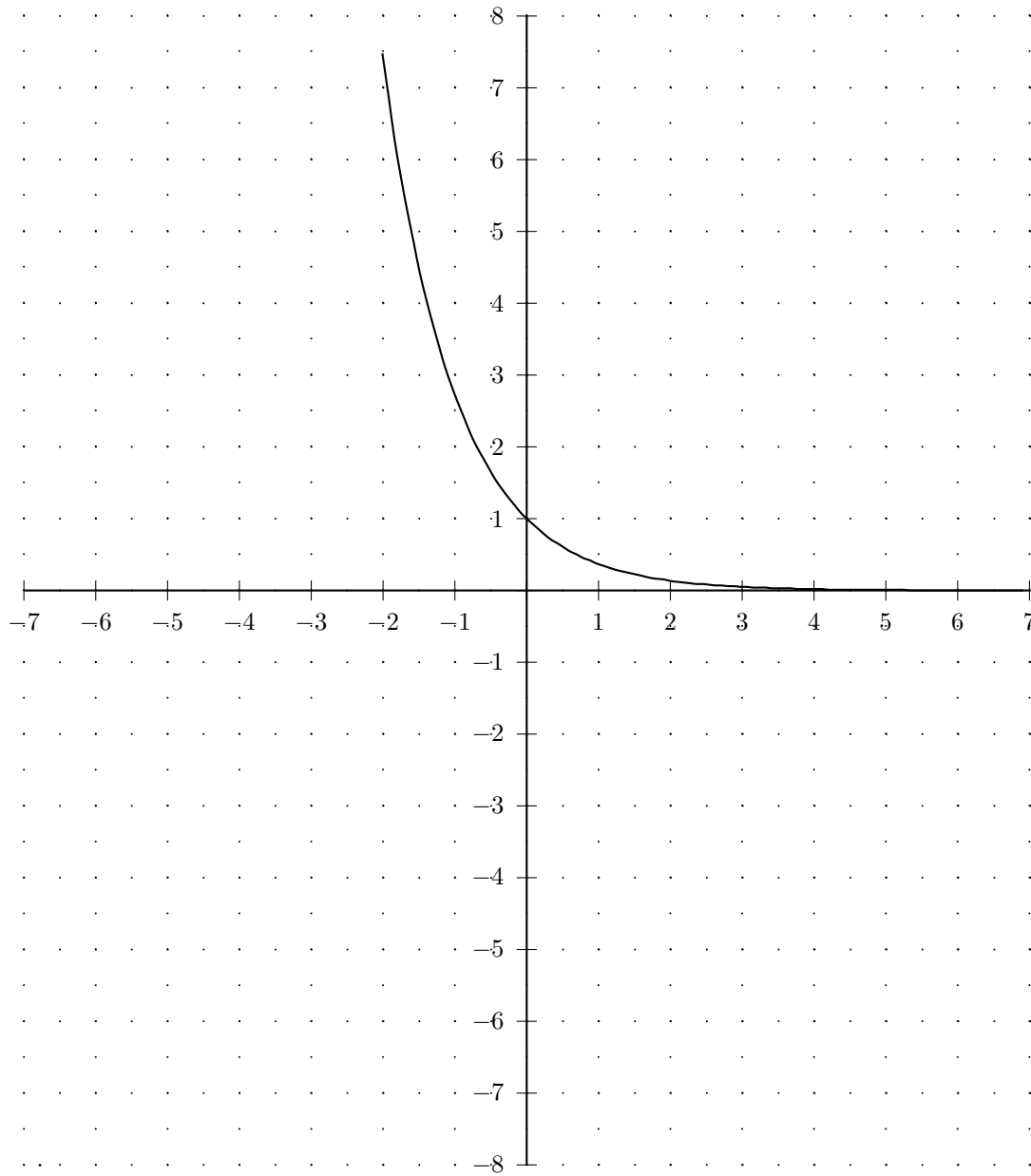
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1096,633	-1096,658	1096,646
$-6\frac{1}{2}$	665,142	-665,157	665,149
-6	403,429	-403,438	403,433
$-5\frac{1}{2}$	244,692	-244,697	244,695
-5	148,413	-148,417	148,415
$-4\frac{1}{2}$	90,017	-90,019	90,018
-4	54,598	-54,599	54,599
$-3\frac{1}{2}$	33,115	-33,116	33,116
-3	20,086	-20,086	20,086
$-2\frac{1}{2}$	12,182	-12,183	12,183
-2	7,389	-7,389	7,389
$-1\frac{1}{2}$	4,482	-4,482	4,482
-1	2,718	-2,718	2,718
$-\frac{1}{2}$	1,649	-1,649	1,649
0	1	-1	1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	-1	1
$\frac{1}{2}$	0,607	-0,607	0,607
1	0,368	-0,368	0,368
$1\frac{1}{2}$	0,223	-0,223	0,223
2	0,135	-0,135	0,135
$2\frac{1}{2}$	0,082	-0,082	0,082
3	0,05	-0,05	0,05
$3\frac{1}{2}$	0,03	-0,03	0,03
4	0,018	-0,018	0,018
$4\frac{1}{2}$	0,011	-0,011	0,011
5	0,007	-0,007	0,007
$5\frac{1}{2}$	0,004	-0,004	0,004
6	0,002	-0,002	0,002
$6\frac{1}{2}$	0,002	-0,002	0,002
7	0,001	-0,001	0,001

•Graph der Funktion  $f(x) = e^{-x}$



## Aufgabe (5)

- Gegeben die Funktion:  $f(x) = e^{-x} + 3$
- Kurvendiskussion

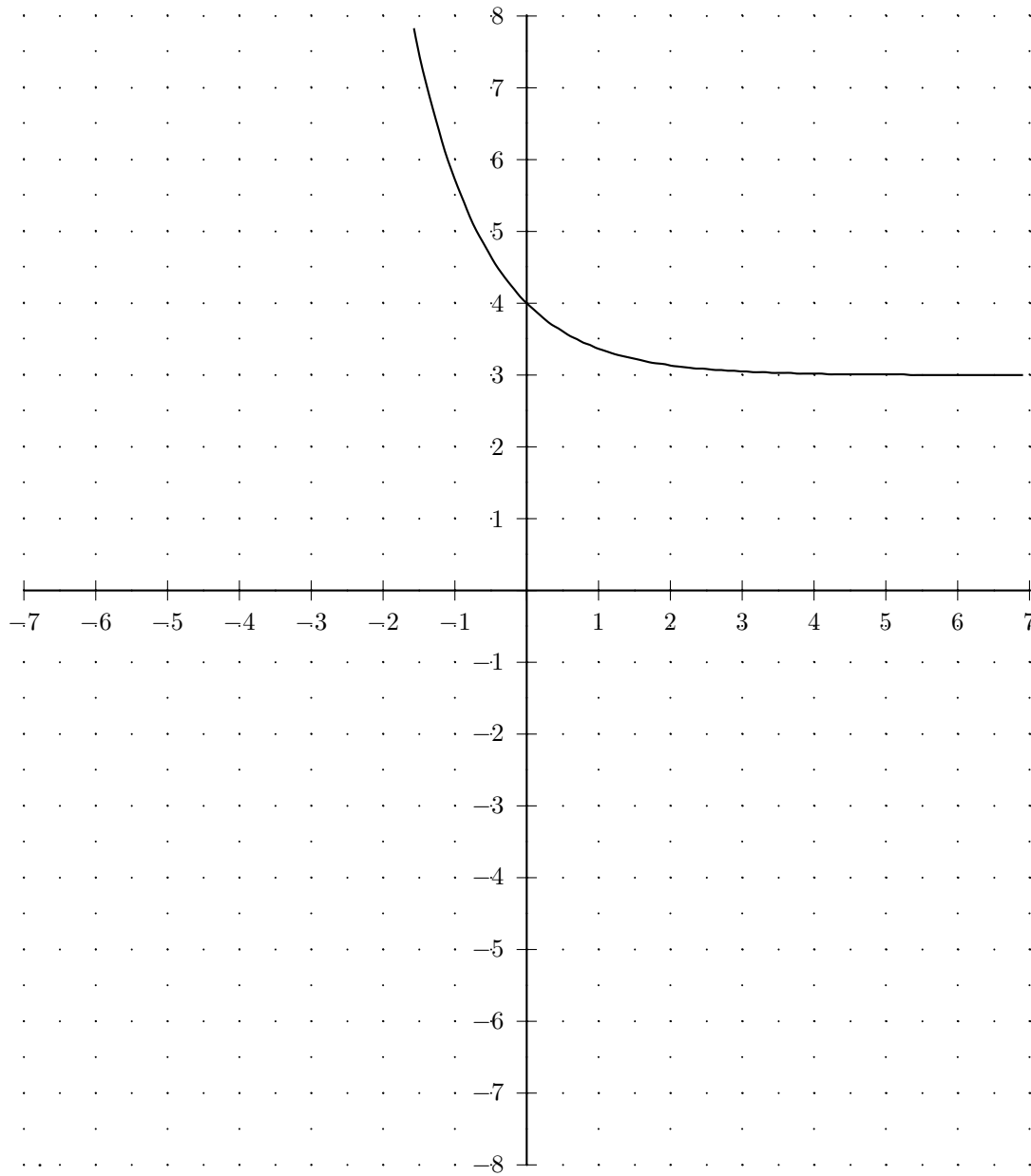
$x$	$f(x)$
-----	--------

- Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1099,633	-1096,658	1096,646
$-6\frac{1}{2}$	668,142	-665,157	665,149
-6	406,429	-403,438	403,433
$-5\frac{1}{2}$	247,692	-244,697	244,695
-5	151,413	-148,417	148,415
$-4\frac{1}{2}$	93,017	-90,019	90,018
-4	57,598	-54,599	54,599
$-3\frac{1}{2}$	36,115	-33,116	33,116
-3	23,086	-20,086	20,086
$-2\frac{1}{2}$	15,182	-12,183	12,183
-2	10,389	-7,389	7,389
$-1\frac{1}{2}$	7,482	-4,482	4,482
-1	5,718	-2,718	2,718
$-\frac{1}{2}$	4,649	-1,649	1,649
0	4	-1	1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	4	-1	1
$\frac{1}{2}$	3,607	-0,607	0,607
1	3,368	-0,368	0,368
$1\frac{1}{2}$	3,223	-0,223	0,223
2	3,135	-0,135	0,135
$2\frac{1}{2}$	3,082	-0,082	0,082
3	3,05	-0,05	0,05
$3\frac{1}{2}$	3,03	-0,03	0,03
4	3,018	-0,018	0,018
$4\frac{1}{2}$	3,011	-0,011	0,011
5	3,007	-0,007	0,007
$5\frac{1}{2}$	3,004	-0,004	0,004
6	3,002	-0,002	0,002
$6\frac{1}{2}$	3,002	-0,002	0,002
7	3,001	-0,001	0,001

•Graph der Funktion  $f(x) = e^{-x} + 3$



## Aufgabe (6)

• Gegeben die Funktion:  $f(x) = e^{2 \cdot x}$

• Kurvendiskussion

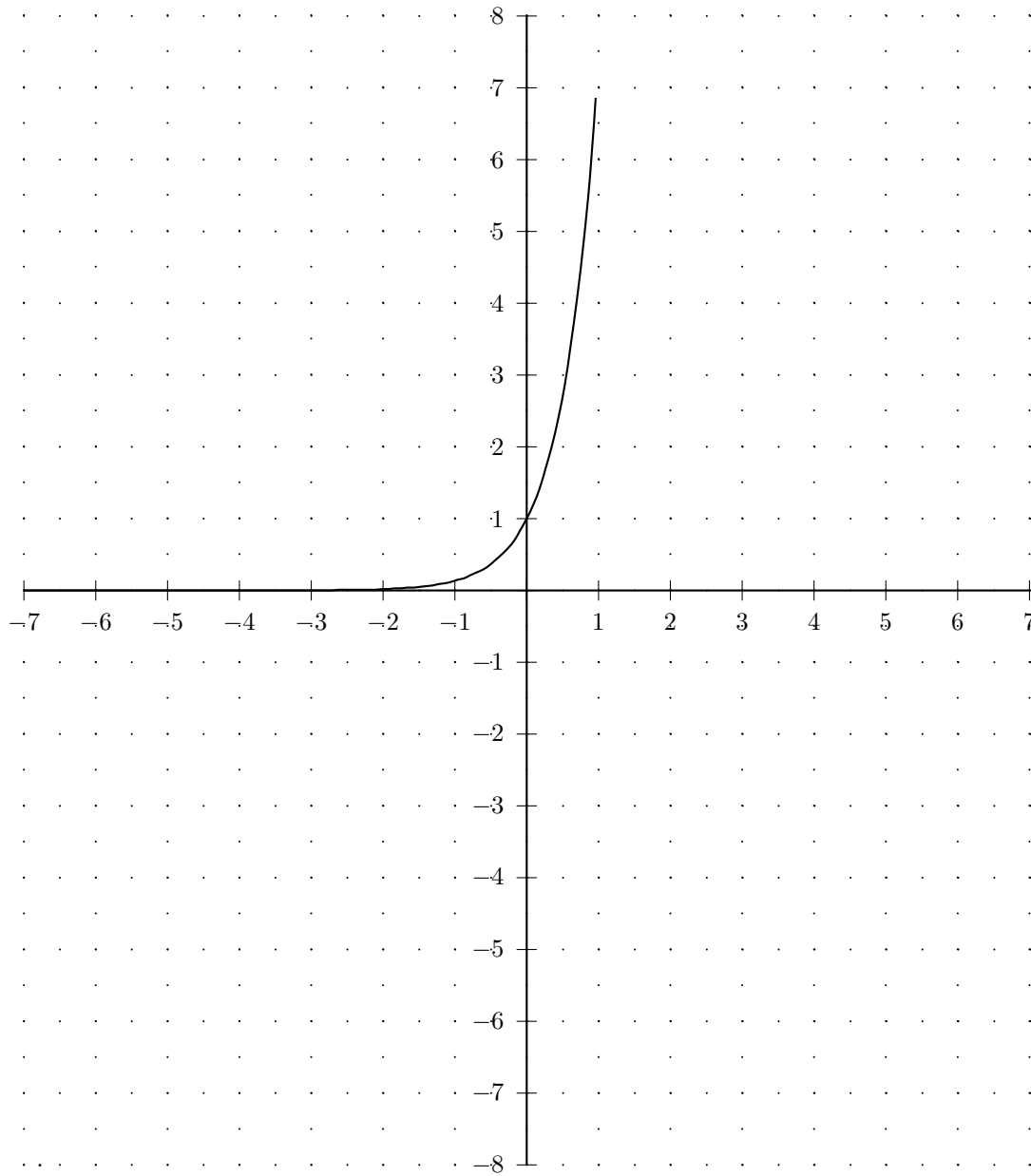
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0	0	0
$-6\frac{1}{2}$	0	0	0
-6	0	0	0
$-5\frac{1}{2}$	0	0	0
-5	0	0	0
$-4\frac{1}{2}$	0	0	0
-4	0	0,001	0,001
$-3\frac{1}{2}$	0,001	0,002	0,004
-3	0,002	0,005	0,01
$-2\frac{1}{2}$	0,007	0,013	0,027
-2	0,018	0,037	0,073
$-1\frac{1}{2}$	0,05	0,1	0,199
-1	0,135	0,271	0,541
$-\frac{1}{2}$	0,368	0,736	1,472
0	1	2	4

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	2	4
$\frac{1}{2}$	2,718	5,437	10,874
1	7,389	14,779	29,558
$1\frac{1}{2}$	20,086	40,175	80,346
2	54,598	109,206	218,403
$2\frac{1}{2}$	148,413	296,853	593,68
3	403,429	806,931	1613,788
$3\frac{1}{2}$	1096,633	2193,465	4386,732
4	2980,958	5962,457	11924,373
$4\frac{1}{2}$	8103,084	16207,638	32413,806
5	22026,466	44056,929	88109,861
$5\frac{1}{2}$	59874,142	119759,15	239507,433
6	162754,791	325539,121	651048,703
$6\frac{1}{2}$	442413,392	884907,076	1769733,859
7	1202604,284	2405426,825	4810635,391

- Graph der Funktion  $f(x) = e^{2 \cdot x}$



## Aufgabe (7)

• Gegeben die Funktion:  $f(x) = e^{\frac{1}{2} \cdot x - 1} + 1$

• Kurvendiskussion

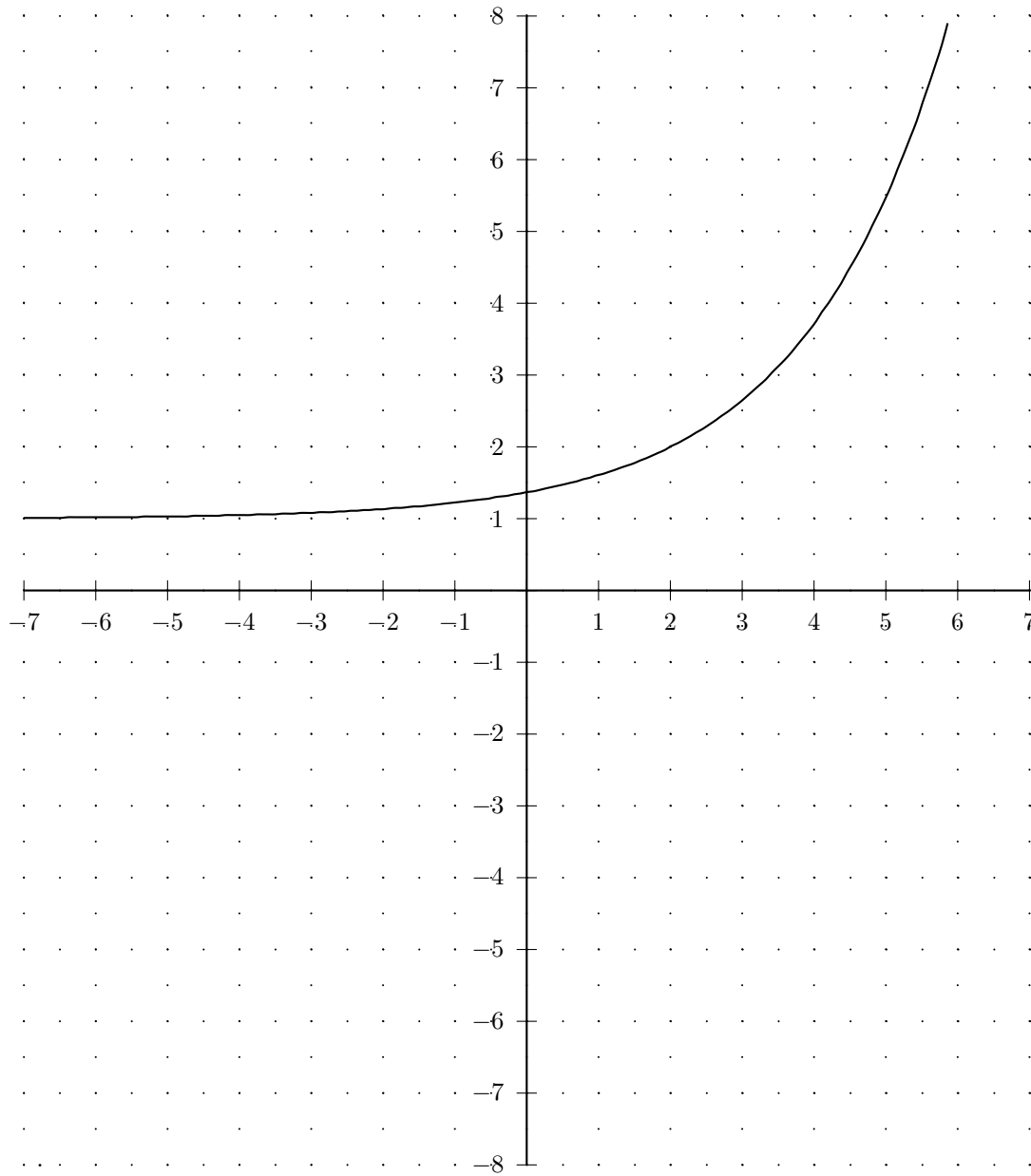
	$x$	$f(x)$
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• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,011	0,006	0,003
$-6\frac{1}{2}$	1,014	0,007	0,004
-6	1,018	0,009	0,005
$-5\frac{1}{2}$	1,024	0,012	0,006
-5	1,03	0,015	0,008
$-4\frac{1}{2}$	1,039	0,019	0,01
-4	1,05	0,025	0,012
$-3\frac{1}{2}$	1,064	0,032	0,016
-3	1,082	0,041	0,021
$-2\frac{1}{2}$	1,105	0,053	0,026
-2	1,135	0,068	0,034
$-1\frac{1}{2}$	1,174	0,087	0,043
-1	1,223	0,112	0,056
$-\frac{1}{2}$	1,287	0,143	0,072
0	1,368	0,184	0,092

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1,368	0,184	0,092
$\frac{1}{2}$	1,472	0,236	0,118
1	1,607	0,303	0,152
$1\frac{1}{2}$	1,779	0,389	0,195
2	2	0,5	$\frac{1}{4}$
$2\frac{1}{2}$	2,284	0,642	0,321
3	2,649	0,824	0,412
$3\frac{1}{2}$	3,117	1,059	0,529
4	3,718	1,359	0,68
$4\frac{1}{2}$	4,49	1,745	0,873
5	5,482	2,241	1,12
$5\frac{1}{2}$	6,755	2,877	1,439
6	8,389	3,695	1,847
$6\frac{1}{2}$	10,488	4,744	2,372
7	13,182	6,091	3,046

•Graph der Funktion  $f(x) = e^{\frac{1}{2} \cdot x - 1} + 1$



## Aufgabe (8)

• Gegeben die Funktion:  $f(x) = 2 \cdot e^{x-2} + 1$

• Kurvendiskussion

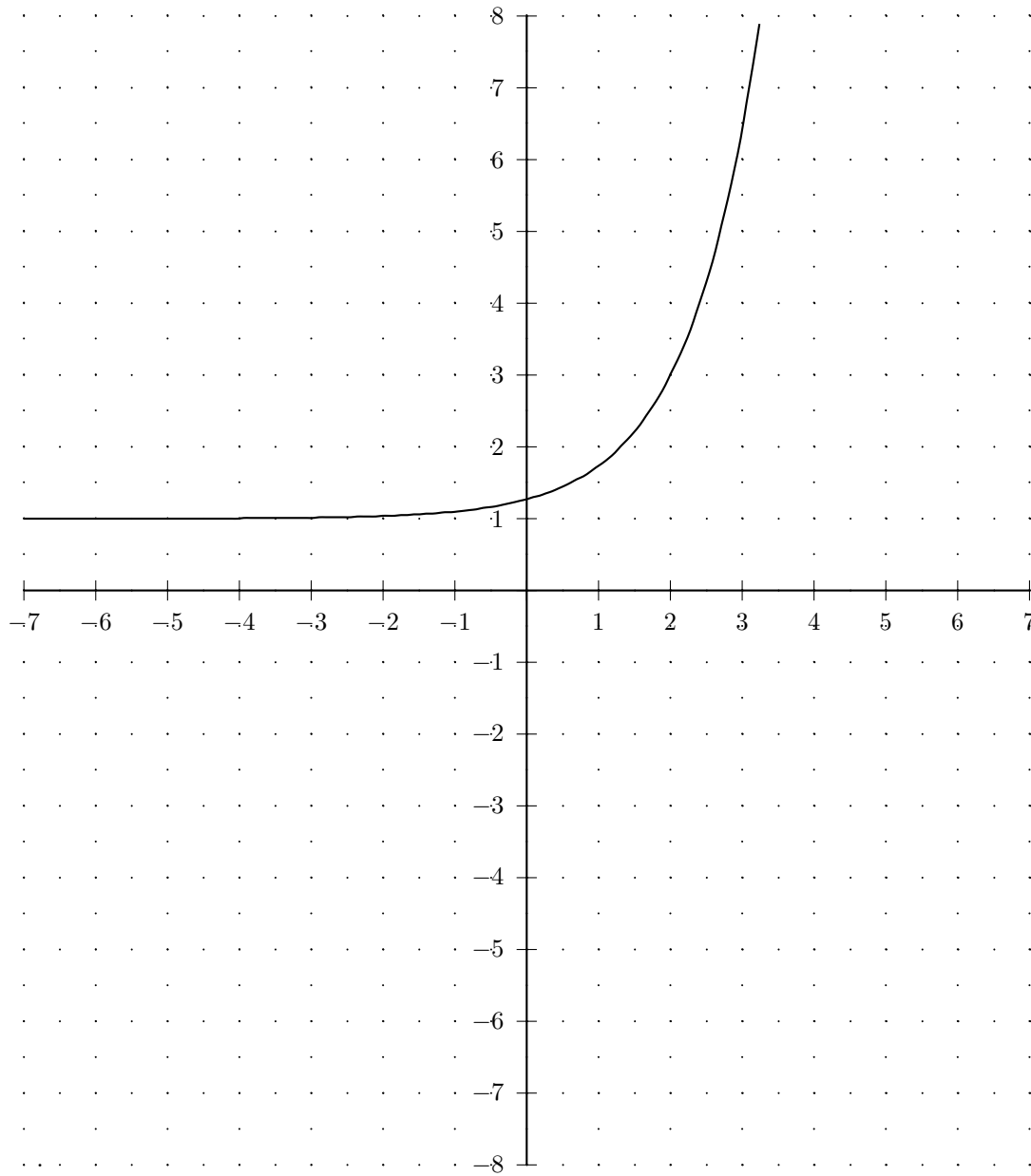
$x$	$f(x)$
-----	--------

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1	0	0
$-6\frac{1}{2}$	1	0	0
-6	1,001	0,001	0,001
$-5\frac{1}{2}$	1,001	0,001	0,001
-5	1,002	0,002	0,002
$-4\frac{1}{2}$	1,003	0,003	0,003
-4	1,005	0,005	0,005
$-3\frac{1}{2}$	1,008	0,008	0,008
-3	1,013	0,013	0,013
$-2\frac{1}{2}$	1,022	0,022	0,022
-2	1,037	0,037	0,037
$-1\frac{1}{2}$	1,06	0,06	0,06
-1	1,1	0,1	0,1
$-\frac{1}{2}$	1,164	0,164	0,164
0	1,271	0,271	0,271

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1,271	0,271	0,271
$\frac{1}{2}$	1,446	0,446	0,446
1	1,736	0,736	0,736
$1\frac{1}{2}$	2,213	1,213	1,213
2	3	2	2
$2\frac{1}{2}$	4,297	3,298	3,297
3	6,437	5,437	5,437
$3\frac{1}{2}$	9,963	8,964	8,963
4	15,778	14,778	14,778
$4\frac{1}{2}$	25,365	24,366	24,365
5	41,171	40,172	40,172
$5\frac{1}{2}$	67,231	66,232	66,232
6	110,196	109,199	109,198
$6\frac{1}{2}$	181,034	180,038	180,036
7	297,826	296,833	296,83

•Graph der Funktion  $f(x) = 2 \cdot e^{x-2} + 1$



## Aufgabe (9)

• Gegeben die Funktion:  $f(x) = \frac{1}{3} \cdot e^{-x}$

• Kurvendiskussion

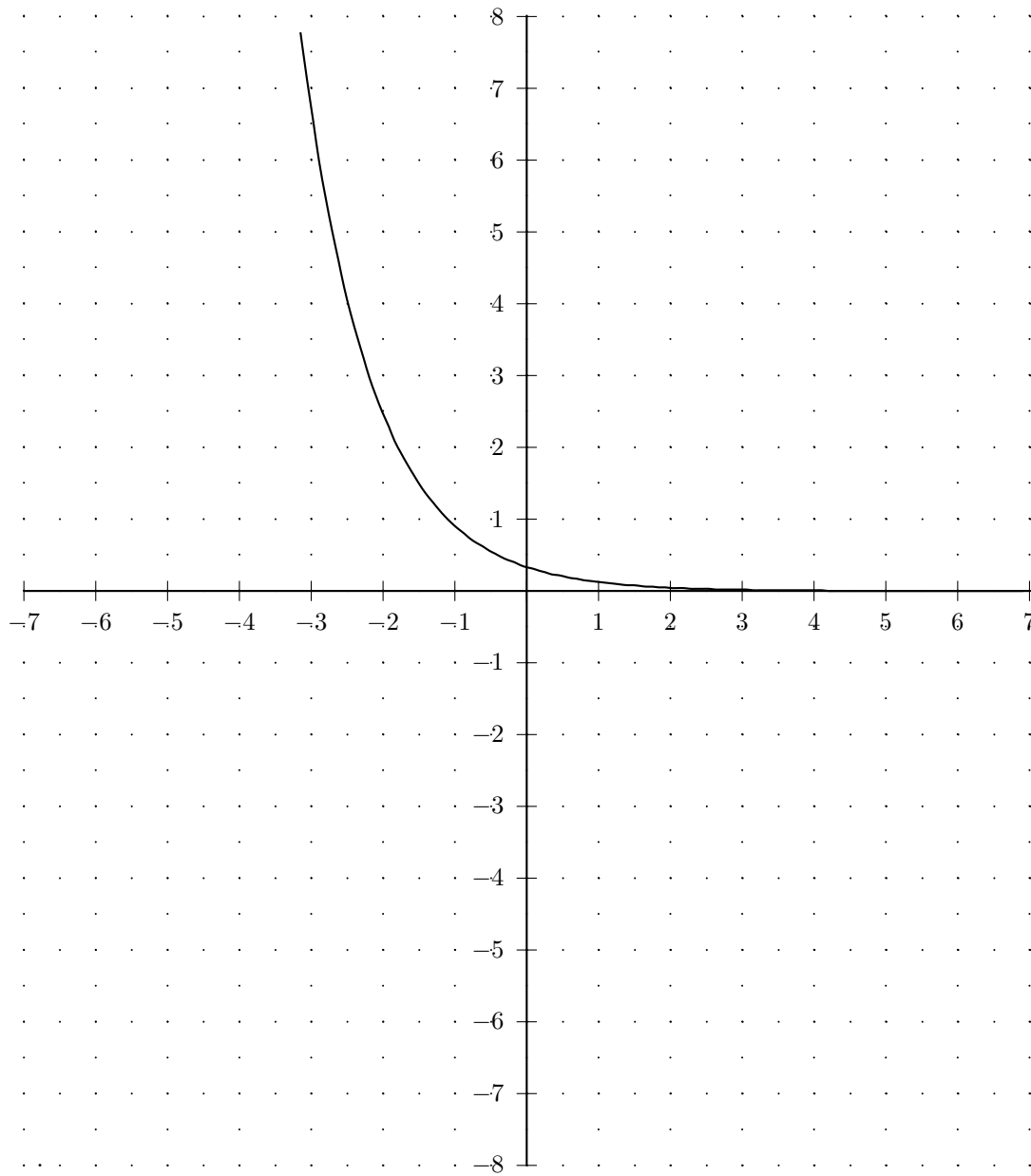
$x$	$f(x)$
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• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	365,544	-365,553	365,549
$-6\frac{1}{2}$	221,714	-221,719	221,716
-6	134,476	-134,479	134,478
$-5\frac{1}{2}$	81,564	-81,566	81,565
-5	49,471	-49,472	49,472
$-4\frac{1}{2}$	30,006	-30,006	30,006
-4	18,199	-18,2	18,2
$-3\frac{1}{2}$	11,038	-11,039	11,039
-3	6,695	-6,695	6,695
$-2\frac{1}{2}$	4,061	-4,061	4,061
-2	2,463	-2,463	2,463
$-1\frac{1}{2}$	1,494	-1,494	1,494
-1	0,906	-0,906	0,906
$-\frac{1}{2}$	0,55	-0,55	0,55
0	$\frac{1}{3}$	-0,333	0,333

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	$\frac{1}{3}$	-0,333	0,333
$\frac{1}{2}$	0,202	-0,202	0,202
1	0,123	-0,123	0,123
$1\frac{1}{2}$	0,074	-0,074	0,074
2	0,045	-0,045	0,045
$2\frac{1}{2}$	0,027	-0,027	0,027
3	0,017	-0,017	0,017
$3\frac{1}{2}$	0,01	-0,01	0,01
4	0,006	-0,006	0,006
$4\frac{1}{2}$	0,004	-0,004	0,004
5	0,002	-0,002	0,002
$5\frac{1}{2}$	0,001	-0,001	0,001
6	0,001	-0,001	0,001
$6\frac{1}{2}$	0,001	-0,001	0,001
7	0	0	0

- Graph der Funktion  $f(x) = \frac{1}{3} \cdot e^{-x}$



## Aufgabe (10)

• Gegeben die Funktion:  $f(x) = -2 \cdot e^{-x} + 3$

• Kurvendiskussion

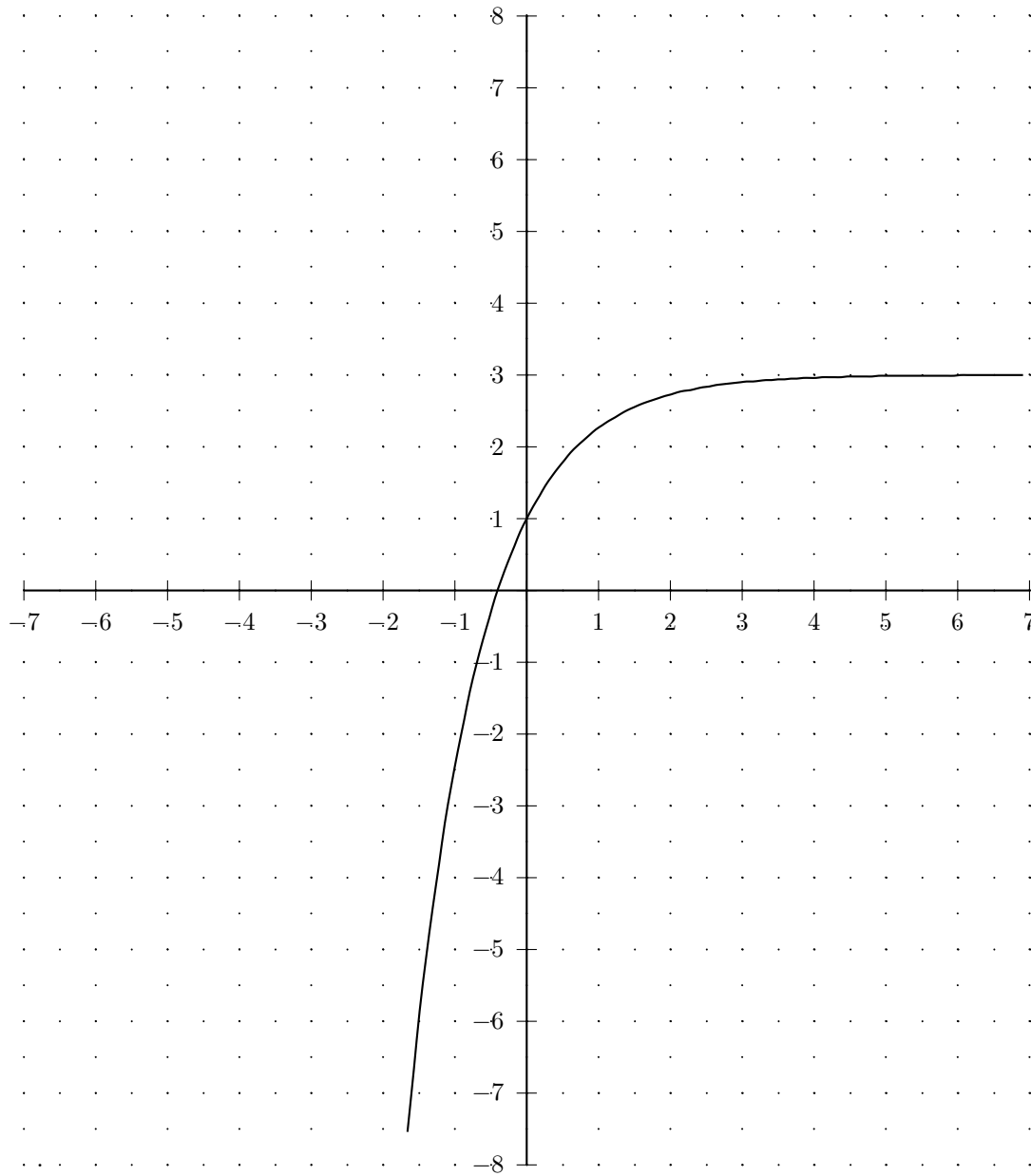
	$x$	$f(x)$
Nullstellen:	-0,406	-0,001

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-2190,266	2193,316	-2193,291
$-6\frac{1}{2}$	-1327,283	1330,313	-1330,298
-6	-803,858	806,876	-806,867
$-5\frac{1}{2}$	-486,384	489,395	-489,389
-5	-293,826	296,833	-296,83
$-4\frac{1}{2}$	-177,034	180,038	-180,036
-4	-106,196	109,199	-109,198
$-3\frac{1}{2}$	-63,231	66,232	-66,232
-3	-37,171	40,172	-40,172
$-2\frac{1}{2}$	-21,365	24,366	-24,365
-2	-11,778	14,778	-14,778
$-1\frac{1}{2}$	-5,963	8,964	-8,963
-1	-2,437	5,437	-5,437
$-\frac{1}{2}$	-0,297	3,298	-3,297
0	1	2	-2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	2	-2
$\frac{1}{2}$	1,787	1,213	-1,213
1	2,264	0,736	-0,736
$1\frac{1}{2}$	2,554	0,446	-0,446
2	2,729	0,271	-0,271
$2\frac{1}{2}$	2,836	0,164	-0,164
3	2,9	0,1	-0,1
$3\frac{1}{2}$	2,94	0,06	-0,06
4	2,963	0,037	-0,037
$4\frac{1}{2}$	2,978	0,022	-0,022
5	2,987	0,013	-0,013
$5\frac{1}{2}$	2,992	0,008	-0,008
6	2,995	0,005	-0,005
$6\frac{1}{2}$	2,997	0,003	-0,003
7	2,998	0,002	-0,002

- Graph der Funktion  $f(x) = -2 \cdot e^{-x} + 3$



## Aufgabe (11)

• Gegeben die Funktion:  $f(x) = x \cdot e^x$

• Kurvendiskussion

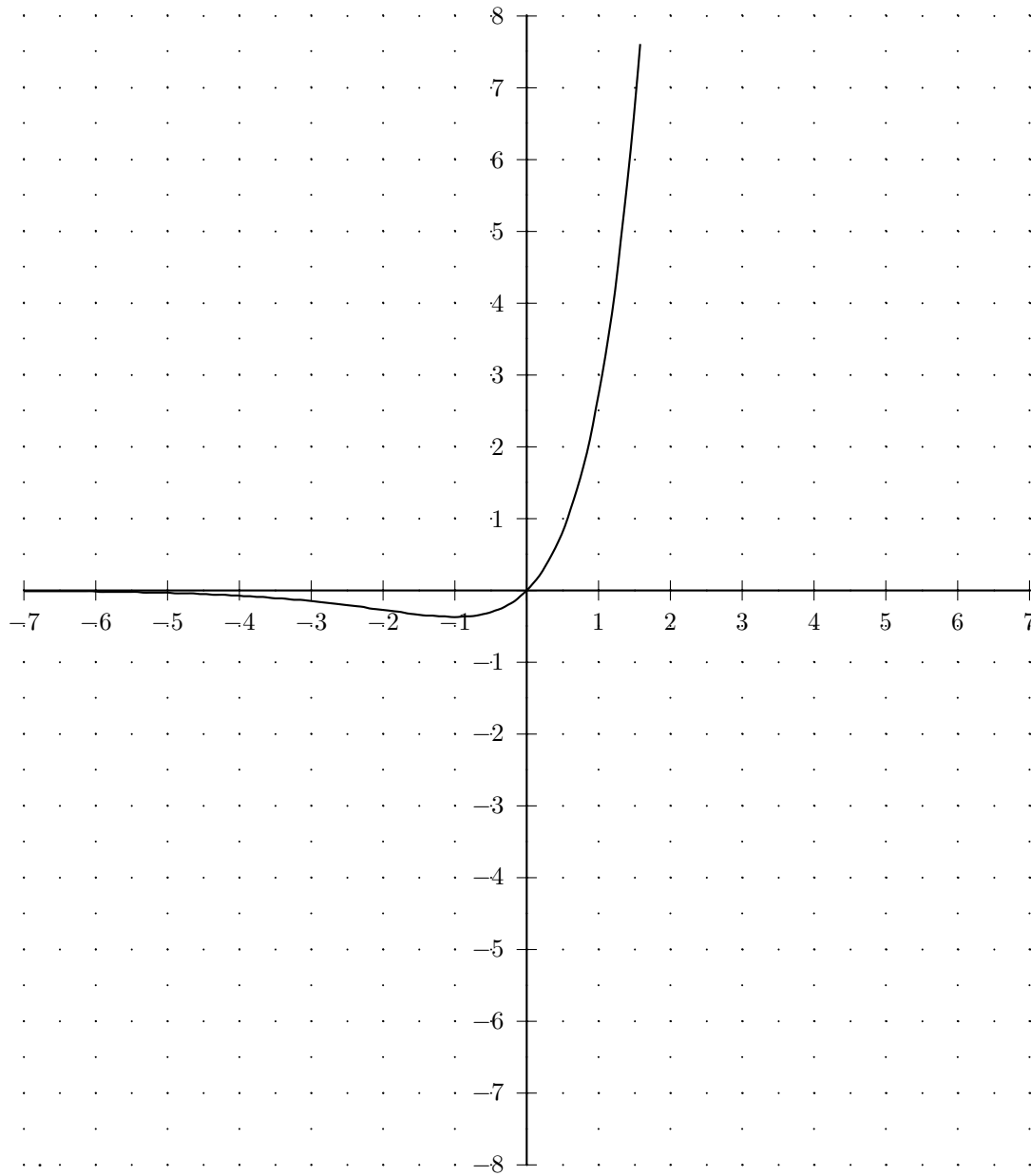
	$x$	$f(x)$
Nullstellen:	0	0
Extremwerte:	-1	-0,368
Wendepunkte:	-2	-0,271

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,006	-0,005	-0,005
$-6\frac{1}{2}$	-0,01	-0,008	-0,007
-6	-0,015	-0,012	-0,01
$-5\frac{1}{2}$	-0,022	-0,018	-0,014
-5	-0,034	-0,027	-0,02
$-4\frac{1}{2}$	-0,05	-0,039	-0,028
-4	-0,073	-0,055	-0,037
$-3\frac{1}{2}$	-0,106	-0,075	-0,045
-3	-0,149	-0,1	-0,05
$-2\frac{1}{2}$	-0,205	-0,123	-0,041
-2	-0,271	-0,135	0
$-1\frac{1}{2}$	-0,335	-0,112	0,112
-1	-0,368	0	0,368
$-\frac{1}{2}$	-0,303	0,303	0,91
0	0	1	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	1	2
$\frac{1}{2}$	0,824	2,473	4,122
1	2,718	5,437	8,155
$1\frac{1}{2}$	6,723	11,205	15,686
2	14,778	22,168	29,557
$2\frac{1}{2}$	30,456	42,64	54,822
3	60,257	80,345	100,429
$3\frac{1}{2}$	115,904	149,024	182,138
4	218,393	272,999	327,594
$4\frac{1}{2}$	405,077	495,11	585,12
5	742,066	890,506	1038,907
$5\frac{1}{2}$	1345,806	1590,545	1835,216
6	2420,573	2824,084	3227,476
$6\frac{1}{2}$	4323,421	4988,706	5653,783
7	7676,432	8773,314	9869,835

•Graph der Funktion  $f(x) = x \cdot e^x$



## Aufgabe (12)

• Gegeben die Funktion:  $f(x) = x^2 \cdot e^x$

• Kurvendiskussion

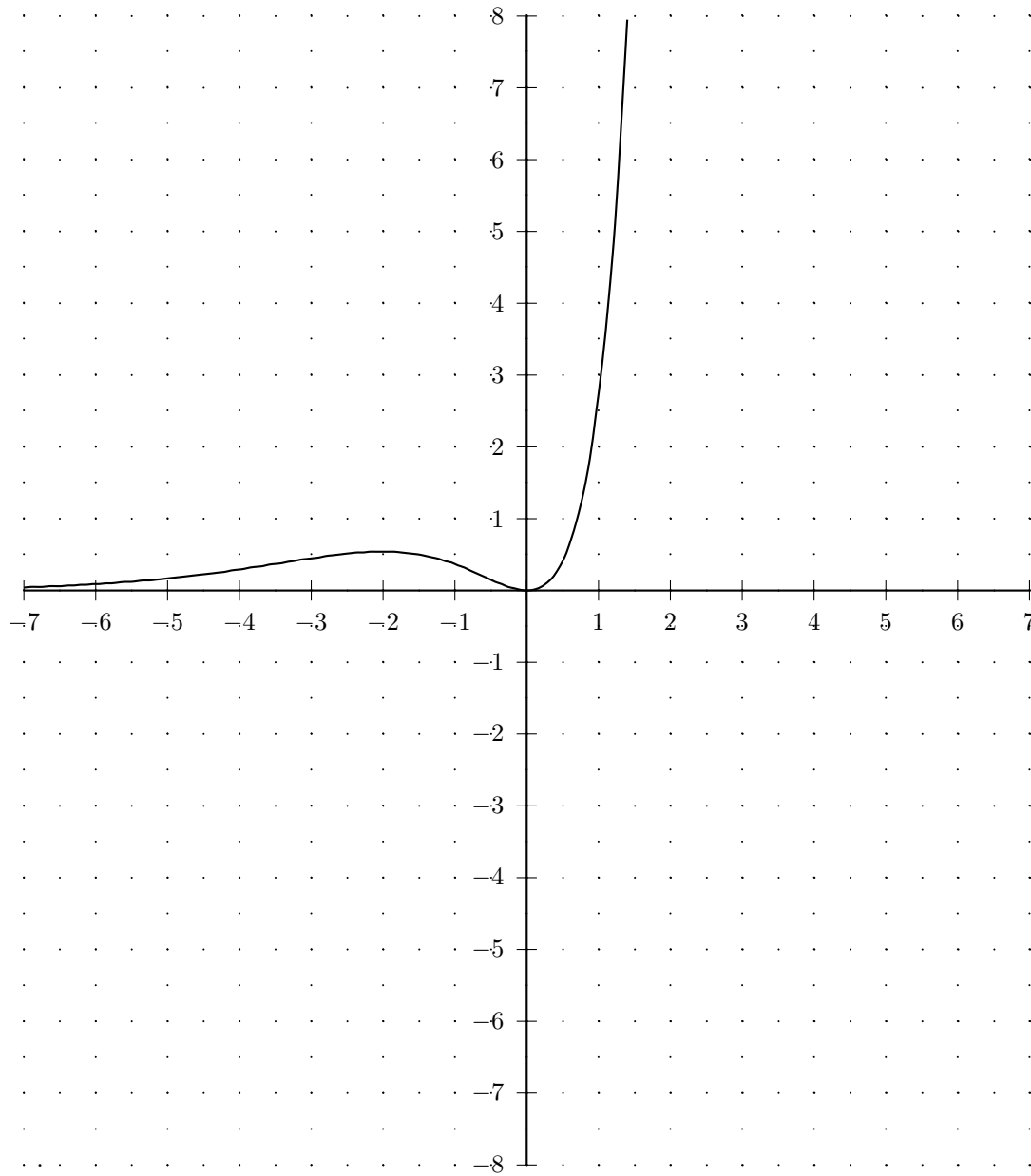
	$x$	$f(x)$
Extremwerte:	-2	0,541
	0	0
Wendepunkte:	-3,414	0,384
	-0,586	0,191

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,045	0,032	0,021
$-6\frac{1}{2}$	0,064	0,044	0,027
-6	0,089	0,059	0,035
$-5\frac{1}{2}$	0,124	0,079	0,042
-5	0,168	0,101	0,047
$-4\frac{1}{2}$	0,225	0,125	0,047
-4	0,293	0,147	0,037
$-3\frac{1}{2}$	0,37	0,159	0,008
-3	0,448	0,149	-0,05
$-2\frac{1}{2}$	0,513	0,103	-0,144
-2	0,541	0	-0,271
$-1\frac{1}{2}$	0,502	-0,167	-0,39
-1	0,368	-0,368	-0,368
$-\frac{1}{2}$	0,152	-0,455	0,152
0	0	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	2
$\frac{1}{2}$	0,412	2,061	7,007
1	2,718	8,156	19,029
$1\frac{1}{2}$	10,084	23,531	45,939
2	29,556	59,116	103,449
$2\frac{1}{2}$	76,141	137,061	222,336
3	180,77	301,298	461,978
$3\frac{1}{2}$	405,664	637,502	935,531
4	873,57	1310,413	1856,374
$4\frac{1}{2}$	1822,847	2633,11	3623,259
5	3710,329	5194,666	6975,548
$5\frac{1}{2}$	7401,931	10093,927	13274,777
6	14523,437	19365,296	25013,024
$6\frac{1}{2}$	28102,234	36750,392	46727,001
7	53735,025	69090,302	86635,475

- Graph der Funktion  $f(x) = x^2 \cdot e^x$



## Aufgabe (13)

• Gegeben die Funktion:  $f(x) = x^3 \cdot e^x$

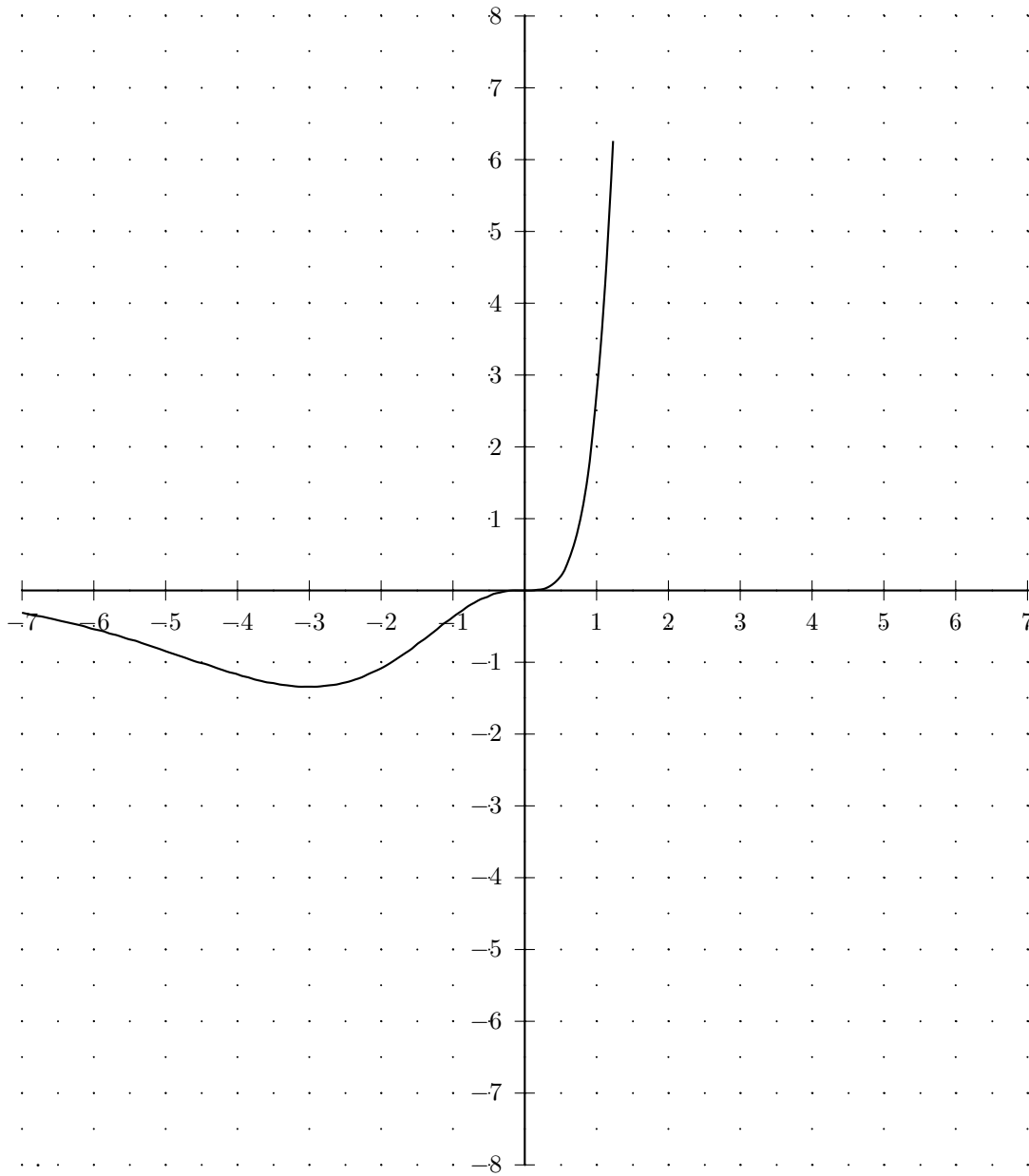
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	0	0
Extremwerte:	-3	-1,344
Wendepunkte:	-4,732 -1,268 0	-0,933 -0,573 0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,313	-0,179	-0,083
$-6\frac{1}{2}$	-0,413	-0,222	-0,09
-6	-0,535	-0,268	-0,089
$-5\frac{1}{2}$	-0,68	-0,309	-0,073
-5	-0,842	-0,337	-0,034
$-4\frac{1}{2}$	-1,012	-0,337	0,037
-4	-1,172	-0,293	0,147
$-3\frac{1}{2}$	-1,295	-0,185	0,291
-3	-1,344	0	0,448
$-2\frac{1}{2}$	-1,283	0,257	0,564
-2	-1,083	0,541	0,541
$-1\frac{1}{2}$	-0,753	0,753	0,251
-1	-0,368	0,736	-0,368
$-\frac{1}{2}$	-0,076	0,379	-0,986
0	0	0	0
0	0	0	0
$\frac{1}{2}$	0,206	1,443	7,626
1	2,718	10,875	35,34
$1\frac{1}{2}$	15,126	45,383	115,969
2	59,112	147,796	325,131
$2\frac{1}{2}$	190,351	418,807	829,961
3	542,309	1084,696	1988,529
$3\frac{1}{2}$	1419,825	2636,985	4549,363
4	3494,282	6115,347	10046,322
$4\frac{1}{2}$	8202,811	13672,088	21570,886
5	18551,645	29684,133	45267,072
$5\frac{1}{2}$	40710,62	62919,431	93199,125
6	87140,619	130716,914	188808,739
$6\frac{1}{2}$	182664,521	266982,96	377226,292
7	376145,173	537373,036	744628,928

•Graph der Funktion  $f(x) = x^3 \cdot e^x$



## Aufgabe (14)

• Gegeben die Funktion:  $f(x) = x^4 \cdot e^x$

• Kurvendiskussion

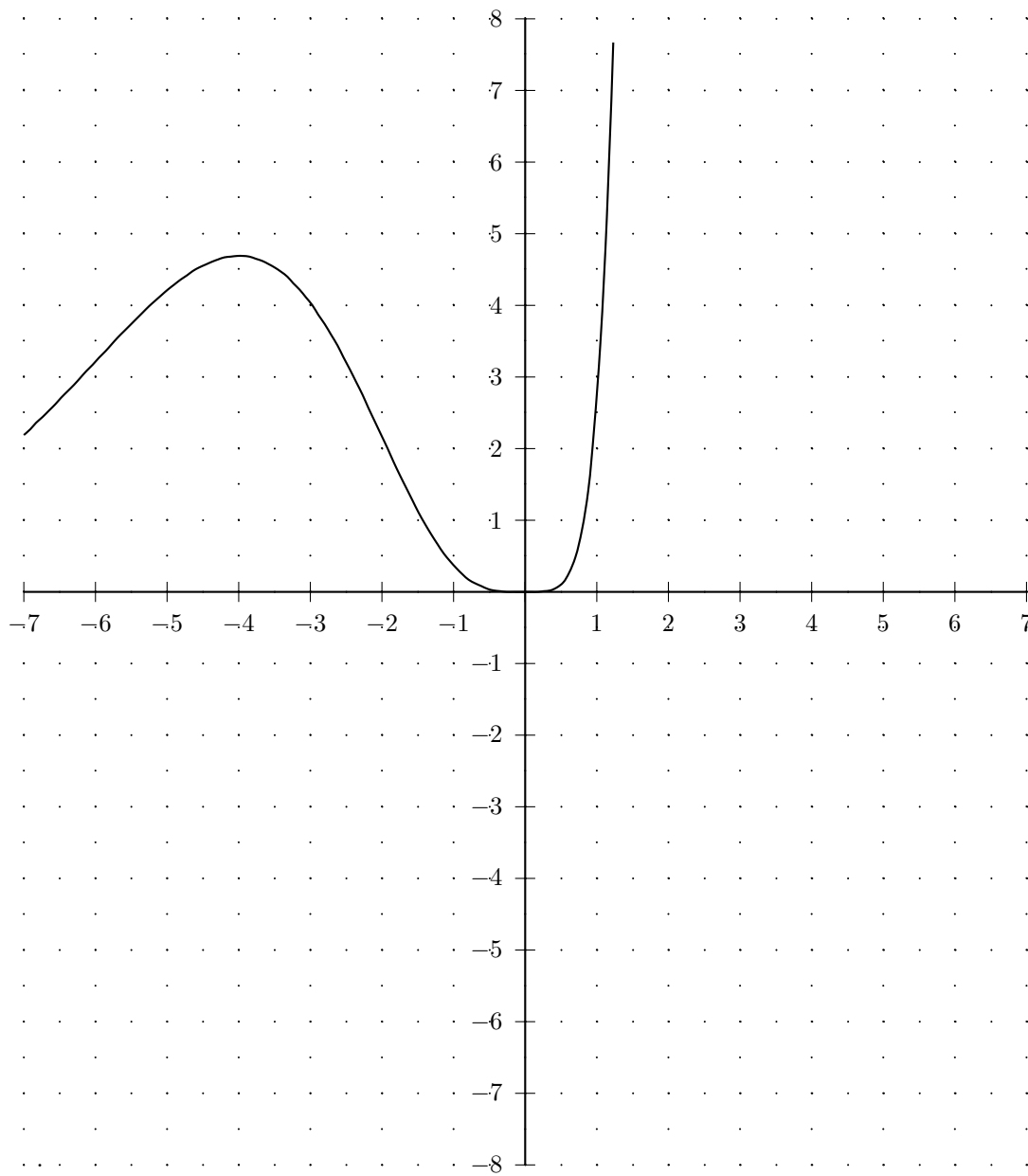
	$x$	$f(x)$
Extremwerte:	-4	4,689
	0	0
Wendepunkte:	-6	3,213
	-2	2,165

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	2,189	0,938	0,223
$-6\frac{1}{2}$	2,684	1,032	0,143
-6	3,212	1,071	0
$-5\frac{1}{2}$	3,74	1,02	-0,216
-5	4,211	0,842	-0,505
$-4\frac{1}{2}$	4,555	0,506	-0,844
-4	4,689	0	-1,172
$-3\frac{1}{2}$	4,531	-0,647	-1,387
-3	4,033	-1,344	-1,344
$-2\frac{1}{2}$	3,206	-1,924	-0,898
-2	2,165	-2,165	0
$-1\frac{1}{2}$	1,13	-1,883	1,13
-1	0,368	-1,104	1,839
$-\frac{1}{2}$	0,038	-0,265	1,251
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,103	0,928	6,7
1	2,718	13,596	57,09
$1\frac{1}{2}$	22,689	83,208	264,72
2	118,225	354,726	945,853
$2\frac{1}{2}$	475,879	1237,426	2912,516
3	1626,928	3796,531	8134,978
$3\frac{1}{2}$	4969,388	10649,581	21196,74
4	13977,126	27956,353	52415,983
$4\frac{1}{2}$	36912,65	69728,674	124413,163
5	92758,224	166975,393	285703,629
$5\frac{1}{2}$	223908,411	386773,832	638434,05
6	522843,716	871454,956	1394286,262
$6\frac{1}{2}$	1187319,386	1918079,436	2985936,819
7	2633016,213	4137807,098	6287148,568

•Graph der Funktion  $f(x) = x^4 \cdot e^x$



## Aufgabe (15)

• Gegeben die Funktion:  $f(x) = x \cdot e^{-x}$

• Kurvendiskussion

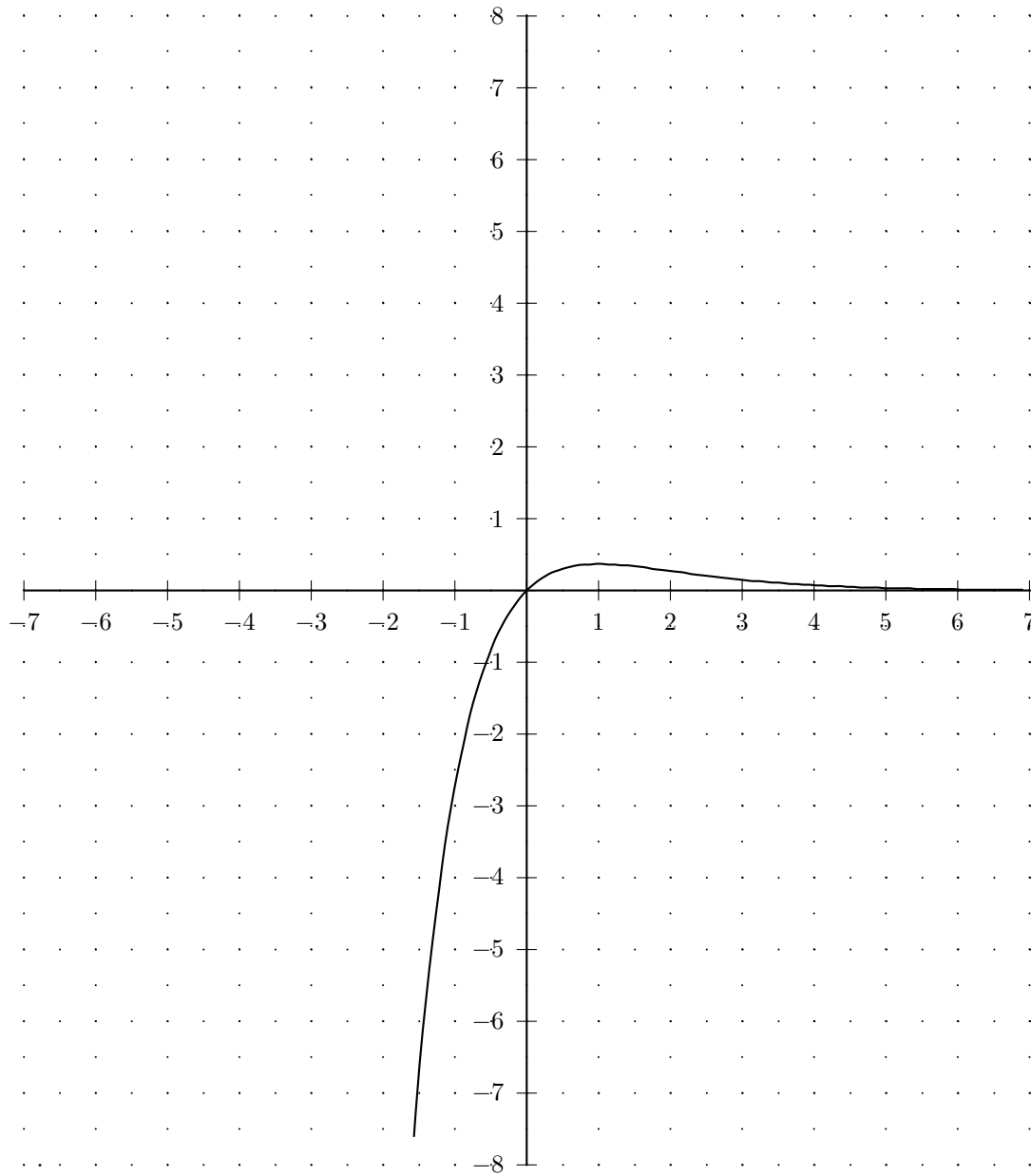
	$x$	$f(x)$
Nullstellen:	0	0
Extremwerte:	1	0,368
Wendepunkte:	2	0,271

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-7676,432	8773,314	-9869,835
$-6\frac{1}{2}$	-4323,421	4988,706	-5653,783
-6	-2420,573	2824,084	-3227,476
$-5\frac{1}{2}$	-1345,806	1590,545	-1835,216
-5	-742,066	890,506	-1038,907
$-4\frac{1}{2}$	-405,077	495,11	-585,12
-4	-218,393	272,999	-327,594
$-3\frac{1}{2}$	-115,904	149,024	-182,138
-3	-60,257	80,345	-100,429
$-2\frac{1}{2}$	-30,456	42,64	-54,822
-2	-14,778	22,168	-29,557
$-1\frac{1}{2}$	-6,723	11,205	-15,686
-1	-2,718	5,437	-8,155
$-\frac{1}{2}$	-0,824	2,473	-4,122
0	0	1	-2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	1	-2
$\frac{1}{2}$	0,303	0,303	-0,91
1	0,368	0	-0,368
$1\frac{1}{2}$	0,335	-0,112	-0,112
2	0,271	-0,135	0
$2\frac{1}{2}$	0,205	-0,123	0,041
3	0,149	-0,1	0,05
$3\frac{1}{2}$	0,106	-0,075	0,045
4	0,073	-0,055	0,037
$4\frac{1}{2}$	0,05	-0,039	0,028
5	0,034	-0,027	0,02
$5\frac{1}{2}$	0,022	-0,018	0,014
6	0,015	-0,012	0,01
$6\frac{1}{2}$	0,01	-0,008	0,007
7	0,006	-0,005	0,005

•Graph der Funktion  $f(x) = x \cdot e^{-x}$



## Aufgabe (16)

• Gegeben die Funktion:  $f(x) = x^2 \cdot e^{-x}$

• Kurvendiskussion

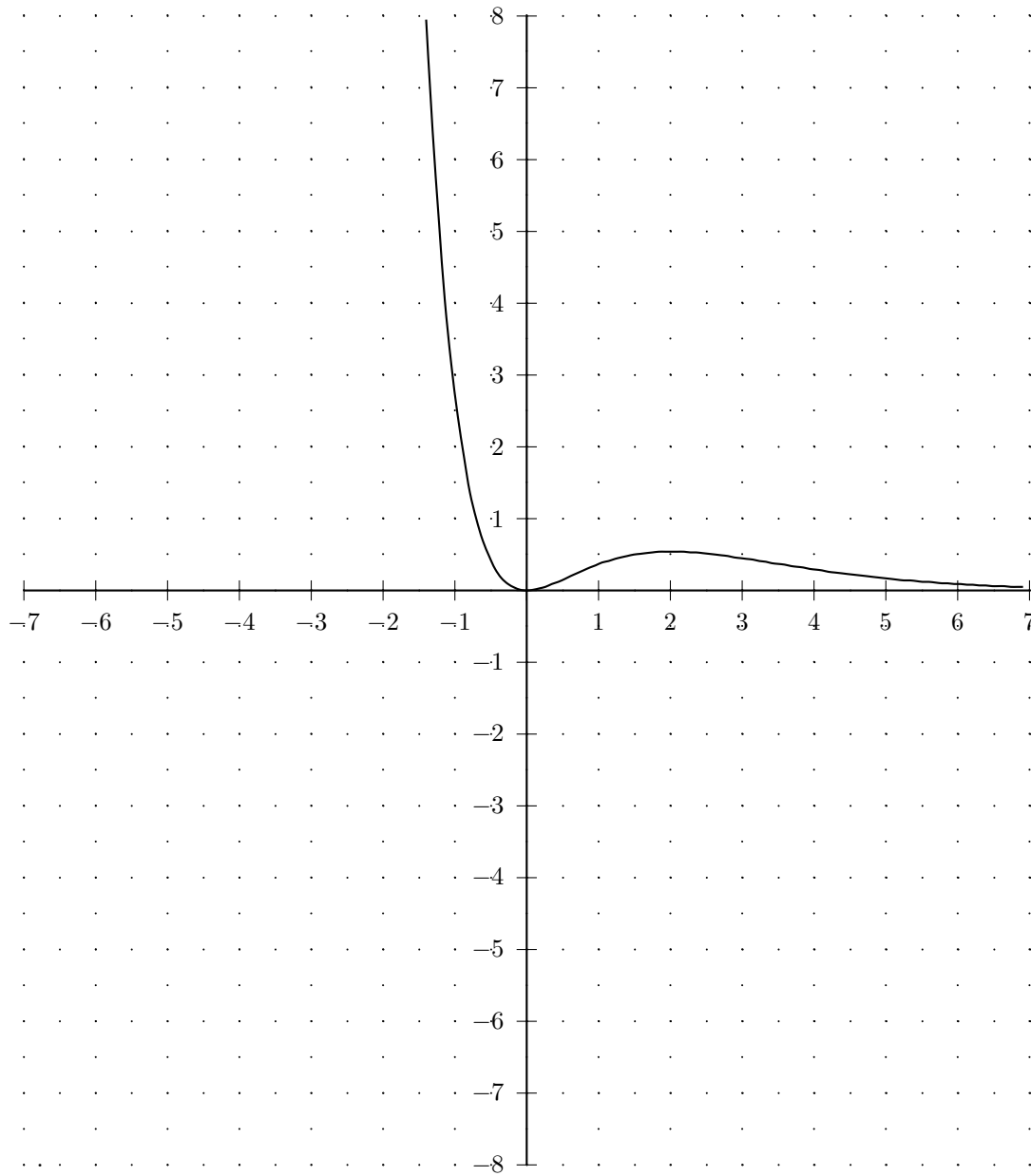
	$x$	$f(x)$
Extremwerte:	0	0
	2	0,541
Wendepunkte:	0,586	0,191
	3,414	0,384

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	53735,025	-69090,302	86635,475
$-6\frac{1}{2}$	28102,234	-36750,392	46727,001
-6	14523,437	-19365,296	25013,024
$-5\frac{1}{2}$	7401,931	-10093,927	13274,777
-5	3710,329	-5194,666	6975,548
$-4\frac{1}{2}$	1822,847	-2633,11	3623,259
-4	873,57	-1310,413	1856,374
$-3\frac{1}{2}$	405,664	-637,502	935,531
-3	180,77	-301,298	461,978
$-2\frac{1}{2}$	76,141	-137,061	222,336
-2	29,556	-59,116	103,449
$-1\frac{1}{2}$	10,084	-23,531	45,939
-1	2,718	-8,156	19,029
$-\frac{1}{2}$	0,412	-2,061	7,007
0	0	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	2
$\frac{1}{2}$	0,152	0,455	0,152
1	0,368	0,368	-0,368
$1\frac{1}{2}$	0,502	0,167	-0,39
2	0,541	0	-0,271
$2\frac{1}{2}$	0,513	-0,103	-0,144
3	0,448	-0,149	-0,05
$3\frac{1}{2}$	0,37	-0,159	0,008
4	0,293	-0,147	0,037
$4\frac{1}{2}$	0,225	-0,125	0,047
5	0,168	-0,101	0,047
$5\frac{1}{2}$	0,124	-0,079	0,042
6	0,089	-0,059	0,035
$6\frac{1}{2}$	0,064	-0,044	0,027
7	0,045	-0,032	0,021

•Graph der Funktion  $f(x) = x^2 \cdot e^{-x}$



## Aufgabe (17)

• Gegeben die Funktion:  $f(x) = x^3 \cdot e^{-x}$

• Kurvendiskussion

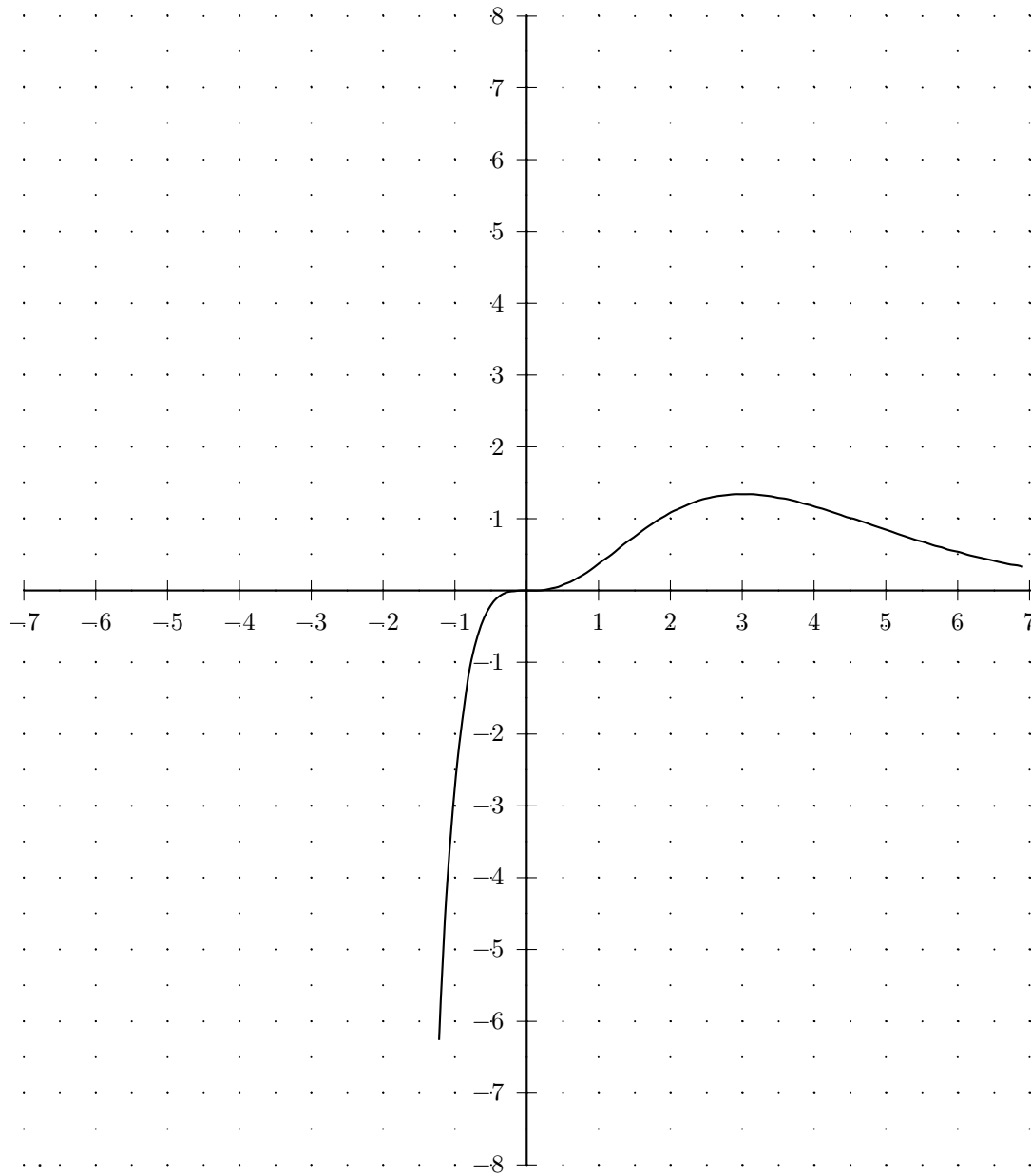
	$x$	$f(x)$
Nullstellen:	0	0
Extremwerte:	3	1,344
Wendepunkte:	0 1,268 4,732	0 0,573 0,933

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-376145,173	537373,036	-744628,928
$-6\frac{1}{2}$	-182664,521	266982,96	-377226,292
-6	-87140,619	130716,914	-188808,739
$-5\frac{1}{2}$	-40710,62	62919,431	-93199,125
-5	-18551,645	29684,133	-45267,072
$-4\frac{1}{2}$	-8202,811	13672,088	-21570,886
-4	-3494,282	6115,347	-10046,322
$-3\frac{1}{2}$	-1419,825	2636,985	-4549,363
-3	-542,309	1084,696	-1988,529
$-2\frac{1}{2}$	-190,351	418,807	-829,961
-2	-59,112	147,796	-325,131
$-1\frac{1}{2}$	-15,126	45,383	-115,969
-1	-2,718	10,875	-35,34
$-\frac{1}{2}$	-0,206	1,443	-7,626
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,076	0,379	0,986
1	0,368	0,736	0,368
$1\frac{1}{2}$	0,753	0,753	-0,251
2	1,083	0,541	-0,541
$2\frac{1}{2}$	1,283	0,257	-0,564
3	1,344	0	-0,448
$3\frac{1}{2}$	1,295	-0,185	-0,291
4	1,172	-0,293	-0,147
$4\frac{1}{2}$	1,012	-0,337	-0,037
5	0,842	-0,337	0,034
$5\frac{1}{2}$	0,68	-0,309	0,073
6	0,535	-0,268	0,089
$6\frac{1}{2}$	0,413	-0,222	0,09
7	0,313	-0,179	0,083

•Graph der Funktion  $f(x) = x^3 \cdot e^{-x}$



## Aufgabe (18)

• Gegeben die Funktion:  $f(x) = x^4 \cdot e^{-x}$

• Kurvendiskussion

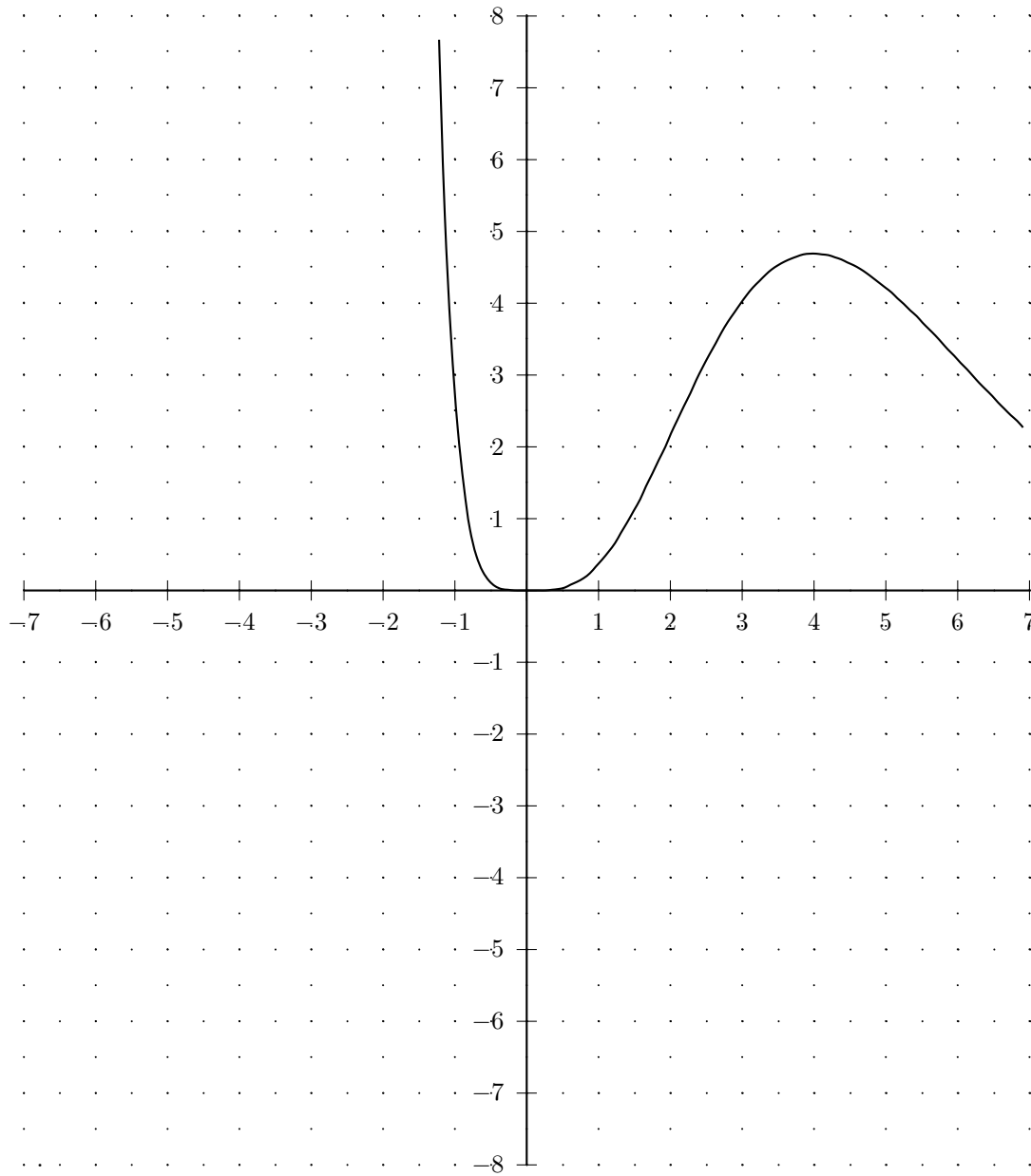
	$x$	$f(x)$
Extremwerte:	0	0
	4	4,689
Wendepunkte:	2	2,165
	6	3,213

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	2633016,213	-4137807,098	6287148,568
$-6\frac{1}{2}$	1187319,386	-1918079,436	2985936,819
-6	522843,716	-871454,956	1394286,262
$-5\frac{1}{2}$	223908,411	-386773,832	638434,05
-5	92758,224	-166975,393	285703,629
$-4\frac{1}{2}$	36912,65	-69728,674	124413,163
-4	13977,126	-27956,353	52415,983
$-3\frac{1}{2}$	4969,388	-10649,581	21196,74
-3	1626,928	-3796,531	8134,978
$-2\frac{1}{2}$	475,879	-1237,426	2912,516
-2	118,225	-354,726	945,853
$-1\frac{1}{2}$	22,689	-83,208	264,72
-1	2,718	-13,596	57,09
$-\frac{1}{2}$	0,103	-0,928	6,7
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,038	0,265	1,251
1	0,368	1,104	1,839
$1\frac{1}{2}$	1,13	1,883	1,13
2	2,165	2,165	0
$2\frac{1}{2}$	3,206	1,924	-0,898
3	4,033	1,344	-1,344
$3\frac{1}{2}$	4,531	0,647	-1,387
4	4,689	0	-1,172
$4\frac{1}{2}$	4,555	-0,506	-0,844
5	4,211	-0,842	-0,505
$5\frac{1}{2}$	3,74	-1,02	-0,216
6	3,212	-1,071	0
$6\frac{1}{2}$	2,684	-1,032	0,143
7	2,189	-0,938	0,223

- Graph der Funktion  $f(x) = x^4 \cdot e^{-x}$



## Aufgabe (19)

• Gegeben die Funktion:  $f(x) = (x - 1) \cdot e^{-x}$

• Kurvendiskussion

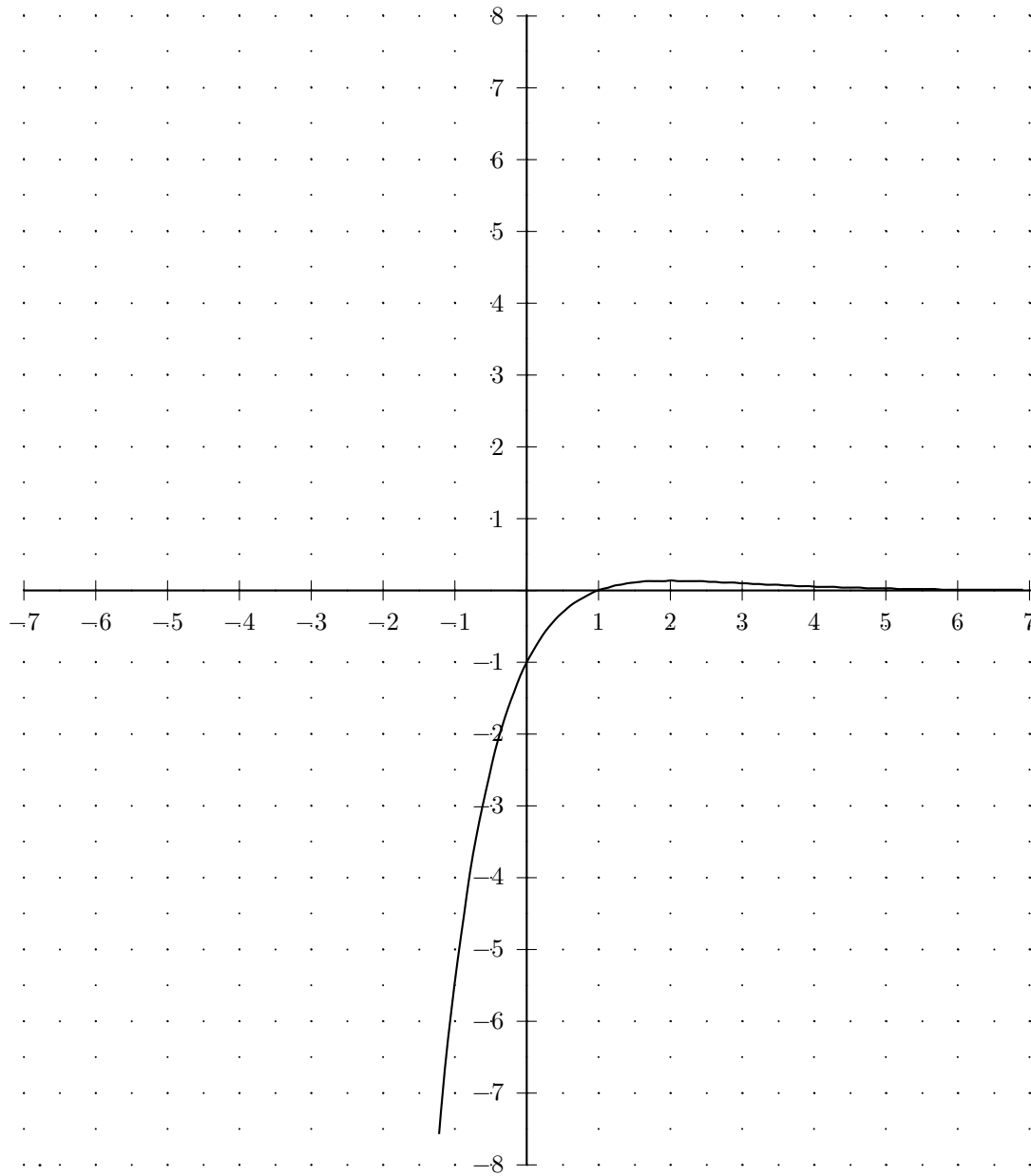
	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	2	0,135
Wendepunkte:	3	0,1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-8773,065	9869,972	-10966,481
$-6\frac{1}{2}$	-4988,562	5653,862	-6318,932
-6	-2824,002	3227,522	-3630,909
$-5\frac{1}{2}$	-1590,498	1835,242	-2079,911
-5	-890,479	1038,922	-1187,322
$-4\frac{1}{2}$	-495,094	585,129	-675,138
-4	-272,991	327,599	-382,193
$-3\frac{1}{2}$	-149,02	182,141	-215,254
-3	-80,342	100,431	-120,515
$-2\frac{1}{2}$	-42,639	54,823	-67,005
-2	-22,167	29,557	-36,946
$-1\frac{1}{2}$	-11,204	15,686	-20,168
-1	-5,437	8,155	-10,873
$-\frac{1}{2}$	-2,473	4,122	-5,771
0	-1	2	-3

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-1	2	-3
$\frac{1}{2}$	-0,303	0,91	-1,516
1	0	0,368	-0,736
$1\frac{1}{2}$	0,112	0,112	-0,335
2	0,135	0	-0,135
$2\frac{1}{2}$	0,123	-0,041	-0,041
3	0,1	-0,05	0
$3\frac{1}{2}$	0,075	-0,045	0,015
4	0,055	-0,037	0,018
$4\frac{1}{2}$	0,039	-0,028	0,017
5	0,027	-0,02	0,013
$5\frac{1}{2}$	0,018	-0,014	0,01
6	0,012	-0,01	0,007
$6\frac{1}{2}$	0,008	-0,007	0,005
7	0,005	-0,005	0,004

- Graph der Funktion  $f(x) = (x - 1) \cdot e^{-x}$



## Aufgabe (20)

• Gegeben die Funktion:  $f(x) = (x^2 - 4) \cdot e^{-x}$

• Kurvendiskussion

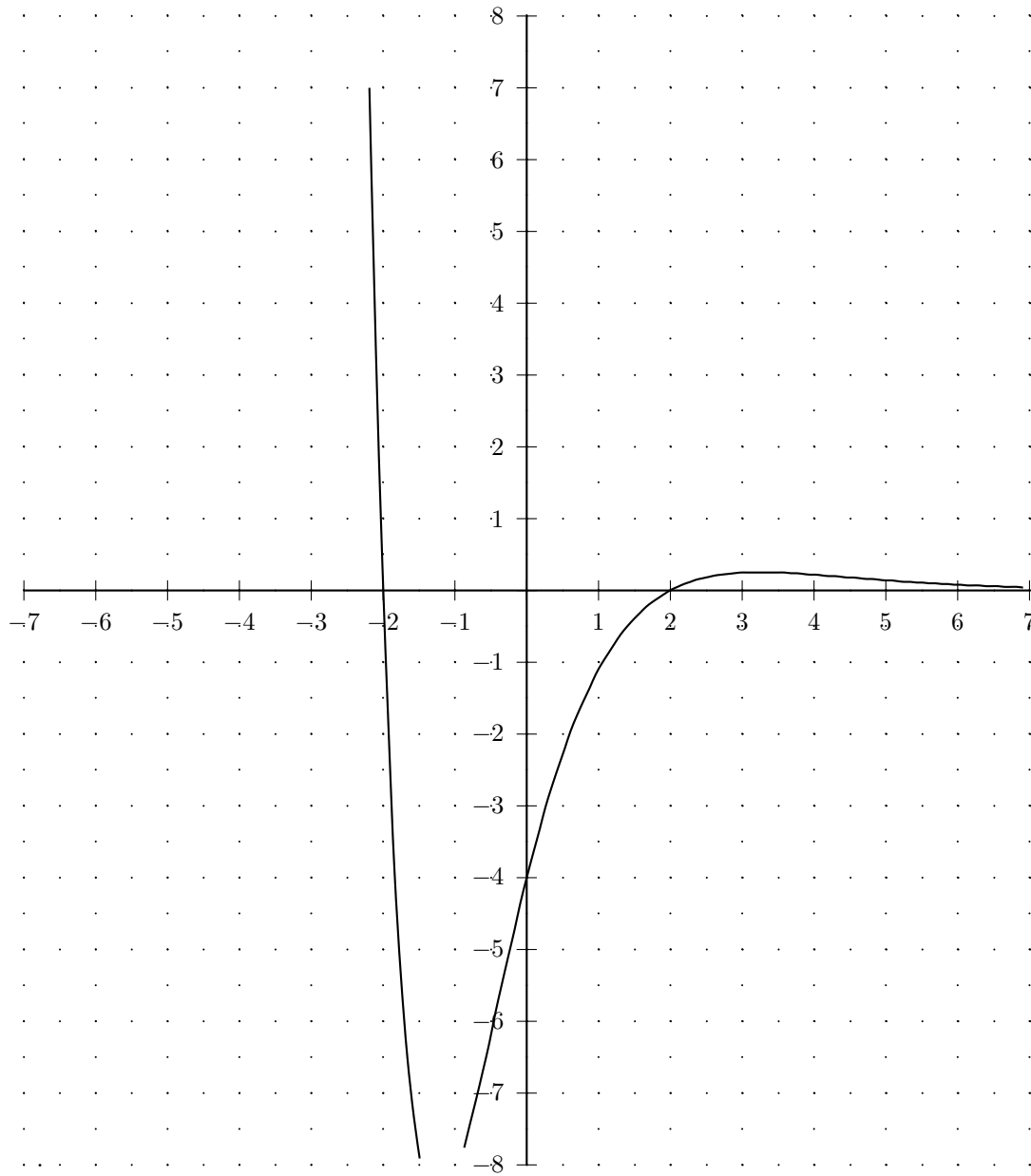
	$x$	$f(x)$
Nullstellen:	-2	-0,008
	2	0
Extremwerte:	-1,236	-8,509
	3,236	0,254
Wendepunkte:	-0,45	-5,954
	4,45	0,185

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	49348,492	-64703,67	82248,892
$-6\frac{1}{2}$	25441,667	-34089,765	44066,405
-6	12909,721	-17751,544	23399,291
$-5\frac{1}{2}$	6423,163	-9115,137	12295,998
-5	3116,676	-4601	6381,889
$-4\frac{1}{2}$	1462,778	-2273,033	3263,187
-4	655,178	-1092,015	1637,979
$-3\frac{1}{2}$	273,202	-505,037	803,068
-3	100,428	-220,954	381,635
$-2\frac{1}{2}$	27,411	-88,33	173,605
-2	0	-29,559	73,893
$-1\frac{1}{2}$	-7,843	-5,603	28,012
-1	-8,155	2,718	8,155
$-\frac{1}{2}$	-6,183	4,534	0,412
0	-4	4	-2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-4	4	-2
$\frac{1}{2}$	-2,274	2,881	-2,274
1	-1,104	1,839	-1,839
$1\frac{1}{2}$	-0,39	1,06	-1,283
2	0	0,541	-0,812
$2\frac{1}{2}$	0,185	0,226	-0,472
3	0,249	0,05	-0,249
$3\frac{1}{2}$	0,249	-0,038	-0,113
4	0,22	-0,073	-0,037
$4\frac{1}{2}$	0,181	-0,081	0,003
5	0,141	-0,074	0,02
$5\frac{1}{2}$	0,107	-0,062	0,026
6	0,079	-0,05	0,025
$6\frac{1}{2}$	0,058	-0,038	0,021
7	0,041	-0,028	0,017

- Graph der Funktion  $f(x) = (x^2 - 4) \cdot e^{-x}$



## Aufgabe (21)

• Gegeben die Funktion:  $f(x) = (x^3 - 1) \cdot e^{-x}$

• Kurvendiskussion

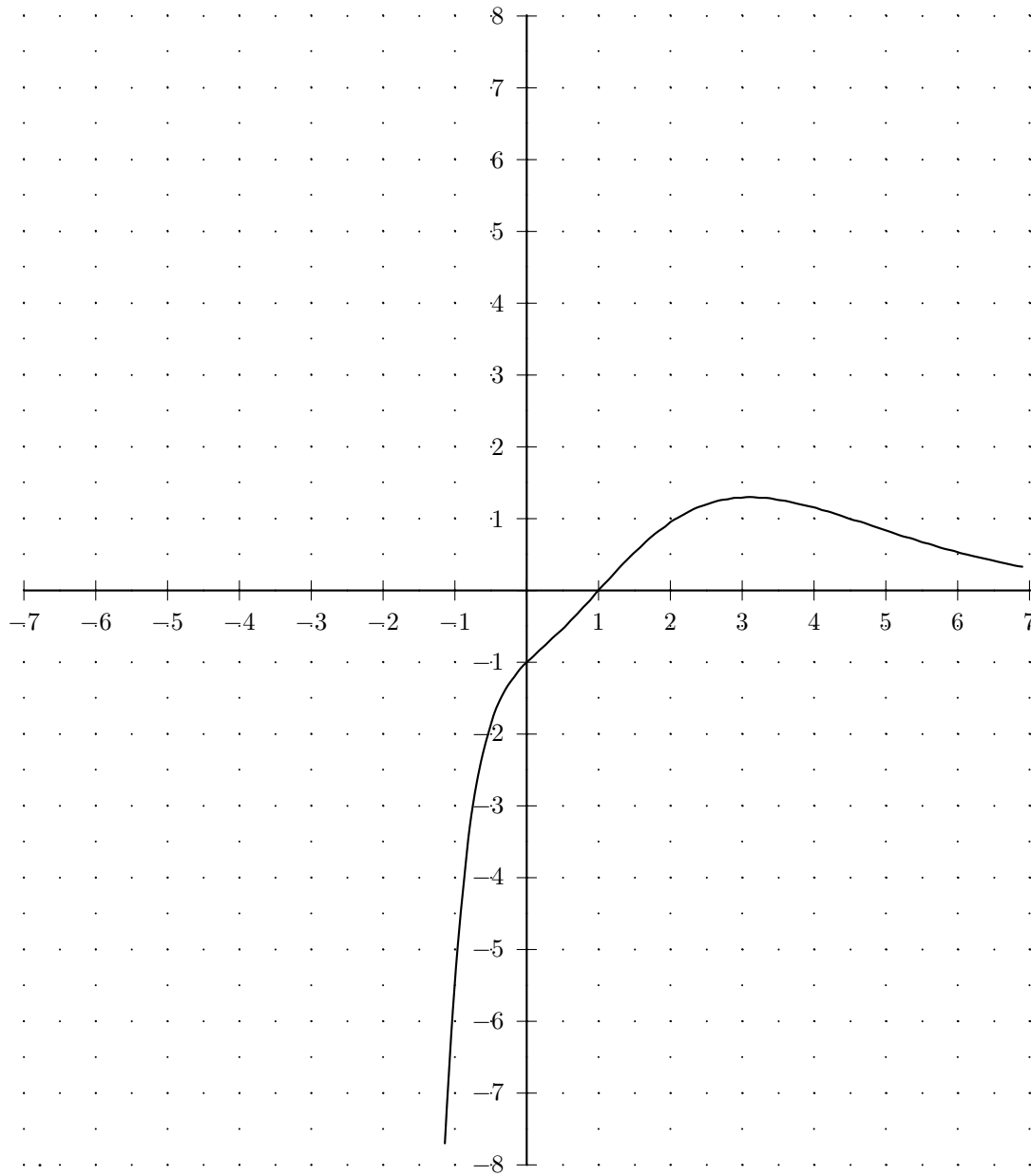
	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	3,104	1,297
Wendepunkte:	0,209 1 4,791	-0,804 0 0,905

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-377241,806	538469,694	-745725,574
$-6\frac{1}{2}$	-183329,663	267648,117	-377891,441
-6	-87544,048	131120,352	-189212,172
$-5\frac{1}{2}$	-40955,312	63164,128	-93443,82
-5	-18700,058	29832,55	-45415,487
$-4\frac{1}{2}$	-8292,828	13762,107	-21660,904
-4	-3548,88	6169 $\frac{33}{56}$	-10100,921
$-3\frac{1}{2}$	-1452,94	2670,101	-4582,479
-3	-562,395	1104,782	-2008,615
$-2\frac{1}{2}$	-202,534	430,99	-842,143
-2	-66,502	155,185	-332,52
$-1\frac{1}{2}$	-19,607	49,865	-120,451
-1	-5,437	13,594	-38,058
$-\frac{1}{2}$	-1,855	3,092	-9,275
0	-1	1	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-1	1	-1
$\frac{1}{2}$	-0,531	0,986	0,379
1	0	1,104	0
$1\frac{1}{2}$	0,53	0,976	-0,474
2	0,947	0,677	-0,677
$2\frac{1}{2}$	1,2	0,339	-0,646
3	1,294	0,05	-0,498
$3\frac{1}{2}$	1,265	-0,155	-0,321
4	1,154	-0,275	-0,165
$4\frac{1}{2}$	1,001	-0,326	-0,049
5	0,836	-0,33	0,027
$5\frac{1}{2}$	0,676	-0,305	0,069
6	0,533	-0,265	0,087
$6\frac{1}{2}$	0,411	-0,221	0,089
7	0,312	-0,178	0,082

- Graph der Funktion  $f(x) = (x^3 - 1) \cdot e^{-x}$



## Aufgabe (22)

• Gegeben die Funktion:  $f(x) = (x^4 - 1) \cdot e^{-x}$

• Kurvendiskussion

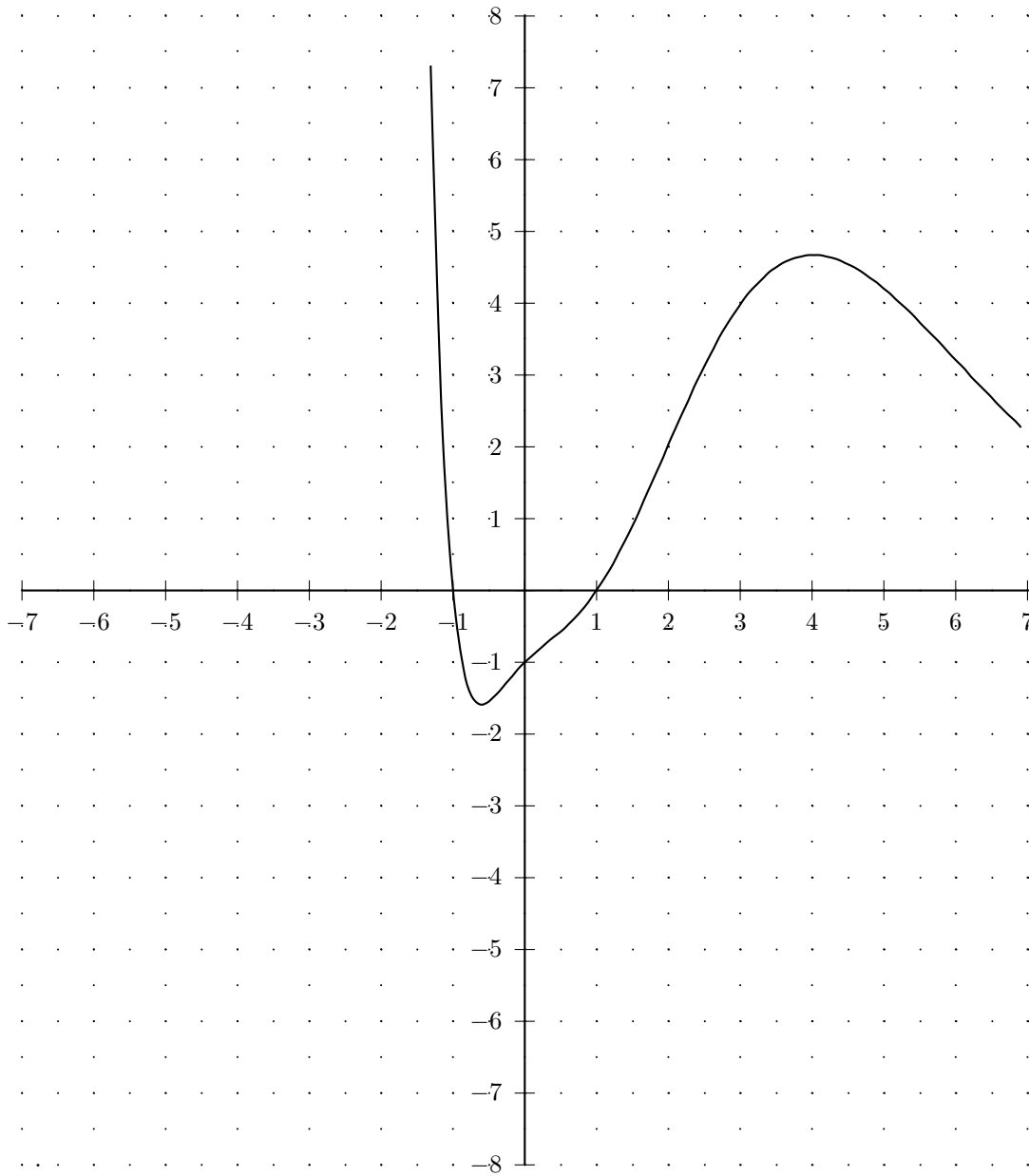
	$x$	$f(x)$
Nullstellen:	-1	0,001
	1	0
Extremwerte:	-0,602	-1,586
	4,016	4,671
Wendepunkte:	-0,266	-1,298
	0,324	-0,715
	1,934	1,878
	6,007	3,202

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	2631919,58	-4136710,44	6286051,923
$-6\frac{1}{2}$	1186654,245	-1917414,279	2985271,67
-6	522440,288	-871051,518	1393882,828
$-5\frac{1}{2}$	223663,719	-386529,134	638189,355
-5	92609,811	-166826,976	285555,214
$-4\frac{1}{2}$	36822,633	-69638,655	124323,145
-4	13922,528	-27901,754	52361,384
$-3\frac{1}{2}$	4936,272	-10616,465	21163,624
-3	1606,843	-3776,445	8114,892
$-2\frac{1}{2}$	463,696	-1225,243	2900,333
-2	110,836	-347,336	938,464
$-1\frac{1}{2}$	18,207	-78,726	260,238
-1	0	-10,878	54,372
$-\frac{1}{2}$	-1,546	0,721	5,051
0	-1	1	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-1	1	-1
$\frac{1}{2}$	-0,569	0,872	0,644
1	0	1,472	1,471
$1\frac{1}{2}$	0,906	2,106	0,906
2	2,03	2,301	-0,135
$2\frac{1}{2}$	3,124	2,006	-0,98
3	3,983	1,394	-1,394
$3\frac{1}{2}$	4,501	0,678	-1,417
4	4,67	0,018	-1,191
$4\frac{1}{2}$	4,544	-0,495	-0,855
5	4,204	-0,835	-0,512
$5\frac{1}{2}$	3,736	-1,016	-0,22
6	3,21	-1,068	-0,002
$6\frac{1}{2}$	2,682	-1,031	$\frac{14}{99}$
7	2,189	-0,937	0,222

- Graph der Funktion  $f(x) = (x^4 - 1) \cdot e^{-x}$



### 3 Logarithmusfunktionen

#### 3.1 Aufgaben

- |  |                                |
|--|--------------------------------|
| (1) $\ln(x)$                           | (13) $x^3 \cdot \ln(x)$        |
| (2) $\ln(x) + 1$                       | (14) $x^4 \cdot \ln(x)$        |
| (3) $\ln(x - 2) + 1$                   | (15) $x \cdot \ln(-x)$         |
| (4) $\ln(-x)$                          | (16) $x^2 \cdot \ln(-x)$       |
| (5) $\ln(-x) + 3$                      | (17) $x^3 \cdot \ln(-x)$       |
| (6) $\ln(2 \cdot x)$                   | (18) $x^4 \cdot \ln(-x)$       |
| (7) $\ln(\frac{1}{2} \cdot x - 1) + 1$ | (19) $(x - 1) \cdot \ln(-x)$   |
| (8) $2 \cdot \ln(x - 2) + 1$           | (20) $(x^2 - 4) \cdot \ln(-x)$ |
| (9) $\frac{1}{3} \cdot \ln(-x)$        | (21) $(x^3 - 1) \cdot \ln(-x)$ |
| (10) $-2 \cdot \ln(-x) + 3$            | (22) $(x^4 - 1) \cdot \ln(-x)$ |
| (11) $x \cdot \ln(x)$                  |                                |
| (12) $x^2 \cdot \ln(x)$                |                                |

### 3.2 Lösungen

Aufgabe (1)

• Gegeben die Funktion:  $f(x) = \ln(x)$

• Kurvendiskussion

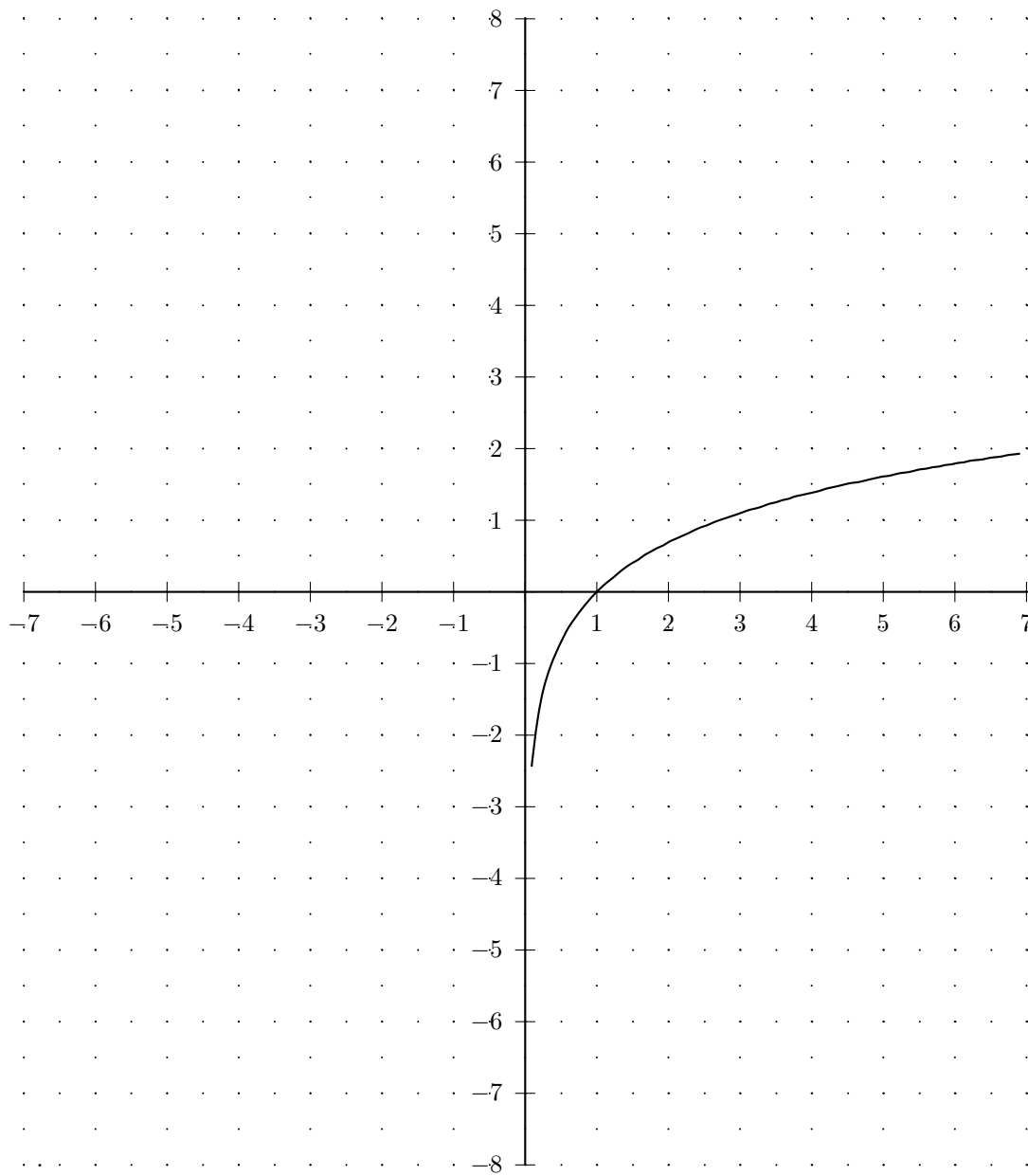
	$x$	$f(x)$
Nullstellen:	1	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	-0,693	2	-4,001
1	0	1	-1
$1\frac{1}{2}$	0,405	0,667	-0,444
2	0,693	0,5	-0,25
$2\frac{1}{2}$	0,916	0,4	-0,16
3	1,099	0,333	$-\frac{1}{9}$
$3\frac{1}{2}$	1,253	0,286	$-\frac{4}{49}$
4	1,386	$\frac{1}{4}$	$-\frac{1}{16}$
$4\frac{1}{2}$	1,504	$\frac{2}{9}$	$-\frac{4}{81}$
5	1,609	$\frac{1}{5}$	$-\frac{1}{25}$
$5\frac{1}{2}$	1,705	$\frac{2}{11}$	-0,033
6	1,792	$\frac{1}{6}$	$-\frac{1}{36}$
$6\frac{1}{2}$	1,872	$\frac{2}{13}$	-0,024
7	1,946	$\frac{1}{7}$	$-\frac{1}{49}$

•Graph der Funktion  $f(x) = \ln(x)$



Aufgabe (2)

• Gegeben die Funktion:  $f(x) = \ln(x) + 1$

• Kurvendiskussion

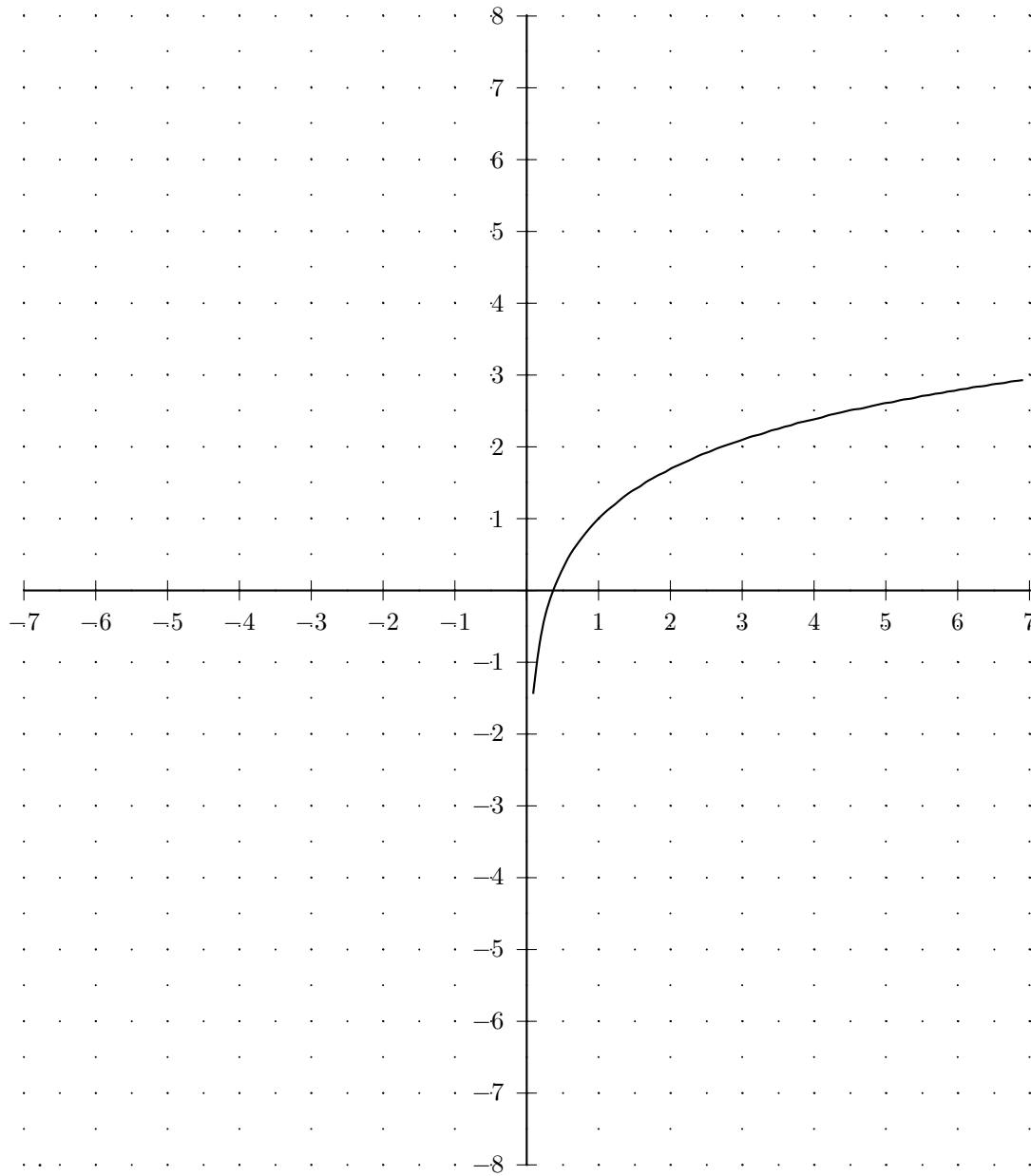
	$x$	$f(x)$
Nullstellen:	0,368	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	0,307	2	-4,001
1	1	1	-1
$1\frac{1}{2}$	1,405	0,667	-0,444
2	1,693	0,5	-0,25
$2\frac{1}{2}$	1,916	0,4	-0,16
3	2,099	0,333	$-\frac{1}{9}$
$3\frac{1}{2}$	2,253	0,286	$-\frac{4}{49}$
4	2,386	$\frac{1}{4}$	$-\frac{1}{16}$
$4\frac{1}{2}$	2,504	$\frac{2}{9}$	$-\frac{4}{81}$
5	2,609	$\frac{1}{5}$	$-\frac{1}{25}$
$5\frac{1}{2}$	2,705	$\frac{2}{11}$	-0,033
6	2,792	$\frac{1}{6}$	$-\frac{1}{36}$
$6\frac{1}{2}$	2,872	$\frac{2}{13}$	-0,024
7	2,946	$\frac{1}{7}$	$-\frac{1}{49}$

•Graph der Funktion  $f(x) = \ln(x) + 1$



## Aufgabe (3)

• Gegeben die Funktion:  $f(x) = \ln(x - 2) + 1$

• Kurvendiskussion

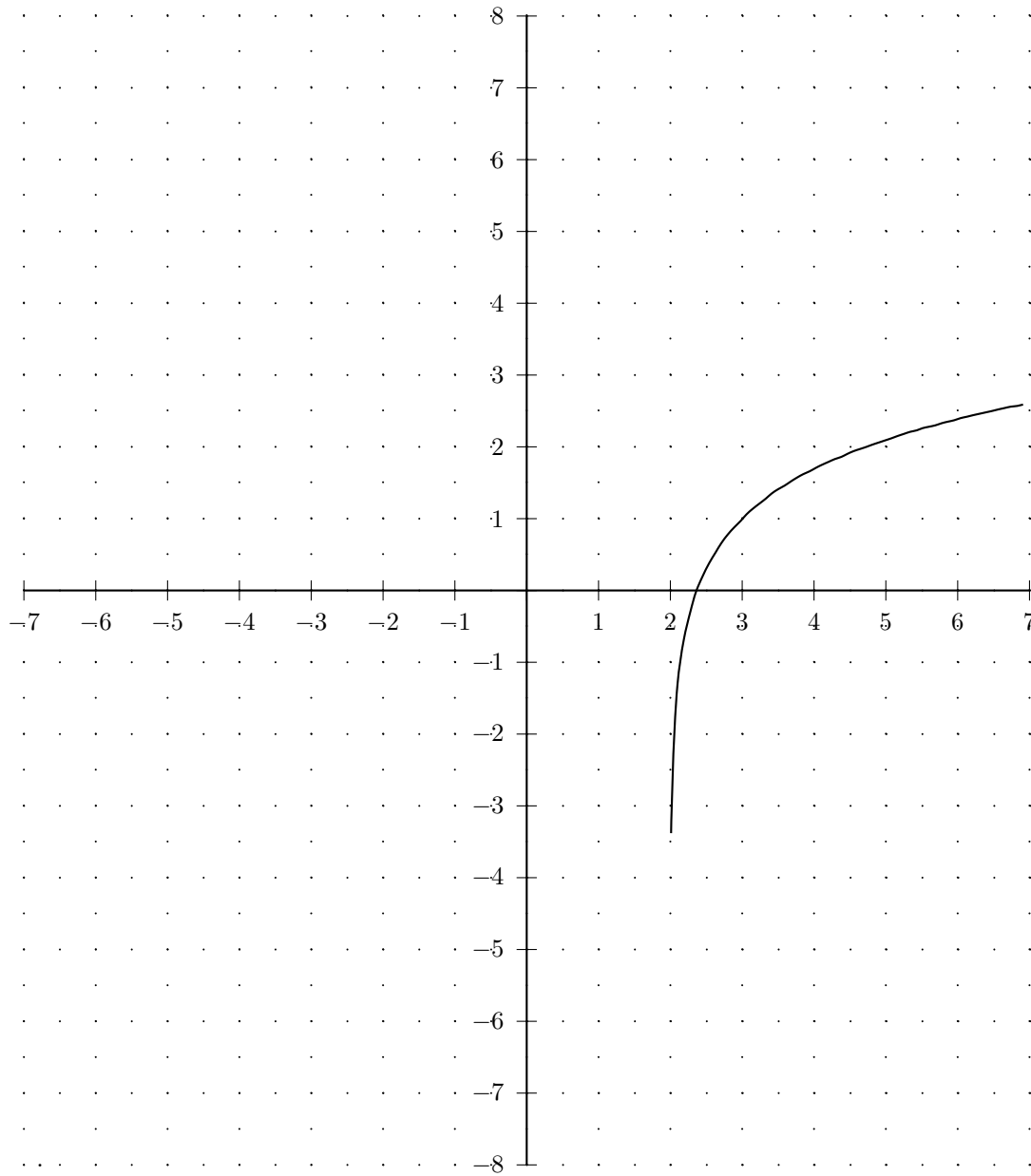
	$x$	$f(x)$
Nullstellen:	2,368	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	0,307	2	-4,001
3	1	1	-1
$3\frac{1}{2}$	1,405	0,667	-0,444
4	1,693	0,5	-0,25
$4\frac{1}{2}$	1,916	0,4	-0,16
5	2,099	0,333	$-\frac{1}{9}$
$5\frac{1}{2}$	2,253	0,286	$-\frac{4}{49}$
6	2,386	$\frac{1}{4}$	$-\frac{1}{16}$
$6\frac{1}{2}$	2,504	$\frac{2}{9}$	$-\frac{4}{81}$
7	2,609	$\frac{1}{5}$	$-\frac{1}{25}$

•Graph der Funktion  $f(x) = \ln(x - 2) + 1$



## Aufgabe (4)

• Gegeben die Funktion:  $f(x) = \ln(-x)$

• Kurvendiskussion

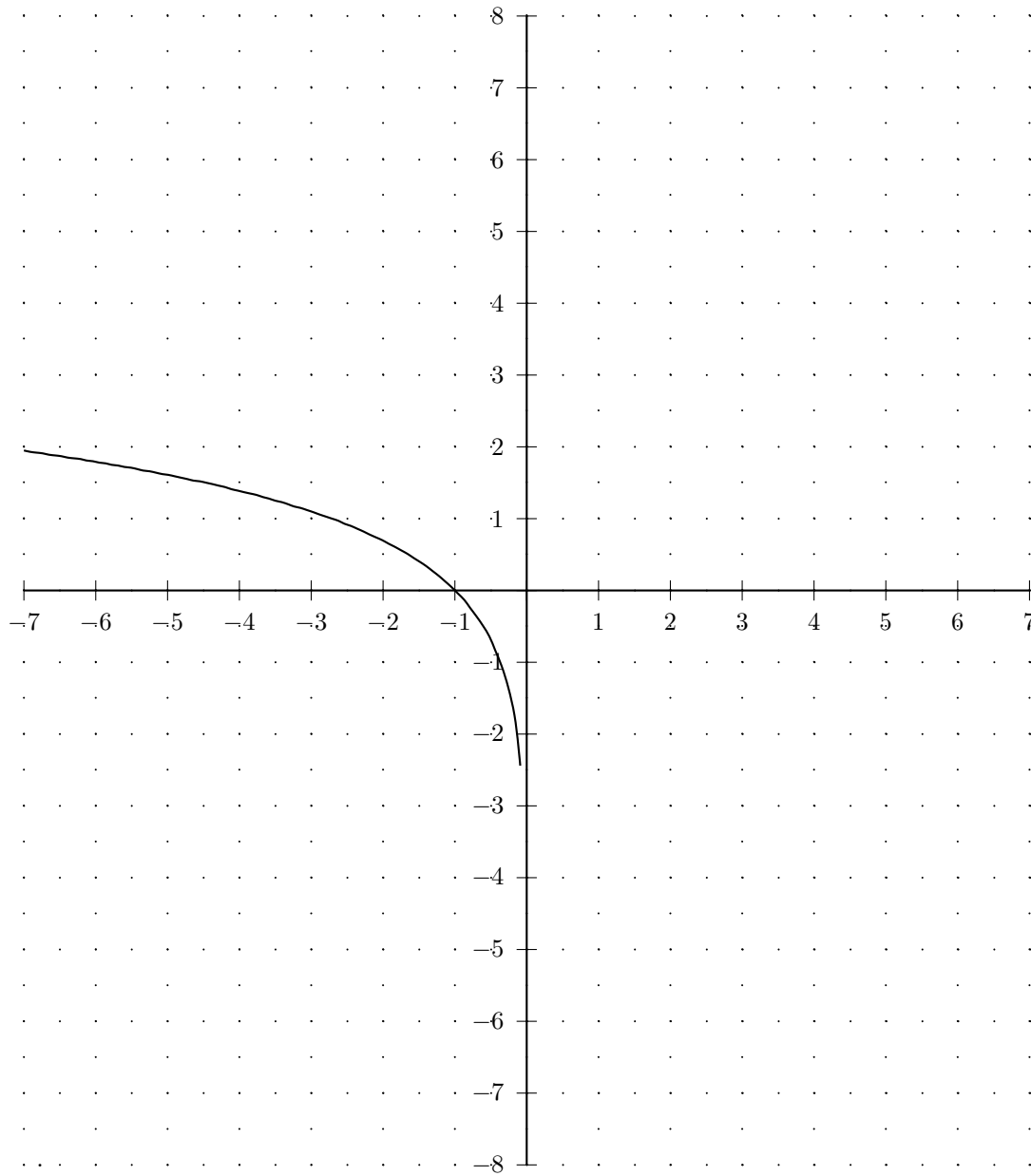
	$x$	$f(x)$
Nullstellen:	-1	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,946	$-\frac{1}{7}$	$-\frac{1}{49}$
$-6\frac{1}{2}$	1,872	$-\frac{2}{13}$	-0,024
-6	1,792	$-\frac{1}{6}$	$-\frac{1}{36}$
$-5\frac{1}{2}$	1,705	$-\frac{2}{11}$	-0,033
-5	1,609	$-\frac{1}{5}$	$-\frac{1}{25}$
$-4\frac{1}{2}$	1,504	$-\frac{2}{9}$	$-\frac{4}{81}$
-4	1,386	$-\frac{1}{4}$	$-\frac{1}{16}$
$-3\frac{1}{2}$	1,253	-0,286	$-\frac{4}{49}$
-3	1,099	-0,333	$-\frac{1}{9}$
$-2\frac{1}{2}$	0,916	-0,4	-0,16
-2	0,693	-0,5	-0,25
$-1\frac{1}{2}$	0,405	-0,667	-0,444
-1	0	-1	-1
$-\frac{1}{2}$	-0,693	-2	-4,001
0	-unendlich	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-unendlich	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

•Graph der Funktion  $f(x) = \ln(-x)$



## Aufgabe (5)

• Gegeben die Funktion:  $f(x) = \ln(-x) + 3$

• Kurvendiskussion

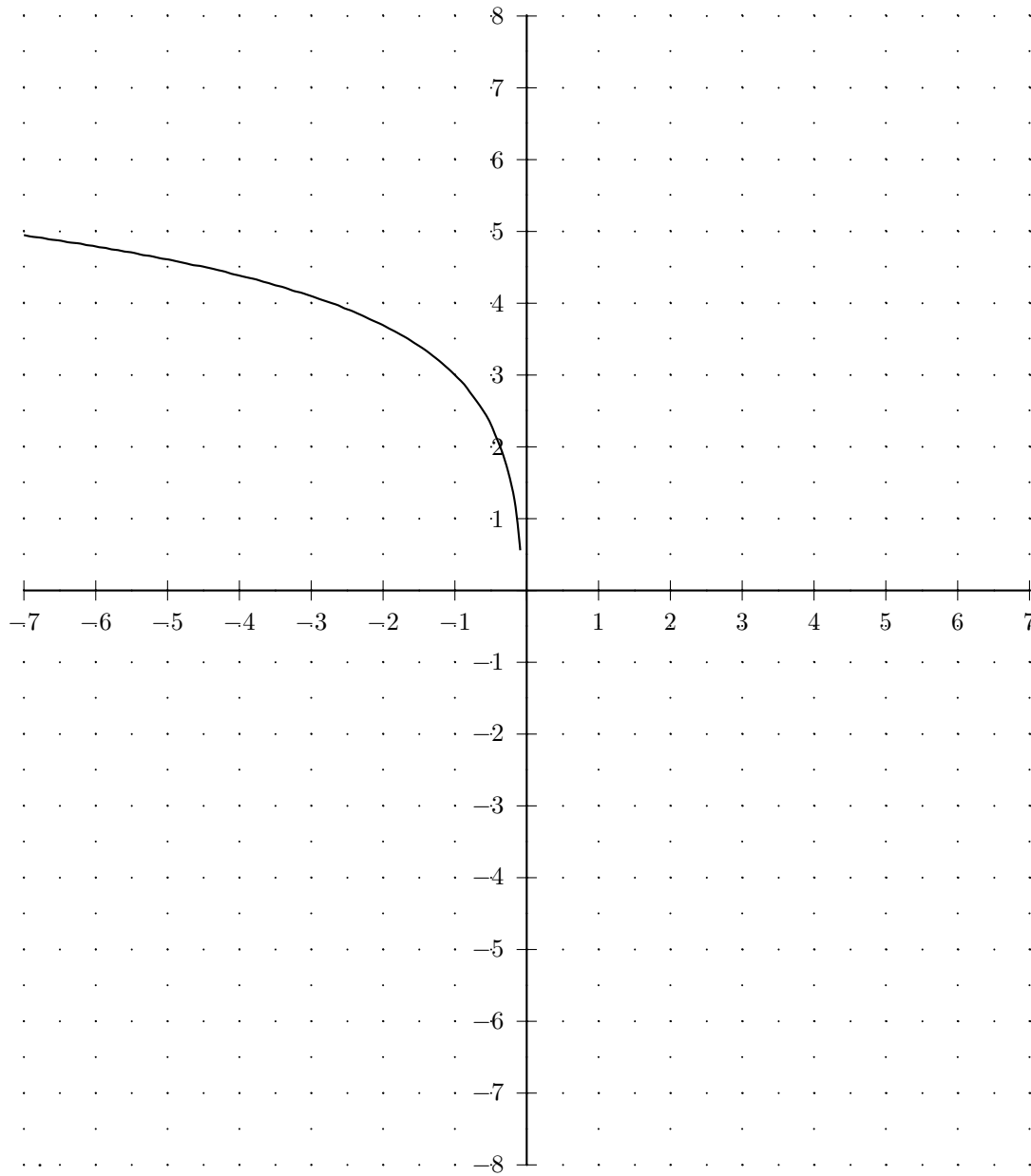
	$x$	$f(x)$
Nullstellen:	-0,05	0,003

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	4,946	$-\frac{1}{7}$	$-\frac{1}{49}$
$-6\frac{1}{2}$	4,872	$-\frac{2}{13}$	-0,024
-6	4,792	$-\frac{1}{6}$	$-\frac{1}{36}$
$-5\frac{1}{2}$	4,705	$-\frac{2}{11}$	-0,033
-5	4,609	$-\frac{1}{5}$	$-\frac{1}{25}$
$-4\frac{1}{2}$	4,504	$-\frac{2}{9}$	$-\frac{4}{81}$
-4	4,386	$-\frac{1}{4}$	$-\frac{1}{16}$
$-3\frac{1}{2}$	4,253	-0,286	$-\frac{4}{49}$
-3	4,099	-0,333	$-\frac{1}{9}$
$-2\frac{1}{2}$	3,916	-0,4	-0,16
-2	3,693	-0,5	-0,25
$-1\frac{1}{2}$	3,405	-0,667	-0,444
-1	3	-1	-1
$-\frac{1}{2}$	2,307	-2	-4,001
0	-unendlich	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-unendlich	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

- Graph der Funktion  $f(x) = \ln(-x) + 3$



## Aufgabe (6)

• Gegeben die Funktion:  $f(x) = \ln(2 \cdot x)$

• Kurvendiskussion

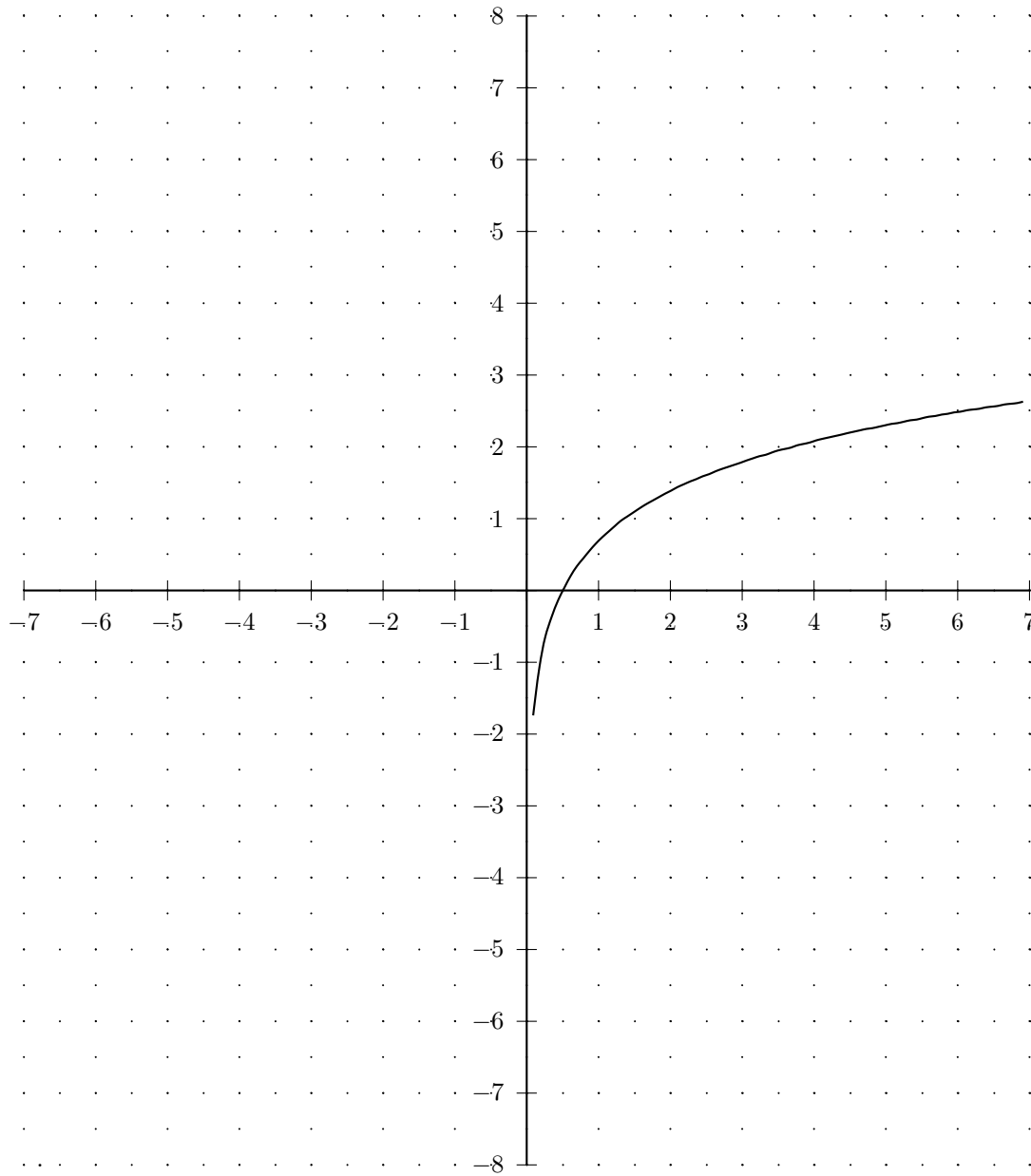
	$x$	$f(x)$
Nullstellen:	0,5	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	0	2	-4,001
1	0,693	1	-1
$1\frac{1}{2}$	1,099	0,667	-0,444
2	1,386	0,5	-0,25
$2\frac{1}{2}$	1,609	0,4	-0,16
3	1,792	0,333	$-\frac{1}{9}$
$3\frac{1}{2}$	1,946	0,286	$-\frac{4}{49}$
4	2,079	$\frac{1}{4}$	$-\frac{1}{16}$
$4\frac{1}{2}$	2,197	$\frac{2}{9}$	$-\frac{4}{81}$
5	2,303	$\frac{1}{5}$	$-\frac{1}{25}$
$5\frac{1}{2}$	2,398	$\frac{2}{11}$	-0,033
6	2,485	$\frac{1}{6}$	$-\frac{1}{36}$
$6\frac{1}{2}$	2,565	$\frac{2}{13}$	-0,024
7	2,639	$\frac{1}{7}$	$-\frac{1}{49}$

- Graph der Funktion  $f(x) = \ln(2 \cdot x)$



## Aufgabe (7)

• Gegeben die Funktion:  $f(x) = \ln\left(\frac{1}{2} \cdot x - 1\right) + 1$

• Kurvendiskussion

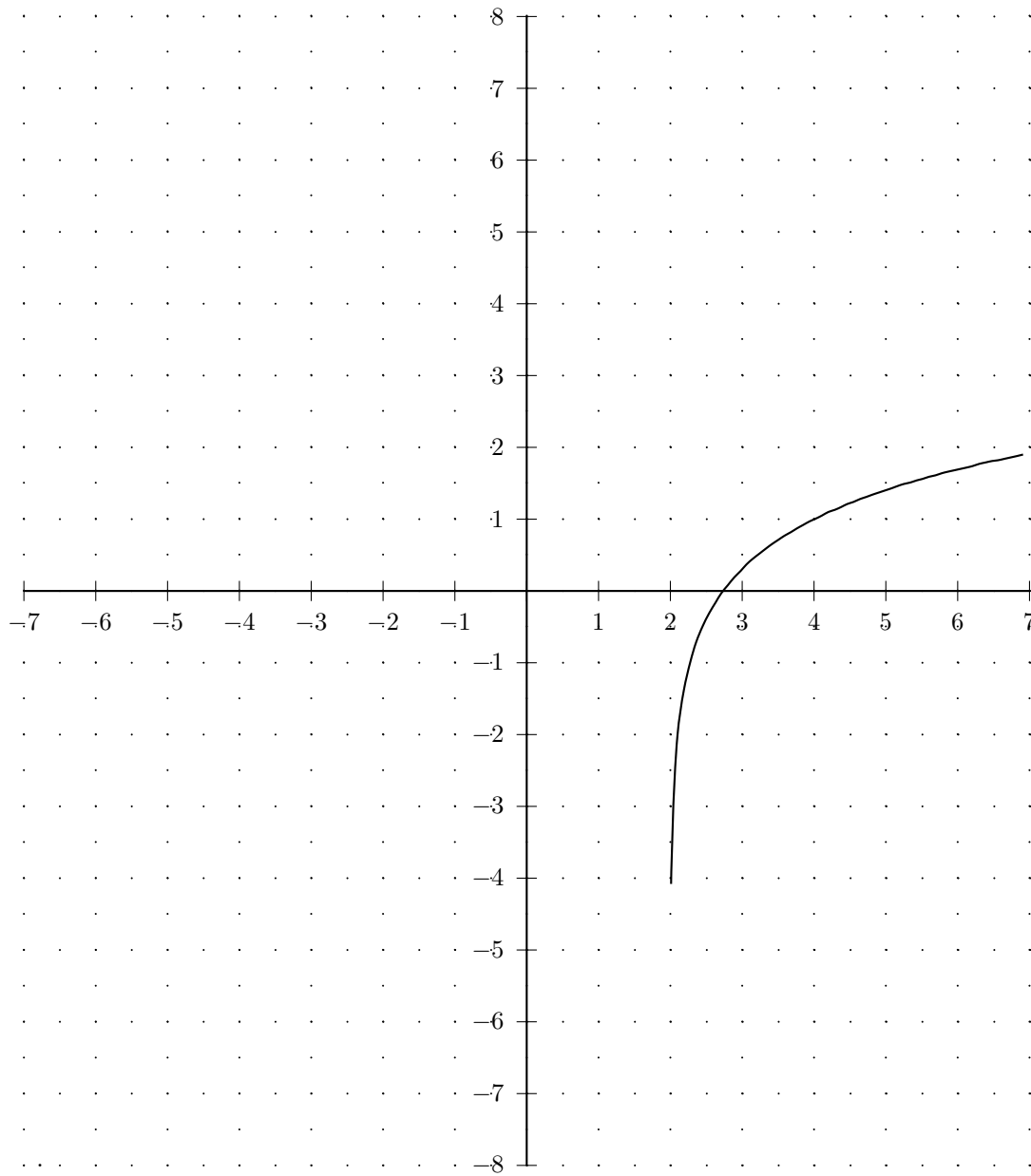
	$x$	$f(x)$
Nullstellen:	2,735	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	-0,386	2	-4,001
3	0,307	1	-1
$3\frac{1}{2}$	0,712	0,667	-0,444
4	1	0,5	-0,25
$4\frac{1}{2}$	1,223	0,4	-0,16
5	1,405	0,333	$-\frac{1}{9}$
$5\frac{1}{2}$	1,56	0,286	$-\frac{4}{49}$
6	1,693	$\frac{1}{4}$	$-\frac{1}{16}$
$6\frac{1}{2}$	1,811	$\frac{2}{9}$	$-\frac{4}{81}$
7	1,916	$\frac{1}{5}$	$-\frac{1}{25}$

•Graph der Funktion  $f(x) = \ln\left(\frac{1}{2} \cdot x - 1\right) + 1$



Aufgabe (8)

• Gegeben die Funktion:  $f(x) = 2 \cdot \ln(x - 2) + 1$

• Kurvendiskussion

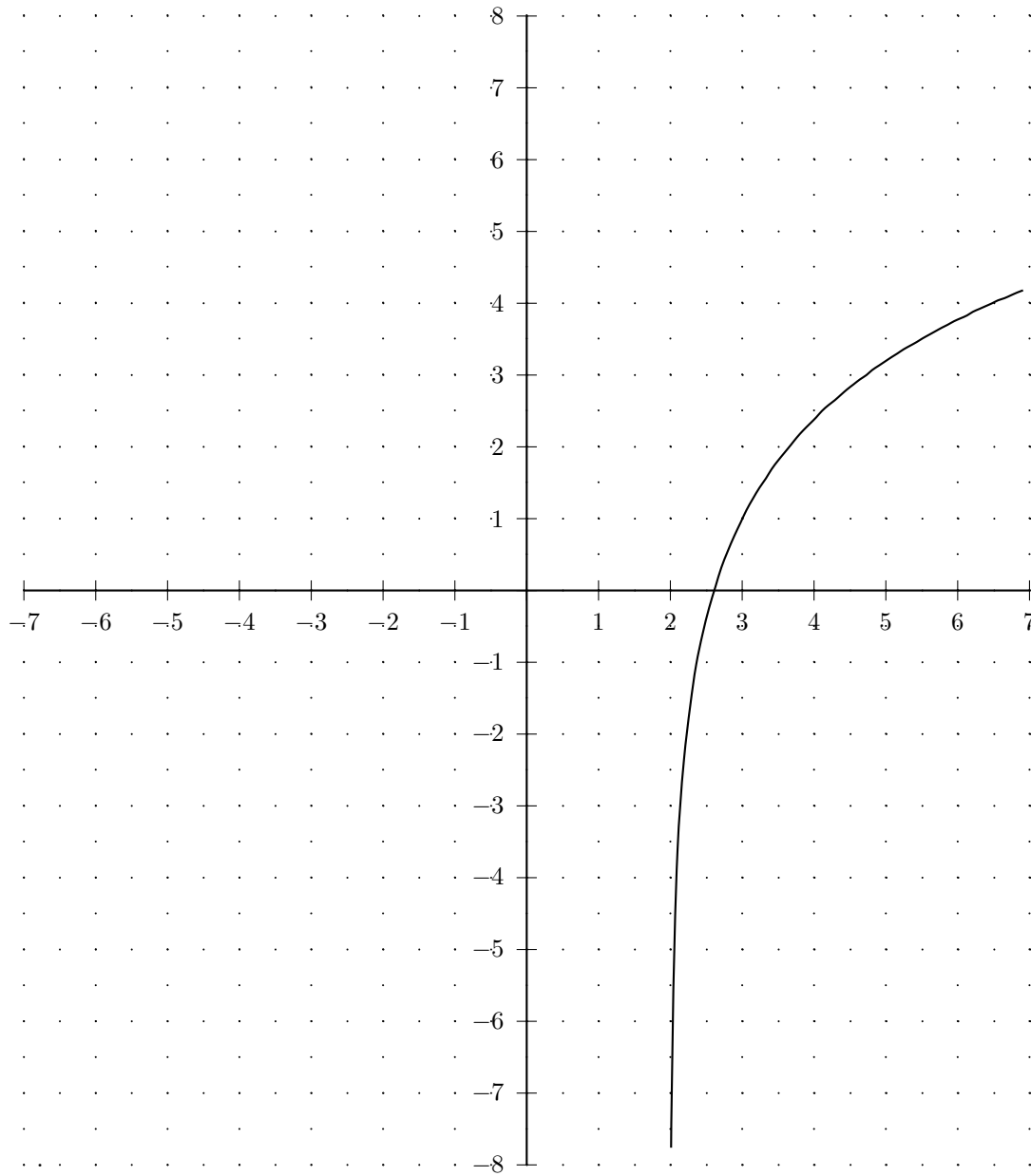
	$x$	$f(x)$
Nullstellen:	2,606	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>-unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	-0,386	4,001	-8,002
3	1	2	-2
$3\frac{1}{2}$	1,811	1,333	-0,889
4	2,386	1	-0,5
$4\frac{1}{2}$	2,833	0,8	-0,32
5	3,197	0,667	-0,222
$5\frac{1}{2}$	3,506	0,571	$-\frac{8}{49}$
6	3,773	0,5	$-\frac{1}{8}$
$6\frac{1}{2}$	4,008	$\frac{4}{9}$	$-\frac{8}{81}$
7	4,219	$\frac{2}{5}$	$-\frac{2}{25}$

•Graph der Funktion  $f(x) = 2 \cdot \ln(x - 2) + 1$



## Aufgabe (9)

• Gegeben die Funktion:  $f(x) = \frac{1}{3} \cdot \ln(-x)$

• Kurvendiskussion

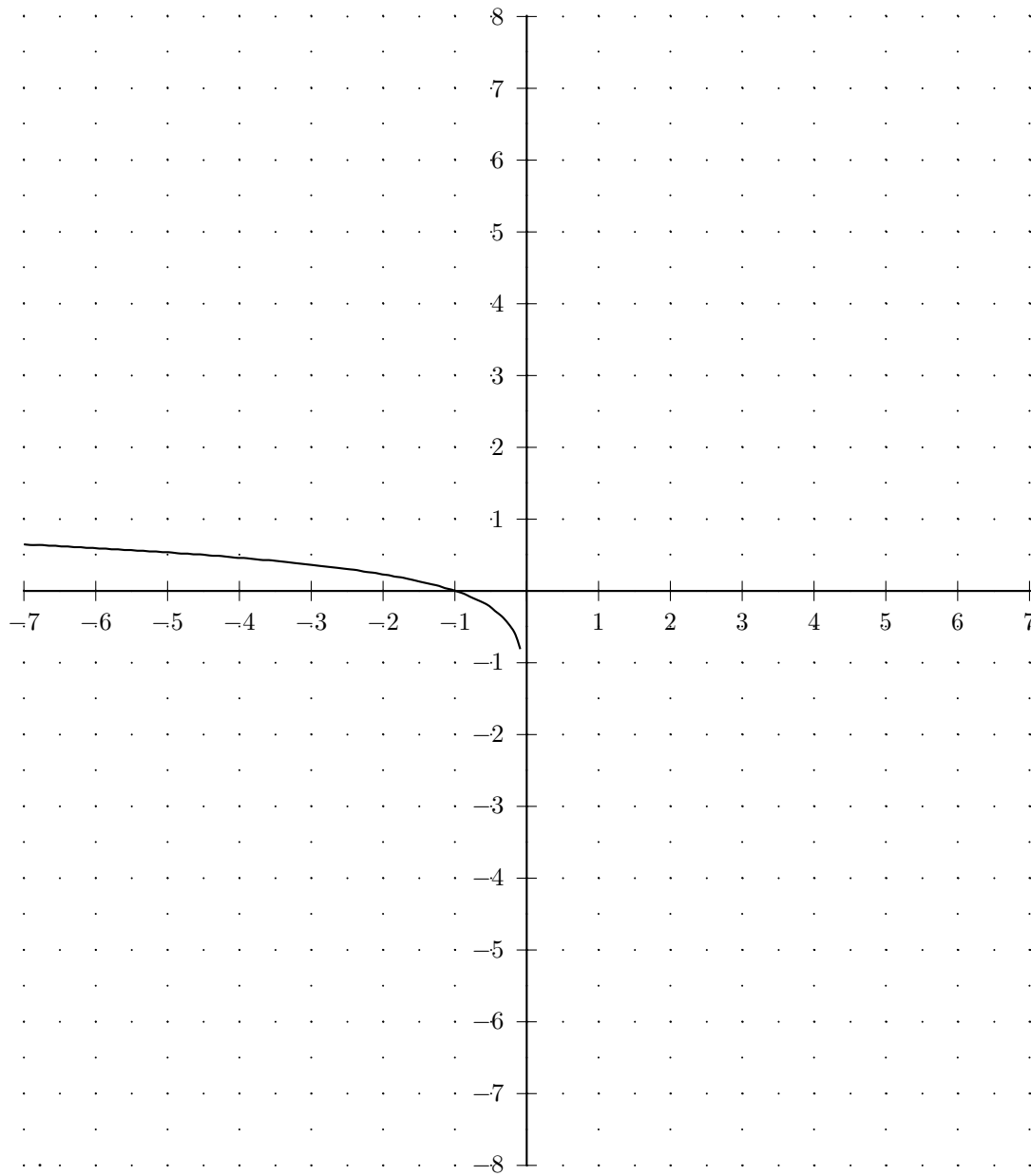
	$x$	$f(x)$
Nullstellen:	-1	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,649	$-\frac{1}{21}$	-0,007
$-6\frac{1}{2}$	0,624	$-\frac{2}{39}$	-0,008
-6	0,597	$-\frac{1}{18}$	-0,009
$-5\frac{1}{2}$	0,568	$-\frac{2}{33}$	-0,011
-5	0,536	$-\frac{1}{15}$	$-\frac{1}{75}$
$-4\frac{1}{2}$	0,501	$-\frac{2}{27}$	-0,016
-4	0,462	$-\frac{1}{12}$	$-\frac{1}{48}$
$-3\frac{1}{2}$	0,418	$-\frac{2}{21}$	-0,027
-3	0,366	$-\frac{1}{9}$	$-\frac{1}{27}$
$-2\frac{1}{2}$	0,305	$-\frac{2}{15}$	$-\frac{4}{75}$
-2	0,231	-0,167	-0,083
$-1\frac{1}{2}$	0,135	-0,222	-0,148
-1	0	-0,333	-0,333
$-\frac{1}{2}$	-0,231	-0,667	-1,334
0	-unendlich	n.def.	n.def.

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-unendlich	n.def.	n.def.
$\frac{1}{2}$	n.def.	n.def.	n.def.
1	n.def.	n.def.	n.def.
$1\frac{1}{2}$	n.def.	n.def.	n.def.
2	n.def.	n.def.	n.def.
$2\frac{1}{2}$	n.def.	n.def.	n.def.
3	n.def.	n.def.	n.def.
$3\frac{1}{2}$	n.def.	n.def.	n.def.
4	n.def.	n.def.	n.def.
$4\frac{1}{2}$	n.def.	n.def.	n.def.
5	n.def.	n.def.	n.def.
$5\frac{1}{2}$	n.def.	n.def.	n.def.
6	n.def.	n.def.	n.def.
$6\frac{1}{2}$	n.def.	n.def.	n.def.
7	n.def.	n.def.	n.def.

- Graph der Funktion  $f(x) = \frac{1}{3} \cdot \ln(-x)$



Aufgabe (10)

• Gegeben die Funktion:  $f(x) = -2 \cdot \ln(-x) + 3$

• Kurvendiskussion

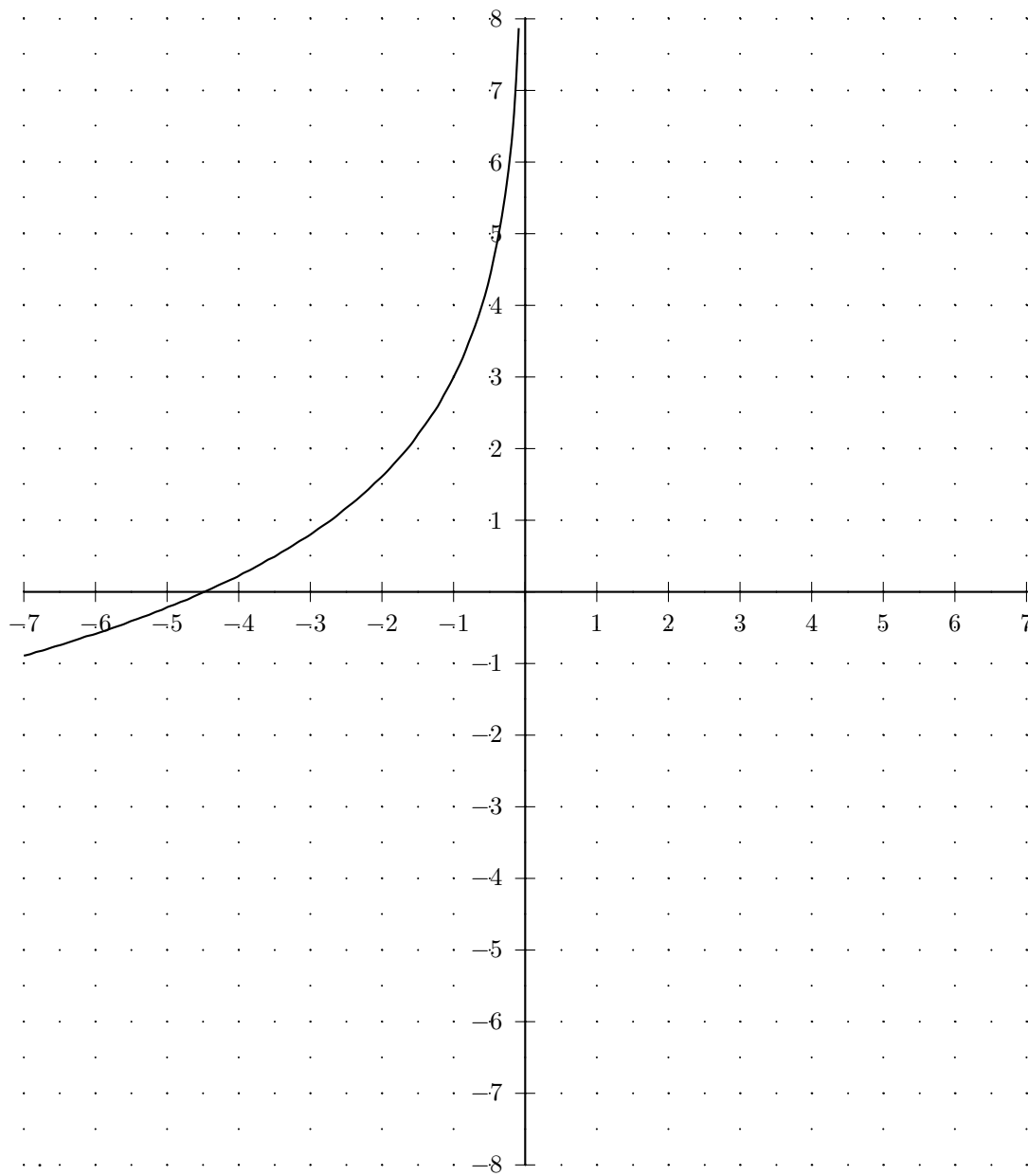
	$x$	$f(x)$
Nullstellen:	-4,482	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,892	$\frac{2}{7}$	$\frac{2}{49}$
$-6\frac{1}{2}$	-0,744	$\frac{4}{13}$	0,047
-6	-0,584	$\frac{1}{3}$	$\frac{1}{18}$
$-5\frac{1}{2}$	-0,409	$\frac{4}{11}$	0,066
-5	-0,219	$\frac{2}{5}$	$\frac{2}{25}$
$-4\frac{1}{2}$	-0,008	$\frac{4}{9}$	$\frac{8}{81}$
-4	0,227	0,5	$\frac{1}{8}$
$-3\frac{1}{2}$	0,494	0,571	$\frac{8}{49}$
-3	0,803	0,667	0,222
$-2\frac{1}{2}$	1,167	0,8	0,32
-2	1,614	1	0,5
$-1\frac{1}{2}$	2,189	1,333	0,889
-1	3	2	2
$-\frac{1}{2}$	4,386	4,001	8,002
0	+unendlich	n.def.	n.def.

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	+unendlich	n.def.	n.def.
$\frac{1}{2}$	n.def.	n.def.	n.def.
1	n.def.	n.def.	n.def.
$1\frac{1}{2}$	n.def.	n.def.	n.def.
2	n.def.	n.def.	n.def.
$2\frac{1}{2}$	n.def.	n.def.	n.def.
3	n.def.	n.def.	n.def.
$3\frac{1}{2}$	n.def.	n.def.	n.def.
4	n.def.	n.def.	n.def.
$4\frac{1}{2}$	n.def.	n.def.	n.def.
5	n.def.	n.def.	n.def.
$5\frac{1}{2}$	n.def.	n.def.	n.def.
6	n.def.	n.def.	n.def.
$6\frac{1}{2}$	n.def.	n.def.	n.def.
7	n.def.	n.def.	n.def.

- Graph der Funktion  $f(x) = -2 \cdot \ln(-x) + 3$



Aufgabe (11)

• Gegeben die Funktion:  $f(x) = x \cdot \ln(x)$

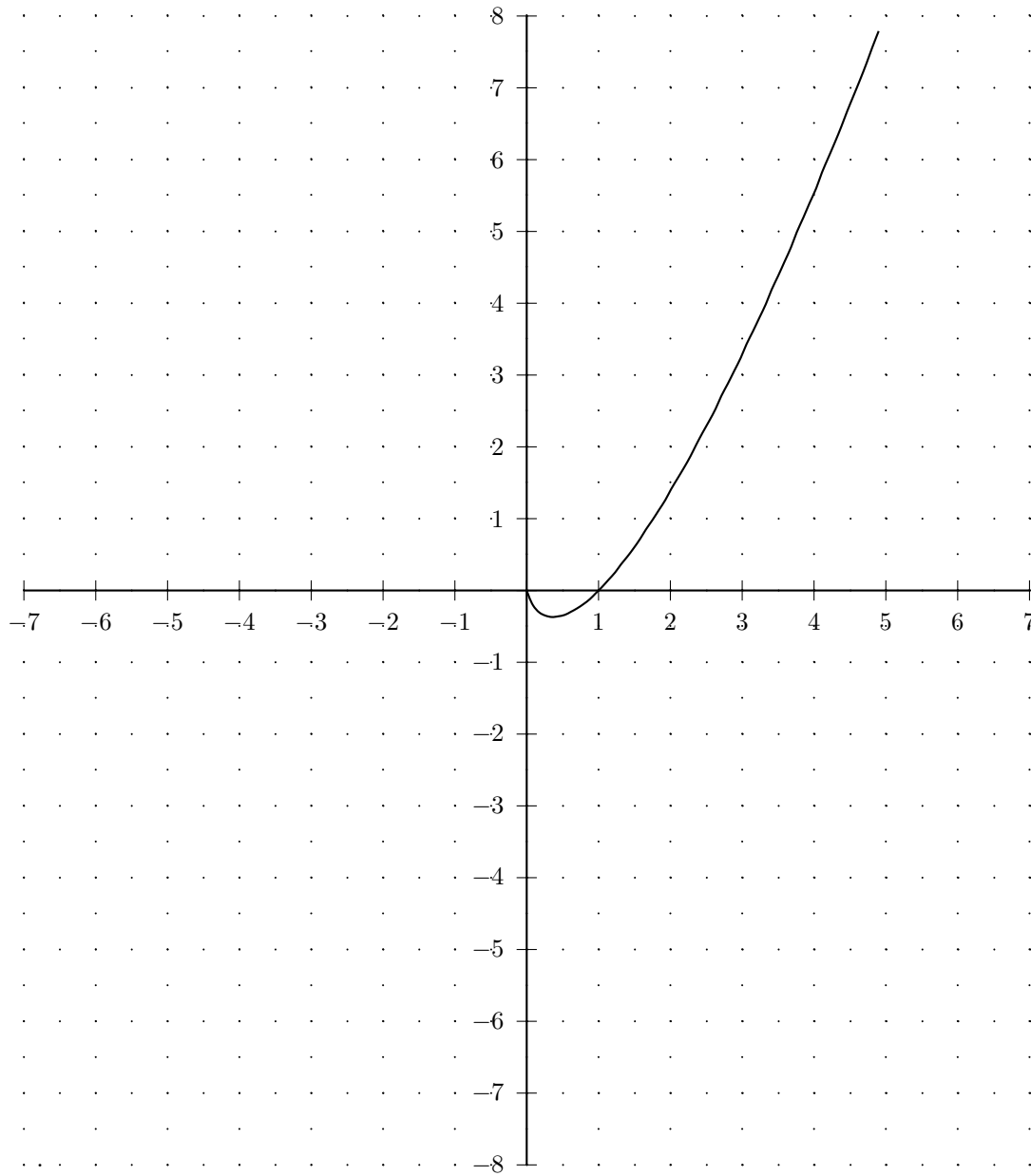
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	0 0,368	0 -0,368
Wendepunkte:	-0,023	<i>n.def.</i>

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$\frac{1}{2}$	-0,347	0,307	2
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	1	0	1	1
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$1\frac{1}{2}$	0,608	1,405	0,667
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	2	1,386	1,693	0,5
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$2\frac{1}{2}$	2,291	1,916	0,4
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	3	3,296	2,099	$\frac{1}{3}$
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$3\frac{1}{2}$	4,385	2,253	$\frac{2}{7}$
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	4	5,545	2,386	$\frac{1}{4}$
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$4\frac{1}{2}$	6,768	2,504	$\frac{2}{9}$
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	5	8,047	2,609	$\frac{1}{5}$
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$5\frac{1}{2}$	9,376	2,705	$\frac{2}{11}$
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	6	10,751	2,792	$\frac{1}{6}$
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$6\frac{1}{2}$	12,167	2,872	$\frac{2}{13}$
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	13,621	2,946	$\frac{1}{7}$

•Graph der Funktion  $f(x) = x \cdot \ln(x)$



## Aufgabe (12)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \ln(x)$

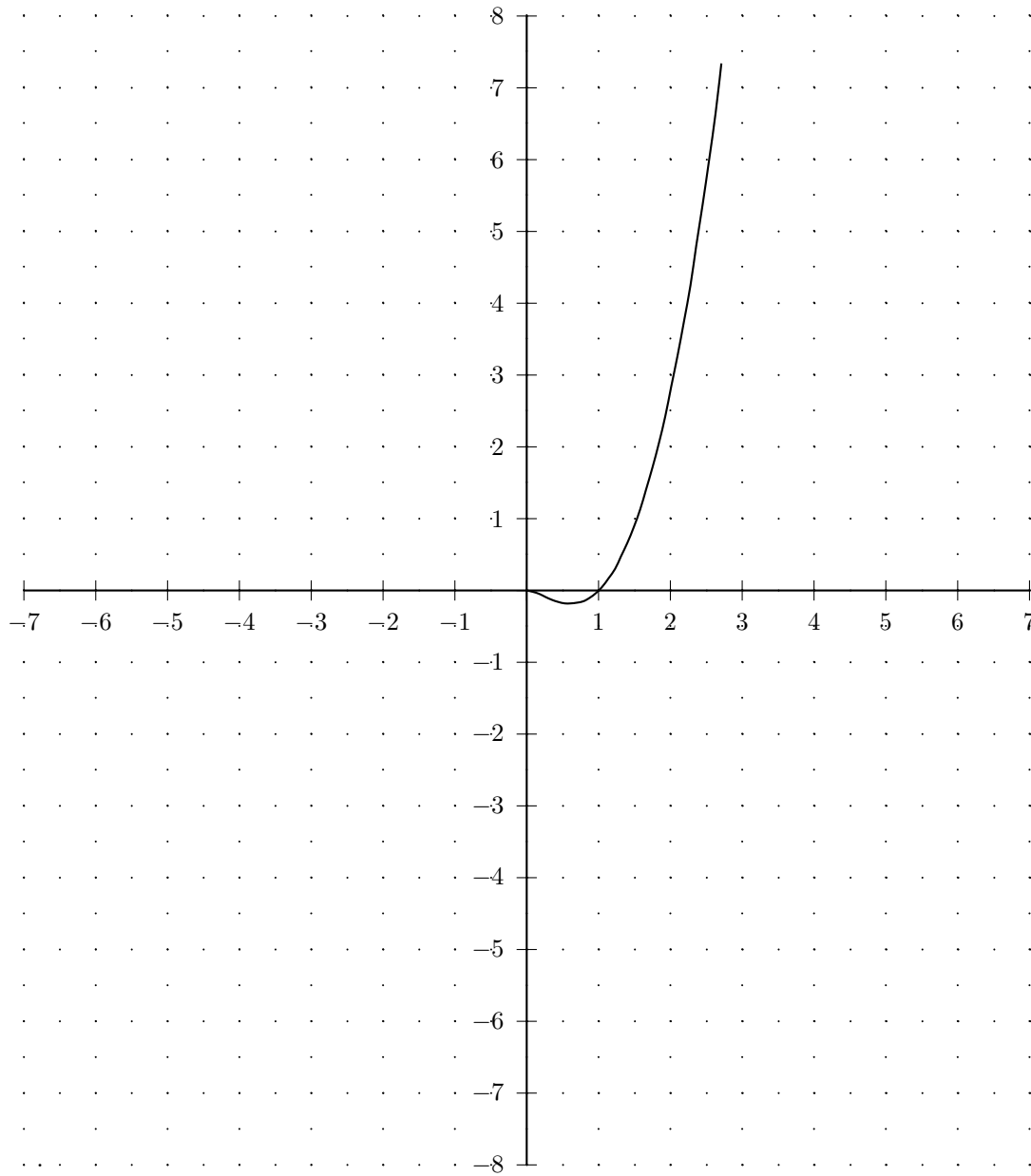
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	0 0,607	0 -0,184
Wendepunkte:	0,223	-0,075

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$\frac{1}{2}$	-0,173	-0,193	1,614
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	1	0	1	3
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$1\frac{1}{2}$	0,912	2,716	3,811
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	2	2,773	4,773	4,386
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$2\frac{1}{2}$	5,727	7,081	4,833
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	3	9,888	9,592	5,197
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$3\frac{1}{2}$	15,346	12,269	5,506
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	4	22,181	15,09	5,773
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$4\frac{1}{2}$	30,458	18,037	6,008
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	5	40,236	21,094	6,219
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$5\frac{1}{2}$	51,569	24,252	6,409
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	6	64,503	27,501	6,584
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$6\frac{1}{2}$	79,084	30,833	6,744
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	95,35	34,243	6,892

•Graph der Funktion  $f(x) = x^2 \cdot \ln(x)$



## Aufgabe (13)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \ln(x)$

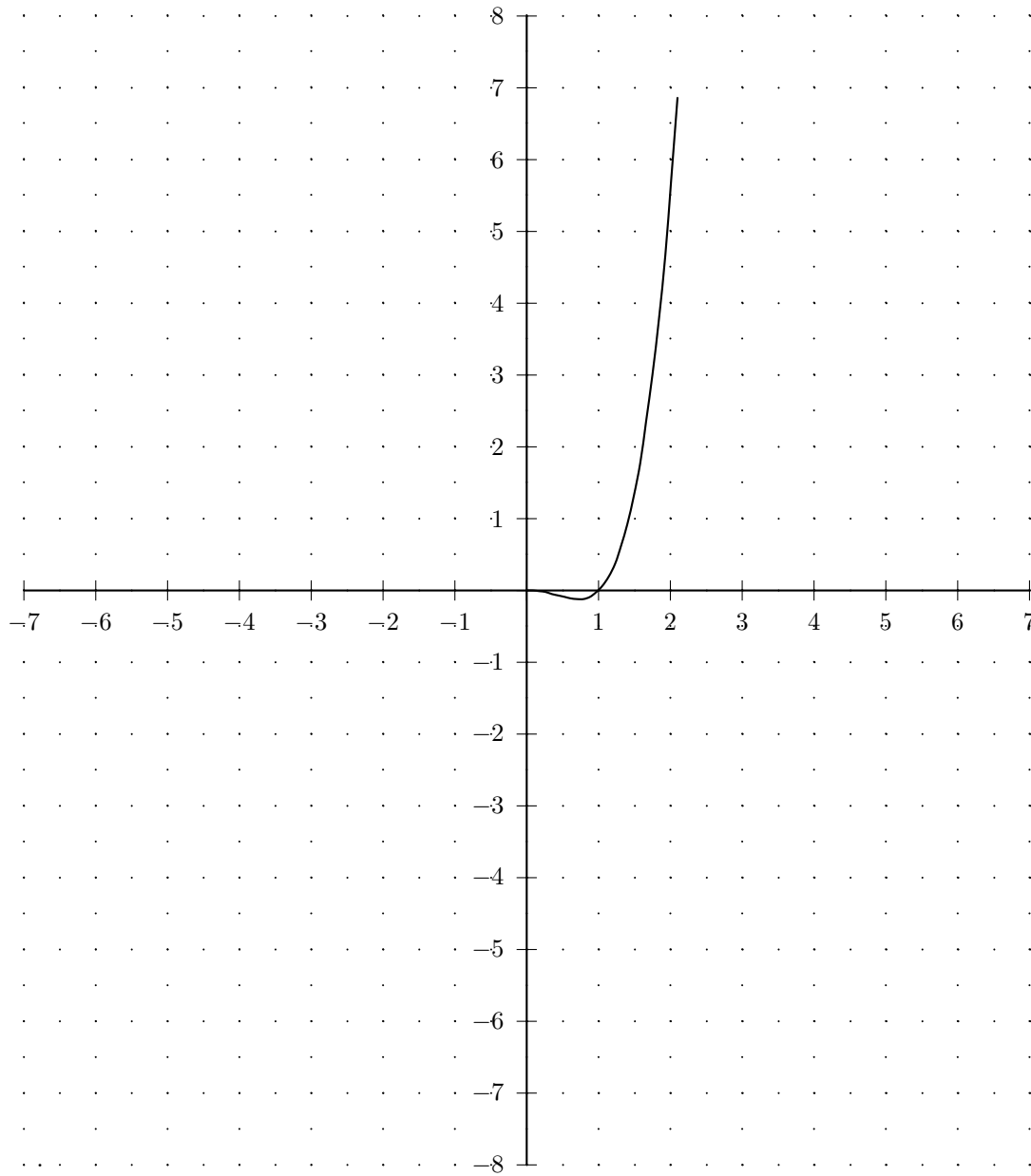
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	0 0,717	0 -0,123
Wendepunkte:	0,435	-0,069

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$\frac{1}{2}$	-0,087	-0,27	0,421
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	1	0	1	5
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$1\frac{1}{2}$	1,368	4,987	11,149
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	2	5,545	12,318	18,318
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$2\frac{1}{2}$	14,317	23,431	26,244
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	3	29,663	38,663	34,775
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$3\frac{1}{2}$	53,712	58,289	43,808
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	4	88,723	82,543	53,271
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$4\frac{1}{2}$	137,059	111,623	63,11
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	5	201,18	145,708	73,283
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$5\frac{1}{2}$	283,627	184,956	83,757
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	6	387,02	229,511	94,503
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$6\frac{1}{2}$	514,044	279,501	105,5
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	667,447	335,049	116,728

•Graph der Funktion  $f(x) = x^3 \cdot \ln(x)$



## Aufgabe (14)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \ln(x)$

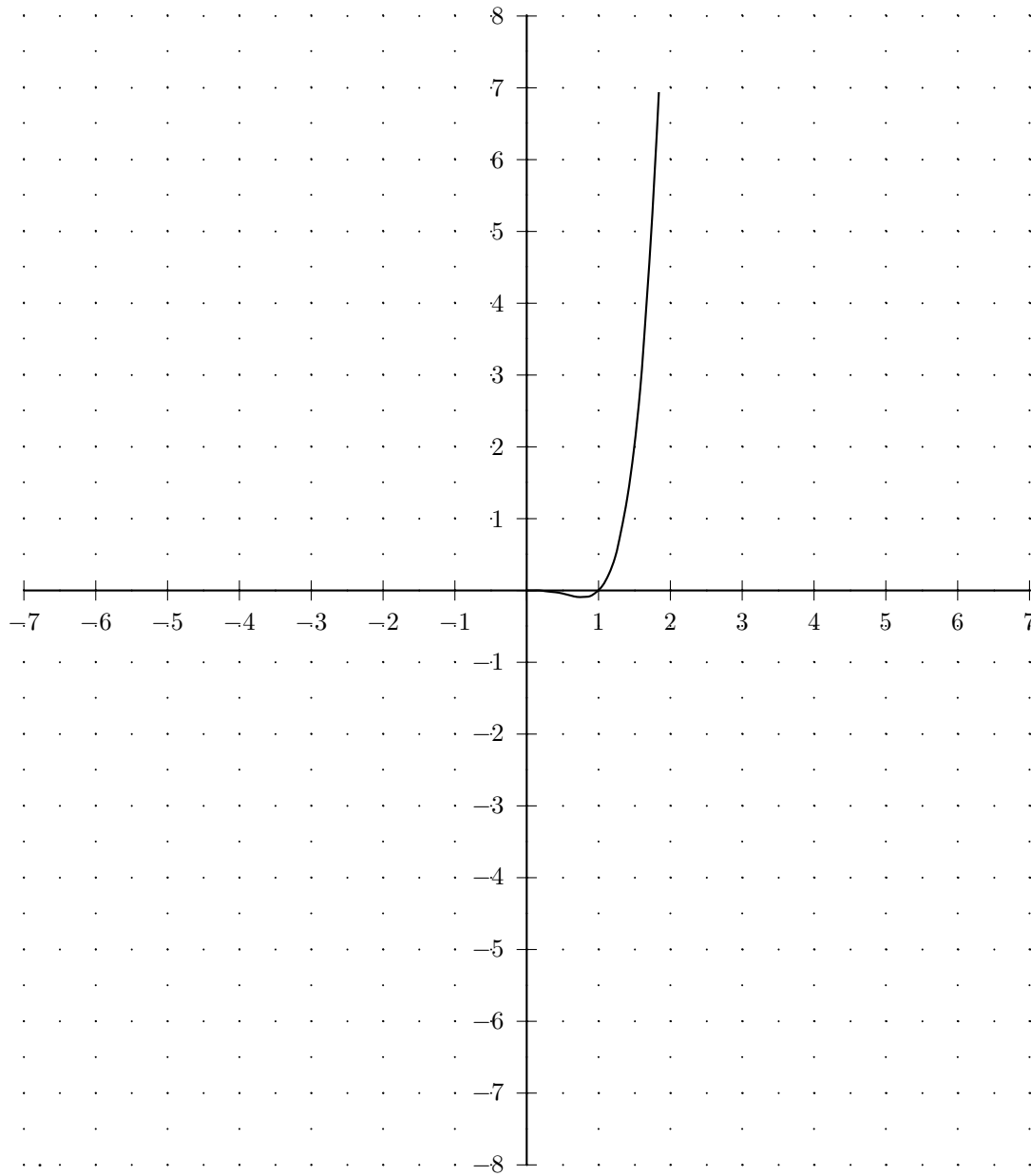
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	1	0
Extremwerte:	0 0,779	0 -0,092
Wendepunkte:	0,558	-0,057

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$\frac{1}{2}$	-0,043	-0,221	-0,329
-6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	1	0	1,001	7,001
$-5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$1\frac{1}{2}$	2,053	8,85	26,698
-5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	2	11,09	30,183	61,272
$-4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$2\frac{1}{2}$	35,793	72,896	112,473
-4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	3	88,988	145,654	181,651
$-3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$3\frac{1}{2}$	187,993	257,728	269,907
-3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	4	354,891	418,897	378,169
$-2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$4\frac{1}{2}$	616,766	639,368	507,242
-2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	5	1005,899	929,726	657,832
$-1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$5\frac{1}{2}$	1559,951	1300,893	830,575
-1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	6	2322,12	1764,09	1026,041
$-\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	$6\frac{1}{2}$	3341,284	2330,81	1244,755
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	4672,13	3012,8	1487,196

•Graph der Funktion  $f(x) = x^4 \cdot \ln(x)$



## Aufgabe (15)

• Gegeben die Funktion:  $f(x) = x \cdot \ln(-x)$

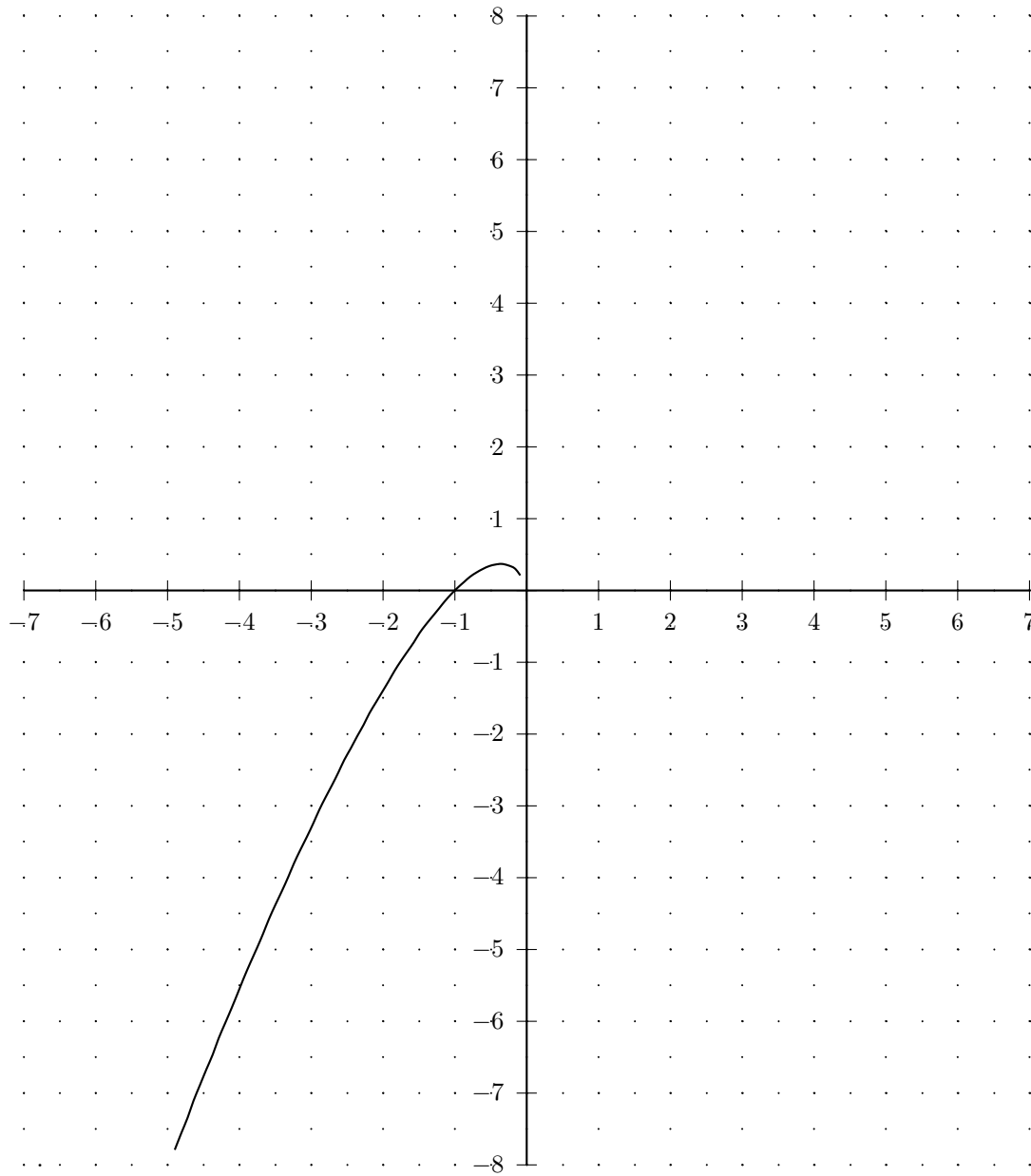
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-1	0
Extremwerte:	-0,368	0,368

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-13,621	2,946	$-\frac{1}{7}$	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	-12,167	2,872	$-\frac{2}{13}$	$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	-10,751	2,792	$-\frac{1}{6}$	1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	-9,376	2,705	$-\frac{2}{11}$	$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	-8,047	2,609	$-\frac{1}{5}$	2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	-6,768	2,504	$-\frac{2}{9}$	$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	-5,545	2,386	$-\frac{1}{4}$	3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	-4,385	2,253	$-\frac{2}{7}$	$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	-3,296	2,099	$-\frac{1}{3}$	4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	-2,291	1,916	-0,4	$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	-1,386	1,693	-0,5	5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	-0,608	1,405	-0,667	$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	0	1	-1	6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	0,347	0,307	-2	$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

•Graph der Funktion  $f(x) = x \cdot \ln(-x)$



## Aufgabe (16)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \ln(-x)$

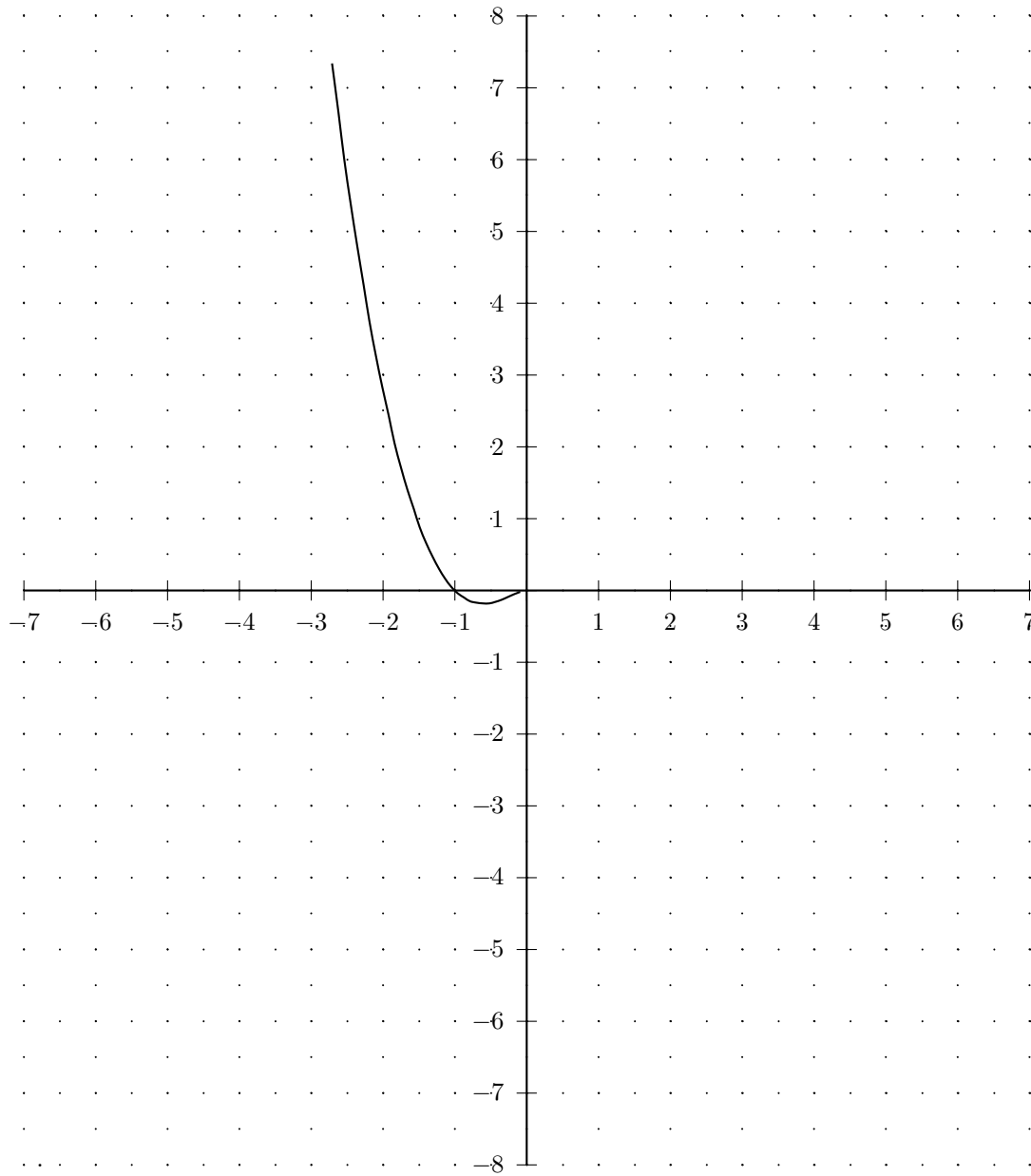
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-1	0
Extremwerte:	-0,607	-0,184
Wendepunkte:	-0,223	-0,075

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	95,35	-34,243	6,892	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	79,084	-30,833	6,744	$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	64,503	-27,501	6,584	1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	51,569	-24,252	6,409	$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	40,236	-21,094	6,219	2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	30,458	-18,037	6,008	$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	22,181	-15,09	5,773	3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	15,346	-12,269	5,506	$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	9,888	-9,592	5,197	4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	5,727	-7,081	4,833	$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	2,773	-4,773	4,386	5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	0,912	-2,716	3,811	$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	0	-1	3	6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	-0,173	0,193	1,614	$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

•Graph der Funktion  $f(x) = x^2 \cdot \ln(-x)$



## Aufgabe (17)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \ln(-x)$

• Kurvendiskussion

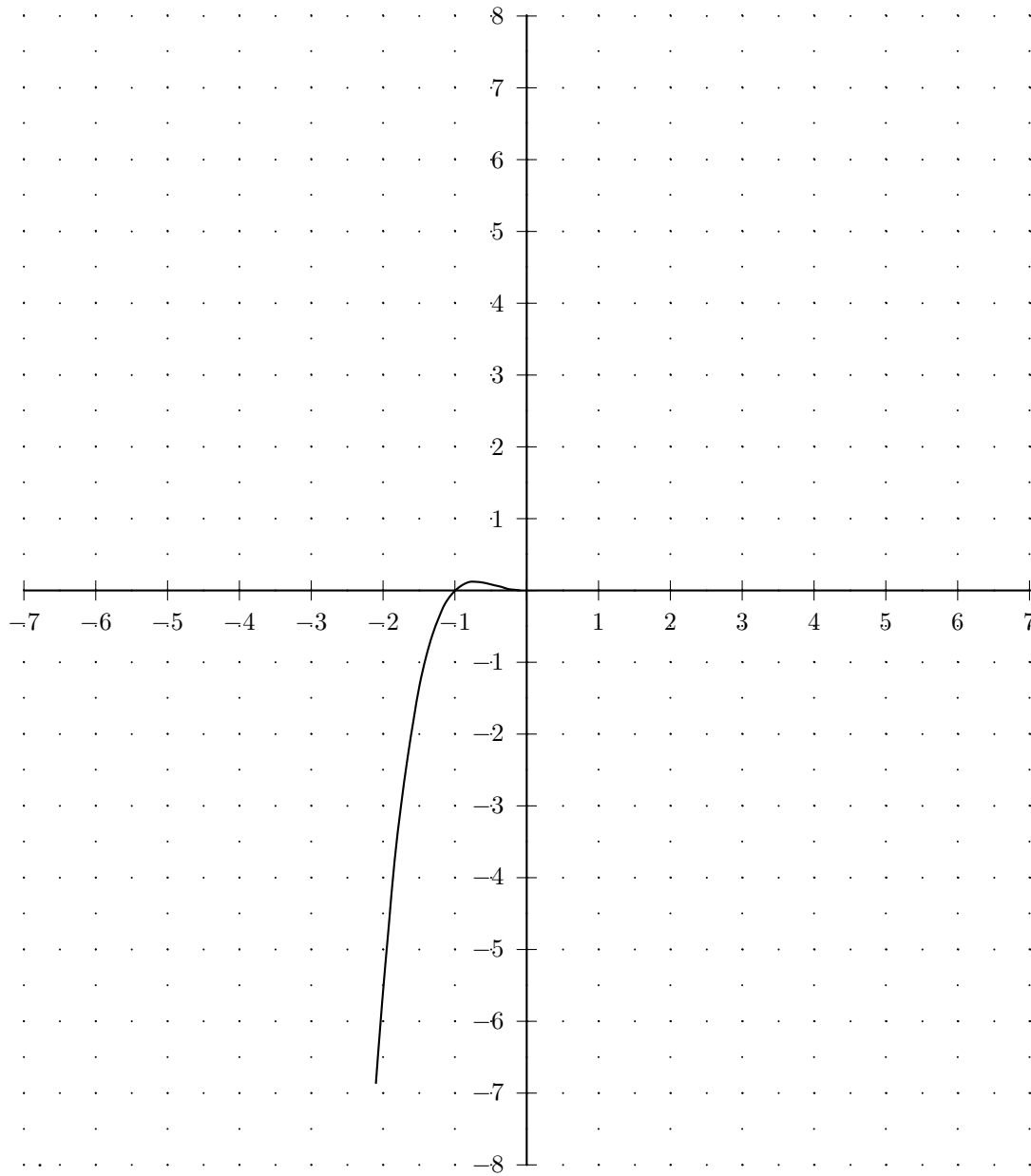
	$x$	$f(x)$
Nullstellen:	-1	0
Extremwerte:	-0,717	0,123
Wendepunkte:	-0,435	0,069

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-667,447	335,049	-116,728
$-6\frac{1}{2}$	-514,044	279,501	-105,5
-6	-387,02	229,511	-94,503
$-5\frac{1}{2}$	-283,627	184,956	-83,757
-5	-201,18	145,708	-73,283
$-4\frac{1}{2}$	-137,059	111,623	-63,11
-4	-88,723	82,543	-53,271
$-3\frac{1}{2}$	-53,712	58,289	-43,808
-3	-29,663	38,663	-34,775
$-2\frac{1}{2}$	-14,317	23,431	-26,244
-2	-5,545	12,318	-18,318
$-1\frac{1}{2}$	-1,368	4,987	-11,149
-1	0	1	-5
$-\frac{1}{2}$	0,087	-0,27	-0,421
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

•Graph der Funktion  $f(x) = x^3 \cdot \ln(-x)$



## Aufgabe (18)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \ln(-x)$

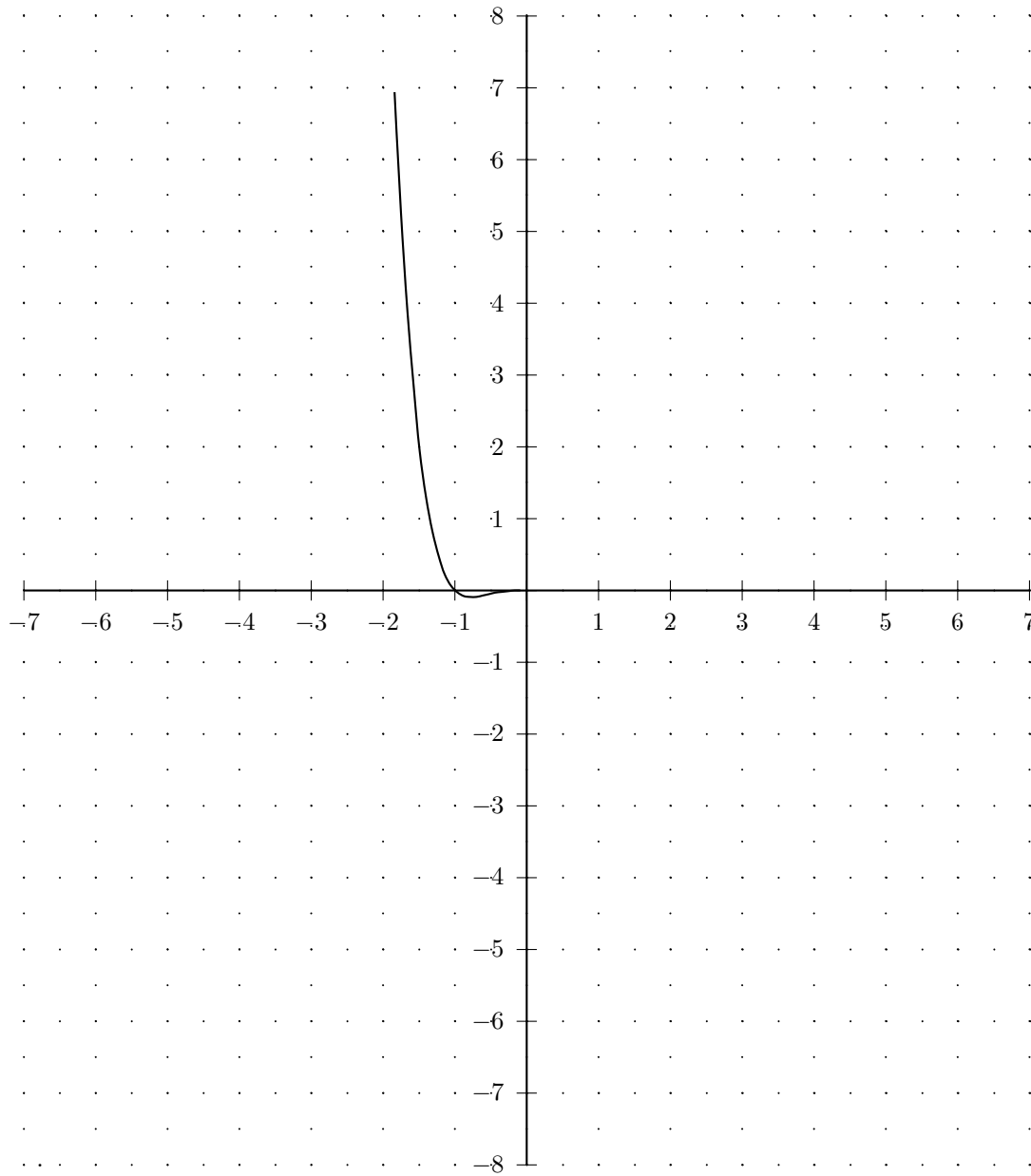
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-1	0
Extremwerte:	-0,779	-0,092
Wendepunkte:	-0,558	-0,057

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	4672,13	-3012,8	1487,196	0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	3341,284	-2330,81	1244,755	$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	2322,12	-1764,09	1026,041	1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	1559,951	-1300,893	830,575	$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	1005,899	-929,726	657,832	2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	616,766	-639,368	507,242	$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	354,891	-418,897	378,169	3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	187,993	-257,728	269,907	$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	88,988	-145,654	181,651	4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	35,793	-72,896	112,473	$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	11,09	-30,183	61,272	5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	2,053	-8,85	26,698	$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	0	-1,001	7,001	6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	-0,043	0,221	-0,329	$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>	7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

•Graph der Funktion  $f(x) = x^4 \cdot \ln(-x)$



## Aufgabe (19)

• Gegeben die Funktion:  $f(x) = (x - 1) \cdot \ln(-x)$

• Kurvendiskussion

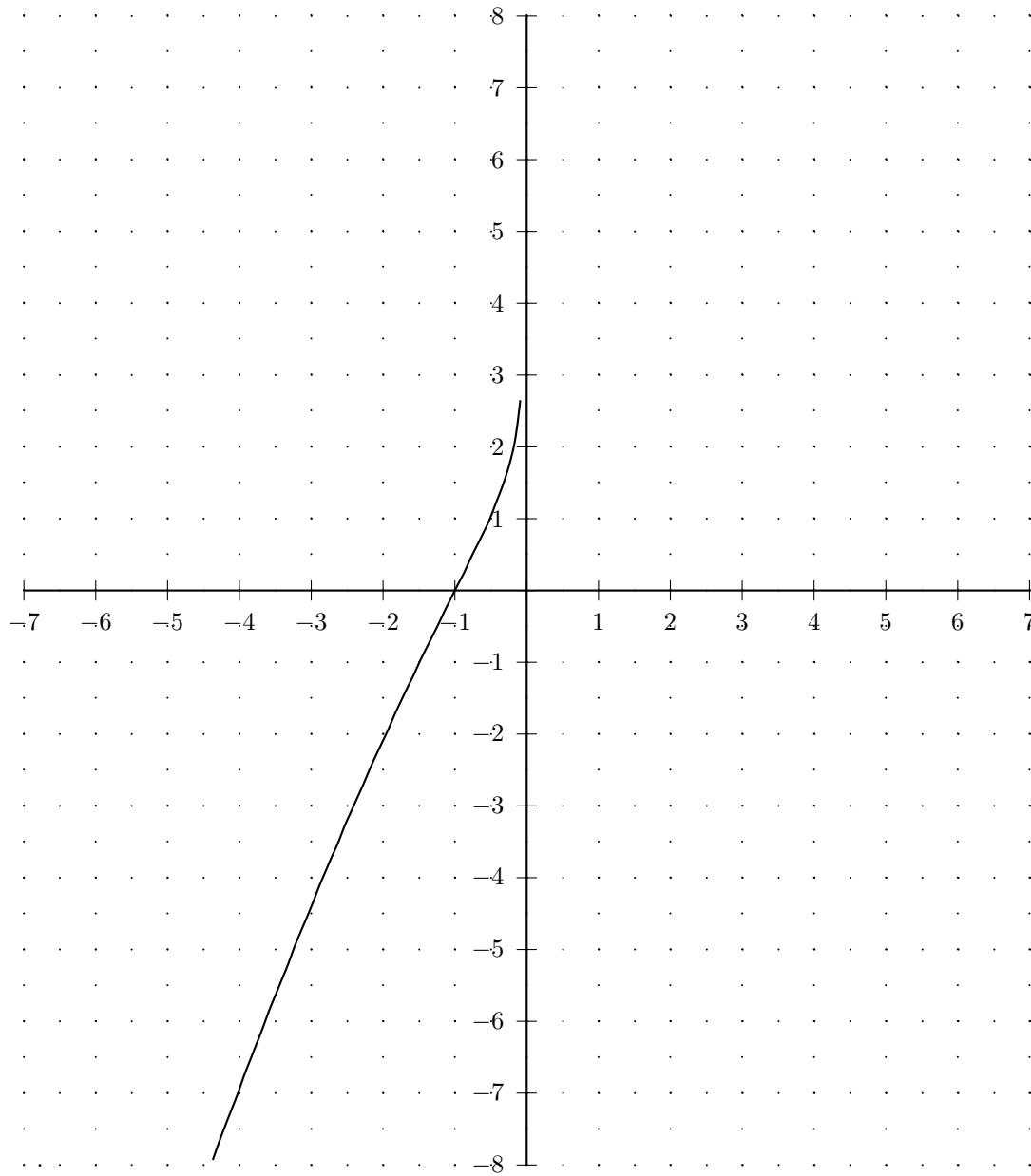
	$x$	$f(x)$
Nullstellen:	-1	0
Wendepunkte:	-1	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-15,567	3,089	$-\frac{6}{49}$
$-6\frac{1}{2}$	-14,039	3,026	-0,13
-6	-12,542	2,958	$-\frac{5}{36}$
$-5\frac{1}{2}$	-11,081	2,887	-0,149
-5	-9,657	2,809	$-\frac{4}{25}$
$-4\frac{1}{2}$	-8,272	2,726	$-\frac{14}{81}$
-4	-6,931	2,636	$-\frac{3}{16}$
$-3\frac{1}{2}$	-5,637	2,538	$-\frac{10}{49}$
-3	-4,394	2,432	$-\frac{2}{9}$
$-2\frac{1}{2}$	-3,207	2,316	$-\frac{6}{25}$
-2	-2,079	2,193	-0,25
$-1\frac{1}{2}$	-1,014	2,072	-0,222
-1	0	2	0
$-\frac{1}{2}$	1,04	2,307	2,001
0	+unendlich	n.def.	n.def.

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	+unendlich	n.def.	n.def.
$\frac{1}{2}$	n.def.	n.def.	n.def.
1	n.def.	n.def.	n.def.
$1\frac{1}{2}$	n.def.	n.def.	n.def.
2	n.def.	n.def.	n.def.
$2\frac{1}{2}$	n.def.	n.def.	n.def.
3	n.def.	n.def.	n.def.
$3\frac{1}{2}$	n.def.	n.def.	n.def.
4	n.def.	n.def.	n.def.
$4\frac{1}{2}$	n.def.	n.def.	n.def.
5	n.def.	n.def.	n.def.
$5\frac{1}{2}$	n.def.	n.def.	n.def.
6	n.def.	n.def.	n.def.
$6\frac{1}{2}$	n.def.	n.def.	n.def.
7	n.def.	n.def.	n.def.

•Graph der Funktion  $f(x) = (x - 1) \cdot \ln(-x)$



Aufgabe (20)

• Gegeben die Funktion:  $f(x) = (x^2 - 4) \cdot \ln(-x)$

• Kurvendiskussion

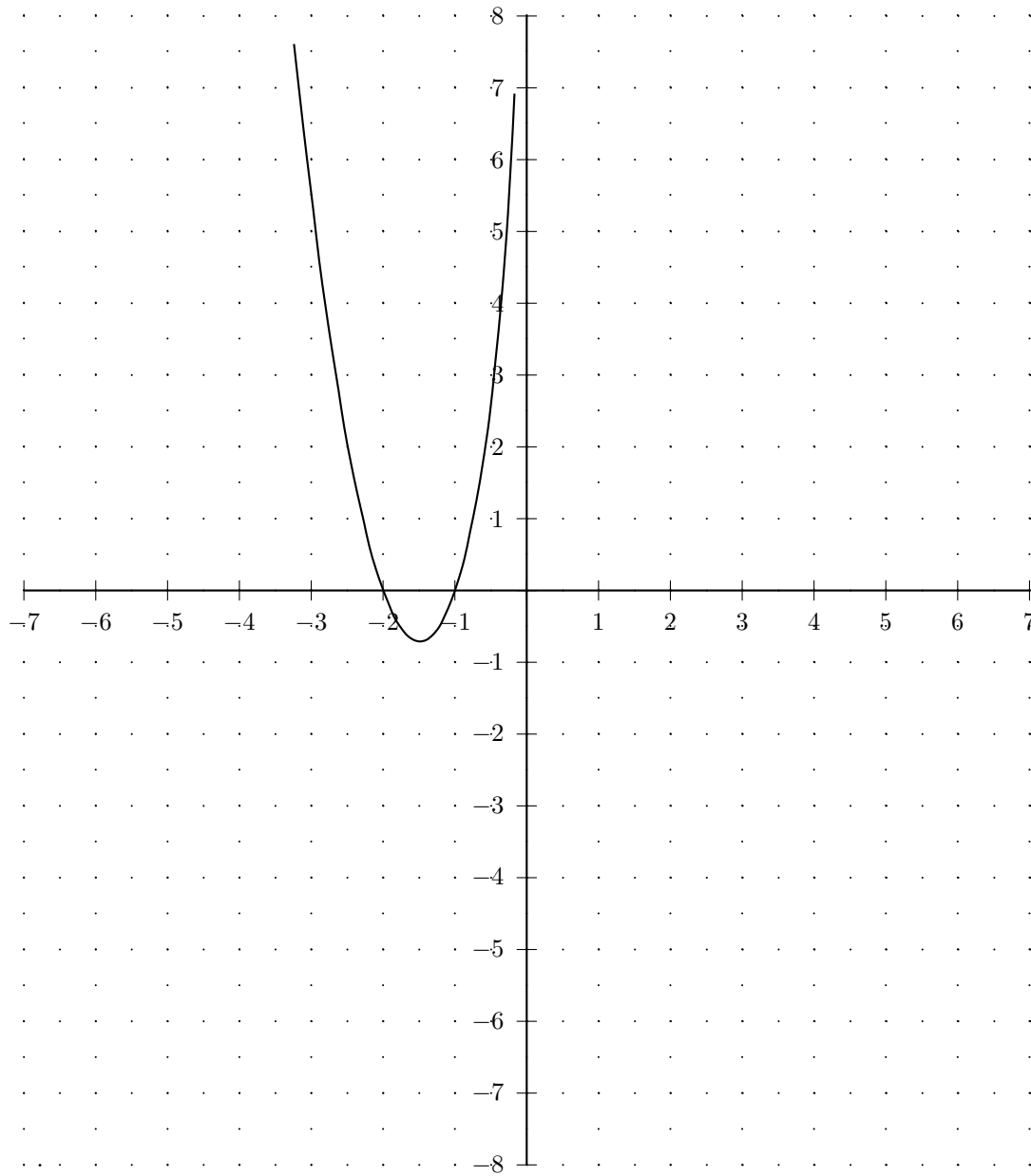
	$x$	$f(x)$
Nullstellen:	-2	-0,001
	-1	0
Extremwerte:	-1,491	-0,71

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	87,566	-33,671	6,973
$-6\frac{1}{2}$	71,596	-30,218	6,838
-6	57,336	-26,834	6,695
$-5\frac{1}{2}$	44,75	-23,525	6,542
-5	33,798	-20,294	6,379
$-4\frac{1}{2}$	24,441	-17,148	6,206
-4	16,636	-14,09	6,023
$-3\frac{1}{2}$	10,335	-11,126	5,832
-3	5,493	-8,258	5,642
$-2\frac{1}{2}$	2,062	-5,481	5,473
-2	0	-2,773	5,386
$-1\frac{1}{2}$	-0,71	-0,05	5,589
-1	0	3	7
$-\frac{1}{2}$	2,599	8,195	17,618
0	+unendlich	n.def.	n.def.

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	+unendlich	n.def.	n.def.
$\frac{1}{2}$	n.def.	n.def.	n.def.
1	n.def.	n.def.	n.def.
$1\frac{1}{2}$	n.def.	n.def.	n.def.
2	n.def.	n.def.	n.def.
$2\frac{1}{2}$	n.def.	n.def.	n.def.
3	n.def.	n.def.	n.def.
$3\frac{1}{2}$	n.def.	n.def.	n.def.
4	n.def.	n.def.	n.def.
$4\frac{1}{2}$	n.def.	n.def.	n.def.
5	n.def.	n.def.	n.def.
$5\frac{1}{2}$	n.def.	n.def.	n.def.
6	n.def.	n.def.	n.def.
$6\frac{1}{2}$	n.def.	n.def.	n.def.
7	n.def.	n.def.	n.def.

•Graph der Funktion  $f(x) = (x^2 - 4) \cdot \ln(-x)$



Aufgabe (21)

• Gegeben die Funktion:  $f(x) = (x^3 - 1) \cdot \ln(-x)$

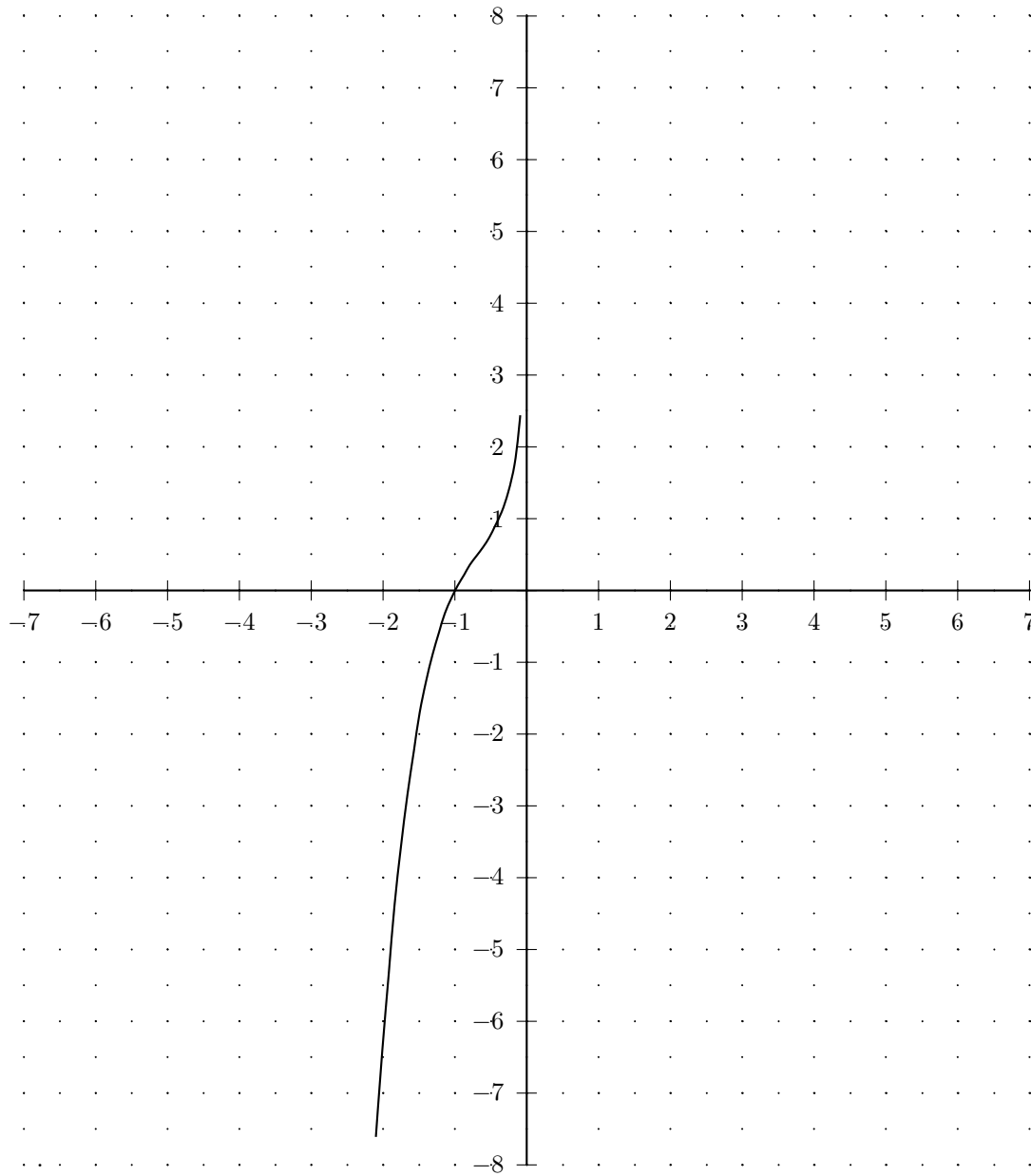
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-1	0
Wendepunkte:	-0,703	0,475

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-669,393	335,192	-116,708	0	+unendlich	n.def.	n.def.
$-6\frac{1}{2}$	-515,915	279,655	-105,477	$\frac{1}{2}$	n.def.	n.def.	n.def.
-6	-388,812	229,677	-94,476	1	n.def.	n.def.	n.def.
$-5\frac{1}{2}$	-285,332	185,138	-83,724	$1\frac{1}{2}$	n.def.	n.def.	n.def.
-5	-202,789	145,908	-73,243	2	n.def.	n.def.	n.def.
$-4\frac{1}{2}$	-138,563	111,845	-63,061	$2\frac{1}{2}$	n.def.	n.def.	n.def.
-4	-90,109	82,793	-53,209	3	n.def.	n.def.	n.def.
$-3\frac{1}{2}$	-54,965	58,575	-43,726	$3\frac{1}{2}$	n.def.	n.def.	n.def.
-3	-30,761	38,996	-34,664	4	n.def.	n.def.	n.def.
$-2\frac{1}{2}$	$-15\frac{7}{30}$	23,831	-26,084	$4\frac{1}{2}$	n.def.	n.def.	n.def.
-2	-6,238	12,818	$-18\frac{4}{59}$	5	n.def.	n.def.	n.def.
$-1\frac{1}{2}$	-1,774	5,654	-10,705	$5\frac{1}{2}$	n.def.	n.def.	n.def.
-1	0	2	-4	6	n.def.	n.def.	n.def.
$-\frac{1}{2}$	0,78	1,731	3,58	$6\frac{1}{2}$	n.def.	n.def.	n.def.
0	+unendlich	n.def.	n.def.	7	n.def.	n.def.	n.def.

•Graph der Funktion  $f(x) = (x^3 - 1) \cdot \ln(-x)$



## Aufgabe (22)

• Gegeben die Funktion:  $f(x) = (x^4 - 1) \cdot \ln(-x)$

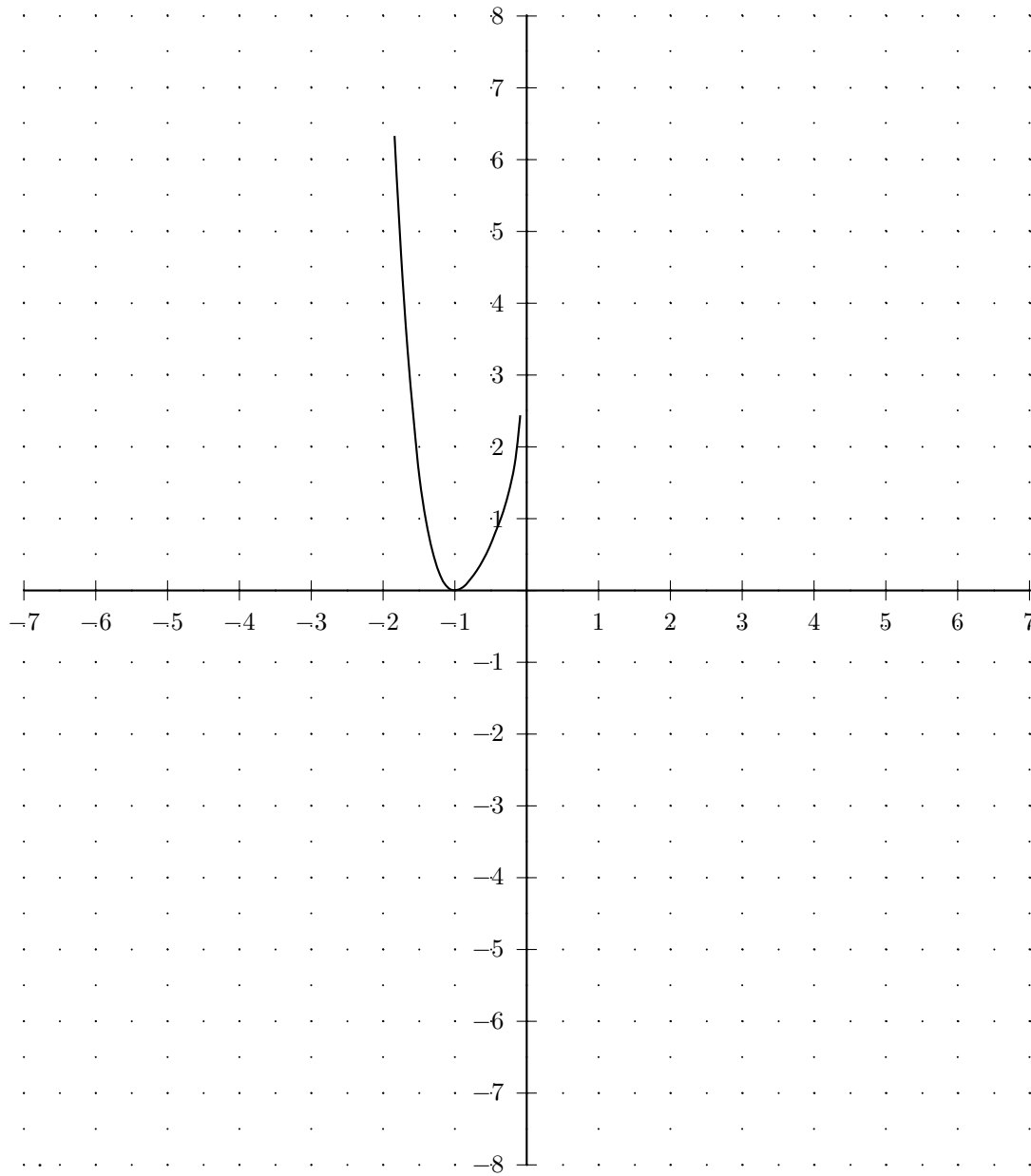
• Kurvendiskussion

	$x$	$f(x)$
Extremwerte:	-1	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$	$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	4670,184	-3012,657	1487,217	0	<i>+unendlich</i>	<i>n.def.</i>	<i>n.def.</i>
$-6\frac{1}{2}$	3339,412	-2330,656	1244,778	$\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-6	2320,329	-1763,923	1026,069	1	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-5\frac{1}{2}$	1558,246	-1300,711	830,608	$1\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-5	1004,289	-929,526	657,872	2	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-4\frac{1}{2}$	615,262	-639,145	507,291	$2\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-4	353,505	-418,647	378,232	3	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-3\frac{1}{2}$	186,74	-257,443	269,989	$3\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-3	87,889	-145,32	181,762	4	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-2\frac{1}{2}$	34,876	-72,496	112,633	$4\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-2	10,397	-29,683	61,522	5	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-1\frac{1}{2}$	1,647	-8,183	27,143	$5\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
-1	0	-0,001	8,001	6	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
$-\frac{1}{2}$	0,65	2,222	3,672	$6\frac{1}{2}$	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>
0	<i>+unendlich</i>	<i>n.def.</i>	<i>n.def.</i>	7	<i>n.def.</i>	<i>n.def.</i>	<i>n.def.</i>

- Graph der Funktion  $f(x) = (x^4 - 1) \cdot \ln(-x)$



## 4 Trigonometrische Funktionen

### 4.1 Aufgaben

- (1)  $\sin(x)$
- (2)  $\sin(x) + 1$
- (3)  $\sin(x - 2) + 1$
- (4)  $\sin(-x)$
- (5)  $\sin(-x) + 3$
- (6)  $\sin(2 \cdot x)$
- (7)  $\sin(\frac{1}{2} \cdot x - 1) + 1$
- (8)  $2 \cdot \sin(x - 2) + 1$
- (9)  $\frac{1}{3} \cdot \sin(-x)$
- (10)  $-2 \cdot \sin(-x) + 3$
- (11)  $2 \cdot \sin(x) + 1$
- (12)  $-3 \cdot \sin(x - 2) + 1$
- (13)  $2 \cdot \sin(-x)$
- (14)  $3 \cdot \sin(-x) + 3$
- (15)  $x \cdot \sin(x)$
- (16)  $x^2 \cdot \sin(x)$
- (17)  $x^3 \cdot \sin(x)$
- (18)  $x^4 \cdot \sin(x)$
- (19)  $x \cdot \sin(-x)$
- (20)  $x^2 \cdot \sin(-x)$
- (21)  $x^3 \cdot \sin(-x)$
- (22)  $x^4 \cdot \sin(-x)$
- (23)  $\cos(x)$
- (24)  $\cos(x) + 1$
- (25)  $\cos(x - 2) + 1$
- (26)  $\cos(-x)$
- (27)  $\cos(-x) + 3$
- (28)  $\cos(2 \cdot x)$
- (29)  $\cos(\frac{1}{2} \cdot x - 1) + 1$
- (30)  $2 \cdot \cos(x - 2) + 1$
- (31)  $\frac{1}{3} \cdot \cos(-x)$
- (32)  $-2 \cdot \cos(-x) + 3$
- (33)  $2 \cdot \cos(x) + 1$
- (34)  $-3 \cdot \cos(x - 2) + 1$
- (35)  $2 \cdot \cos(-x)$
- (36)  $3 \cdot \cos(-x) + 3$
- (37)  $x \cdot \cos(x)$
- (38)  $x^2 \cdot \cos(x)$
- (39)  $x^3 \cdot \cos(x)$
- (40)  $x^4 \cdot \cos(x)$
- (41)  $x \cdot \cos(x)$
- (42)  $x^2 \cdot \cos(x)$
- (43)  $x^3 \cdot \cos(x)$
- (44)  $x^4 \cdot \cos(x)$

## 4.2 Lösungen

## Aufgabe (1)

• Gegeben die Funktion:  $f(x) = \sin(x)$

• Kurvendiskussion

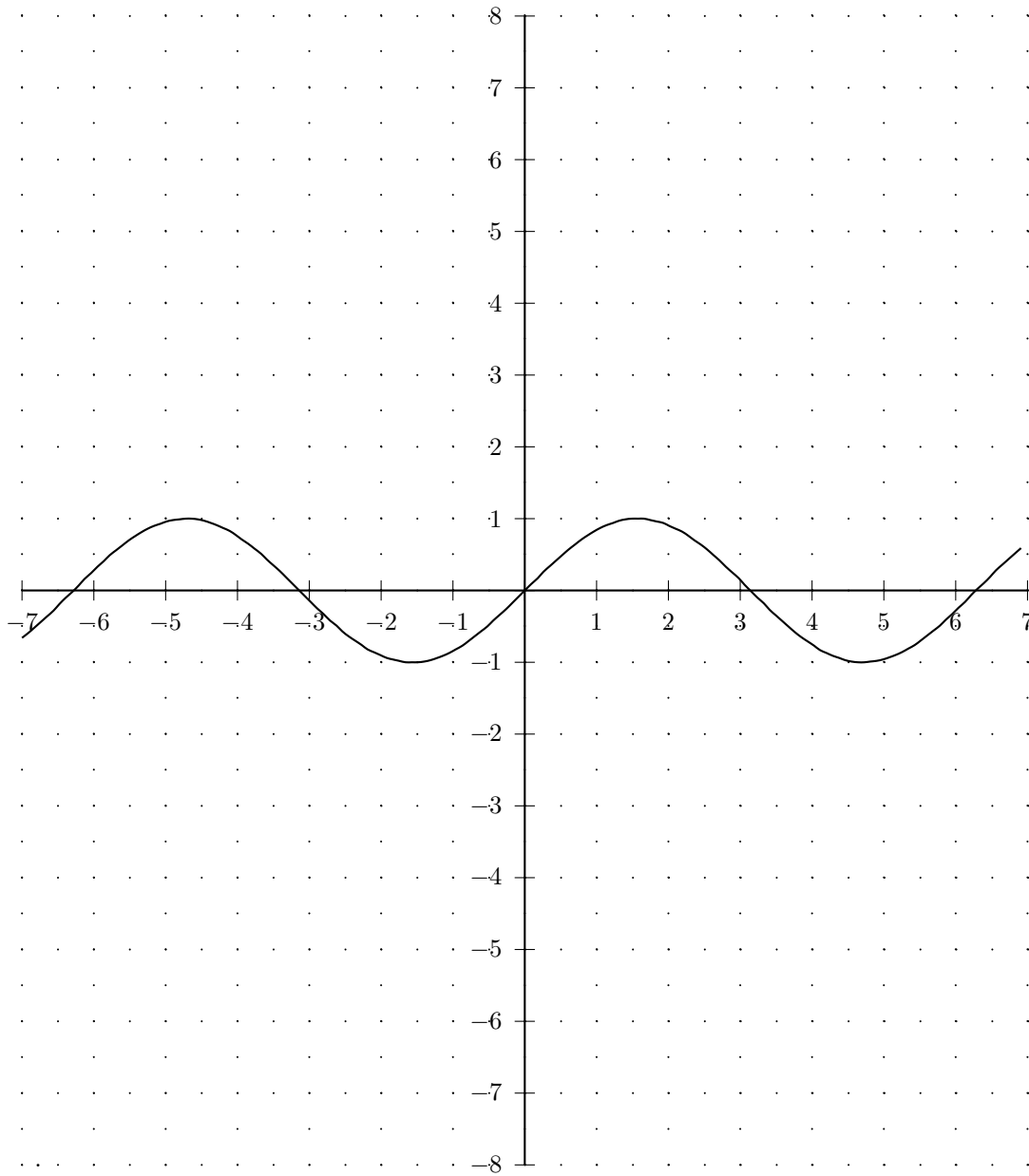
	$x$	$f(x)$
Nullstellen:	-6,283	0
	-3,142	0
	0	0
	3,142	0
	6,283	0
Extremwerte:	-4,713	1
	-1,571	-1
	1,571	1
	4,713	-1
Wendepunkte:	-6,283	0
	-3,142	0
	-0,023	-0,023
	3,142	0
	6,283	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,657	0,754	0,657
$-6\frac{1}{2}$	-0,215	0,977	0,215
-6	0,279	0,96	$-\frac{19}{68}$
$-5\frac{1}{2}$	0,706	0,709	-0,706
-5	0,959	0,284	-0,959
$-4\frac{1}{2}$	0,978	-0,211	-0,978
-4	0,757	-0,654	-0,757
$-3\frac{1}{2}$	0,351	-0,936	-0,351
-3	-0,141	-0,99	0,141
$-2\frac{1}{2}$	-0,598	-0,801	0,598
-2	-0,909	-0,416	0,909
$-1\frac{1}{2}$	-0,997	0,071	0,997
-1	-0,841	0,54	0,841
$-\frac{1}{2}$	-0,479	0,878	0,479
0	0	1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	1	0
$\frac{1}{2}$	0,479	0,878	-0,479
1	0,841	0,54	-0,841
$1\frac{1}{2}$	0,997	0,071	-0,997
2	0,909	-0,416	-0,909
$2\frac{1}{2}$	0,598	-0,801	-0,598
3	0,141	-0,99	-0,141
$3\frac{1}{2}$	-0,351	-0,936	0,351
4	-0,757	-0,654	0,757
$4\frac{1}{2}$	-0,978	-0,211	0,978
5	-0,959	0,284	0,959
$5\frac{1}{2}$	-0,706	0,709	0,706
6	-0,279	0,96	$\frac{19}{68}$
$6\frac{1}{2}$	0,215	0,977	-0,215
7	0,657	0,754	-0,657

•Graph der Funktion  $f(x) = \sin(x)$



## Aufgabe (2)

• Gegeben die Funktion:  $f(x) = \sin(x) + 1$

• Kurvendiskussion

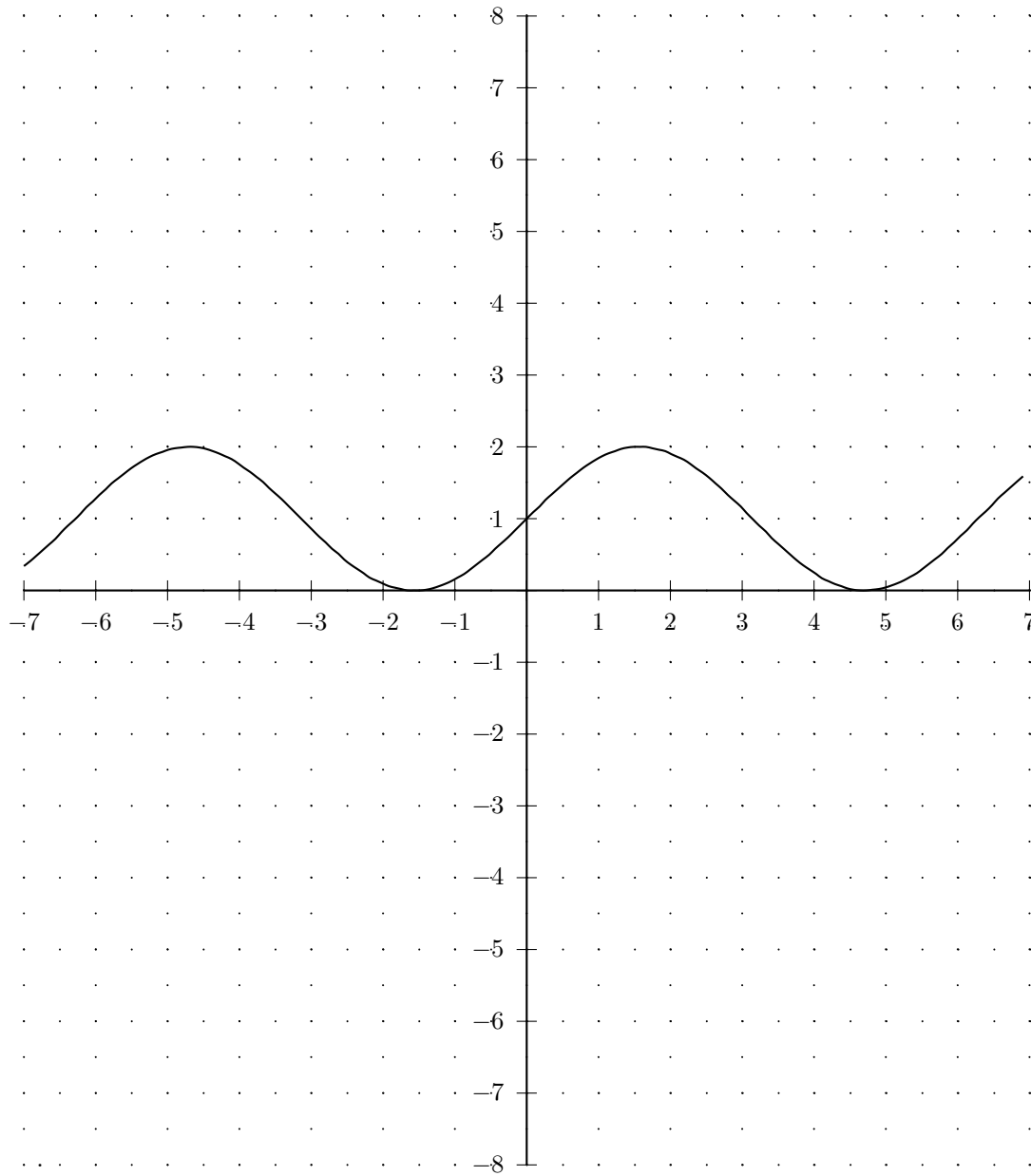
	$x$	$f(x)$
Extremwerte:	-4,713	2
	-1,571	0
	1,571	2
	4,713	0
Wendepunkte:	-6,283	1
	-3,142	1
	-0,023	0,977
	3,142	1
	6,283	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,343	0,754	0,657
$-6\frac{1}{2}$	0,785	0,977	0,215
-6	1,279	0,96	$-\frac{19}{68}$
$-5\frac{1}{2}$	1,706	0,709	-0,706
-5	1,959	0,284	-0,959
$-4\frac{1}{2}$	1,978	-0,211	-0,978
-4	1,757	-0,654	-0,757
$-3\frac{1}{2}$	1,351	-0,936	-0,351
-3	0,859	-0,99	0,141
$-2\frac{1}{2}$	0,402	-0,801	0,598
-2	0,091	-0,416	0,909
$-1\frac{1}{2}$	0,003	0,071	0,997
-1	0,159	0,54	0,841
$-\frac{1}{2}$	0,521	0,878	0,479
0	1	1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	1	0
$\frac{1}{2}$	1,479	0,878	-0,479
1	1,841	0,54	-0,841
$1\frac{1}{2}$	1,997	0,071	-0,997
2	1,909	-0,416	-0,909
$2\frac{1}{2}$	1,598	-0,801	-0,598
3	1,141	-0,99	-0,141
$3\frac{1}{2}$	0,649	-0,936	0,351
4	0,243	-0,654	0,757
$4\frac{1}{2}$	0,022	-0,211	0,978
5	0,041	0,284	0,959
$5\frac{1}{2}$	0,294	0,709	0,706
6	0,721	0,96	$\frac{19}{68}$
$6\frac{1}{2}$	1,215	0,977	-0,215
7	1,657	0,754	-0,657

•Graph der Funktion  $f(x) = \sin(x) + 1$



## Aufgabe (3)

• Gegeben die Funktion:  $f(x) = \sin(x - 2) + 1$

• Kurvendiskussion

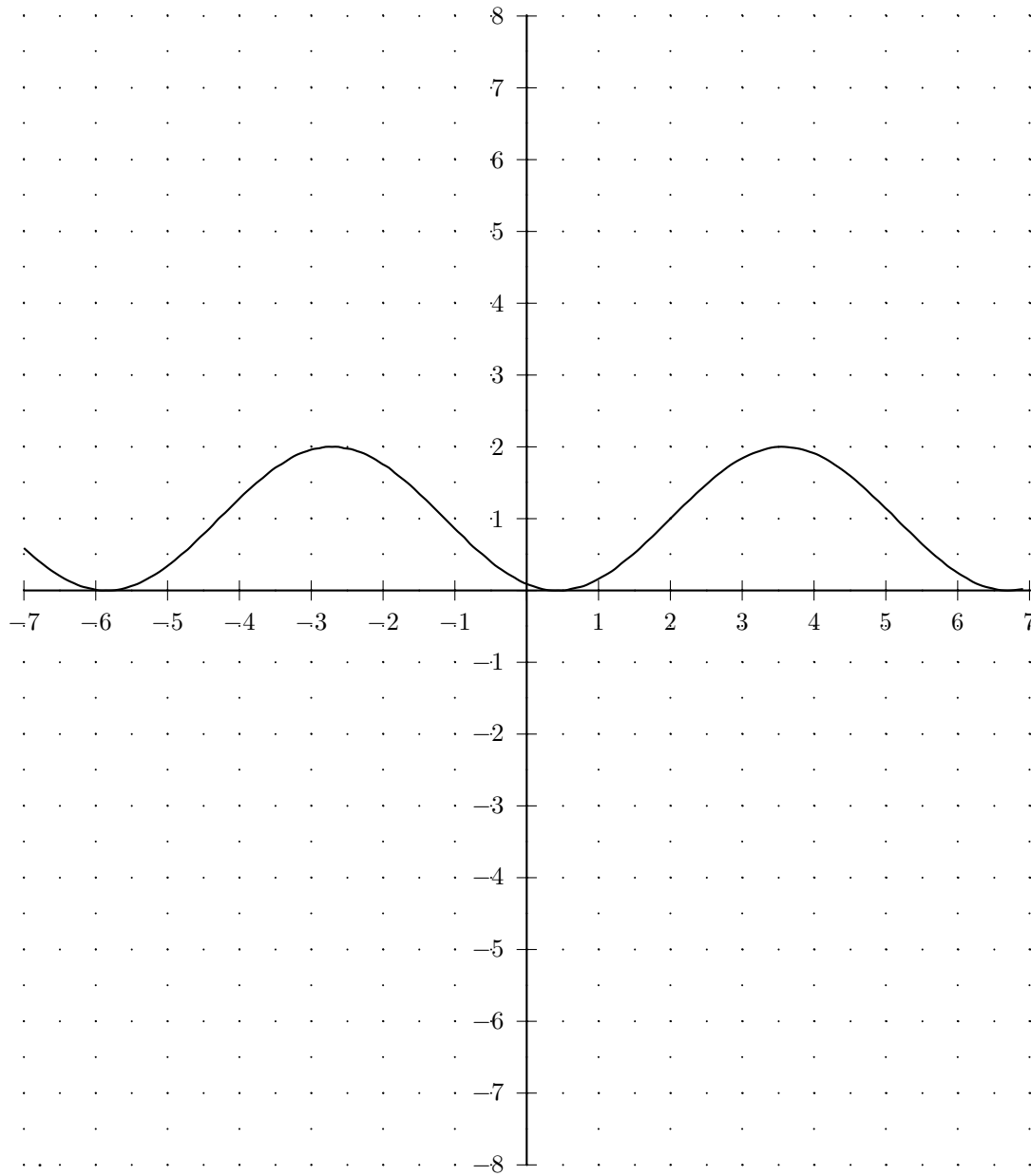
	$x$	$f(x)$
Extremwerte:	-5,854	0
	$-2\frac{57}{80}$	2
	0,429	0
	3,571	2
	6,713	0
Wendepunkte:	-4,283	1
	-1,142	1
	2	1
	5,142	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,588	-0,911	0,412
$-6\frac{1}{2}$	0,202	-0,602	0,798
-6	0,011	-0,145	0,989
$-5\frac{1}{2}$	0,062	0,347	0,938
-5	0,343	0,754	0,657
$-4\frac{1}{2}$	0,785	0,977	0,215
-4	1,279	0,96	$-\frac{19}{68}$
$-3\frac{1}{2}$	1,706	0,709	-0,706
-3	1,959	0,284	-0,959
$-2\frac{1}{2}$	1,978	-0,211	-0,978
-2	1,757	-0,654	-0,757
$-1\frac{1}{2}$	1,351	-0,936	-0,351
-1	0,859	-0,99	0,141
$-\frac{1}{2}$	0,402	-0,801	0,598
0	0,091	-0,416	0,909

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0,091	-0,416	0,909
$\frac{1}{2}$	0,003	0,071	0,997
1	0,159	0,54	0,841
$1\frac{1}{2}$	0,521	0,878	0,479
2	1	1	0
$2\frac{1}{2}$	1,479	0,878	-0,479
3	1,841	0,54	-0,841
$3\frac{1}{2}$	1,997	0,071	-0,997
4	1,909	-0,416	-0,909
$4\frac{1}{2}$	1,598	-0,801	-0,598
5	1,141	-0,99	-0,141
$5\frac{1}{2}$	0,649	-0,936	0,351
6	0,243	-0,654	0,757
$6\frac{1}{2}$	0,022	-0,211	0,978
7	0,041	0,284	0,959

•Graph der Funktion  $f(x) = \sin(x - 2) + 1$



## Aufgabe (4)

• Gegeben die Funktion:  $f(x) = \sin(-x)$

• Kurvendiskussion

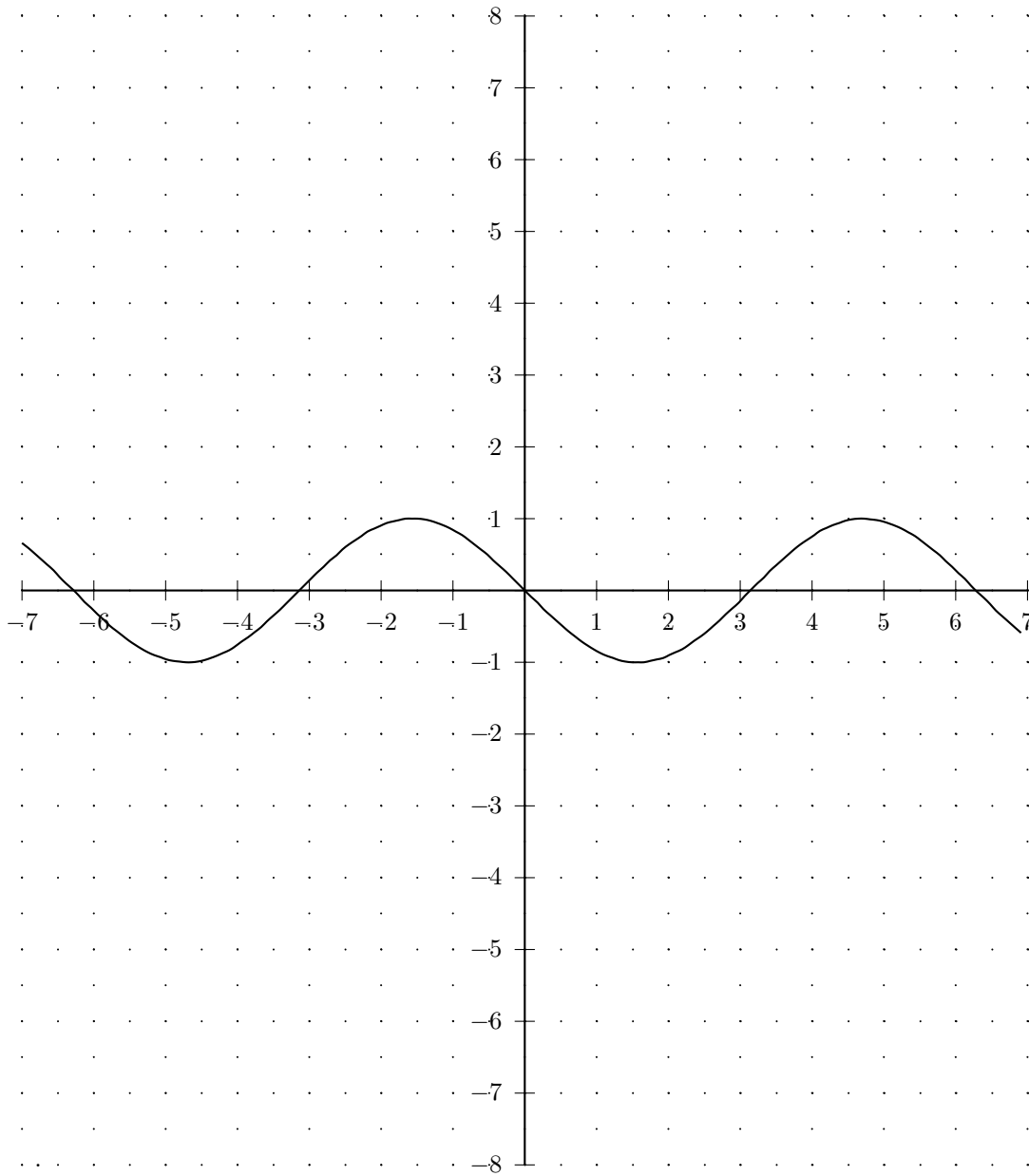
	$x$	$f(x)$
Nullstellen:	-6,283	0
	-3,142	0
	0	0
	3,142	0
	6,283	0
Extremwerte:	-4,713	-1
	-1,571	1
	1,571	-1
	4,713	1
Wendepunkte:	-6,283	0
	-3,142	0
	-0,023	0,023
	3,142	0
	6,283	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,657	-0,754	-0,657
$-6\frac{1}{2}$	0,215	-0,977	-0,215
-6	-0,279	-0,96	$\frac{19}{68}$
$-5\frac{1}{2}$	-0,706	-0,709	0,706
-5	-0,959	-0,284	0,959
$-4\frac{1}{2}$	-0,978	0,211	0,978
-4	-0,757	0,654	0,757
$-3\frac{1}{2}$	-0,351	0,936	0,351
-3	0,141	0,99	-0,141
$-2\frac{1}{2}$	0,598	0,801	-0,598
-2	0,909	0,416	-0,909
$-1\frac{1}{2}$	0,997	-0,071	-0,997
-1	0,841	-0,54	-0,841
$-\frac{1}{2}$	0,479	-0,878	-0,479
0	0	-1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	-1	0
$\frac{1}{2}$	-0,479	-0,878	0,479
1	-0,841	-0,54	0,841
$1\frac{1}{2}$	-0,997	-0,071	0,997
2	-0,909	0,416	0,909
$2\frac{1}{2}$	-0,598	0,801	0,598
3	-0,141	0,99	0,141
$3\frac{1}{2}$	0,351	0,936	-0,351
4	0,757	0,654	-0,757
$4\frac{1}{2}$	0,978	0,211	-0,978
5	0,959	-0,284	-0,959
$5\frac{1}{2}$	0,706	-0,709	-0,706
6	0,279	-0,96	$-\frac{19}{68}$
$6\frac{1}{2}$	-0,215	-0,977	0,215
7	-0,657	-0,754	0,657

•Graph der Funktion  $f(x) = \sin(-x)$



## Aufgabe (5)

• Gegeben die Funktion:  $f(x) = \sin(-x) + 3$

• Kurvendiskussion

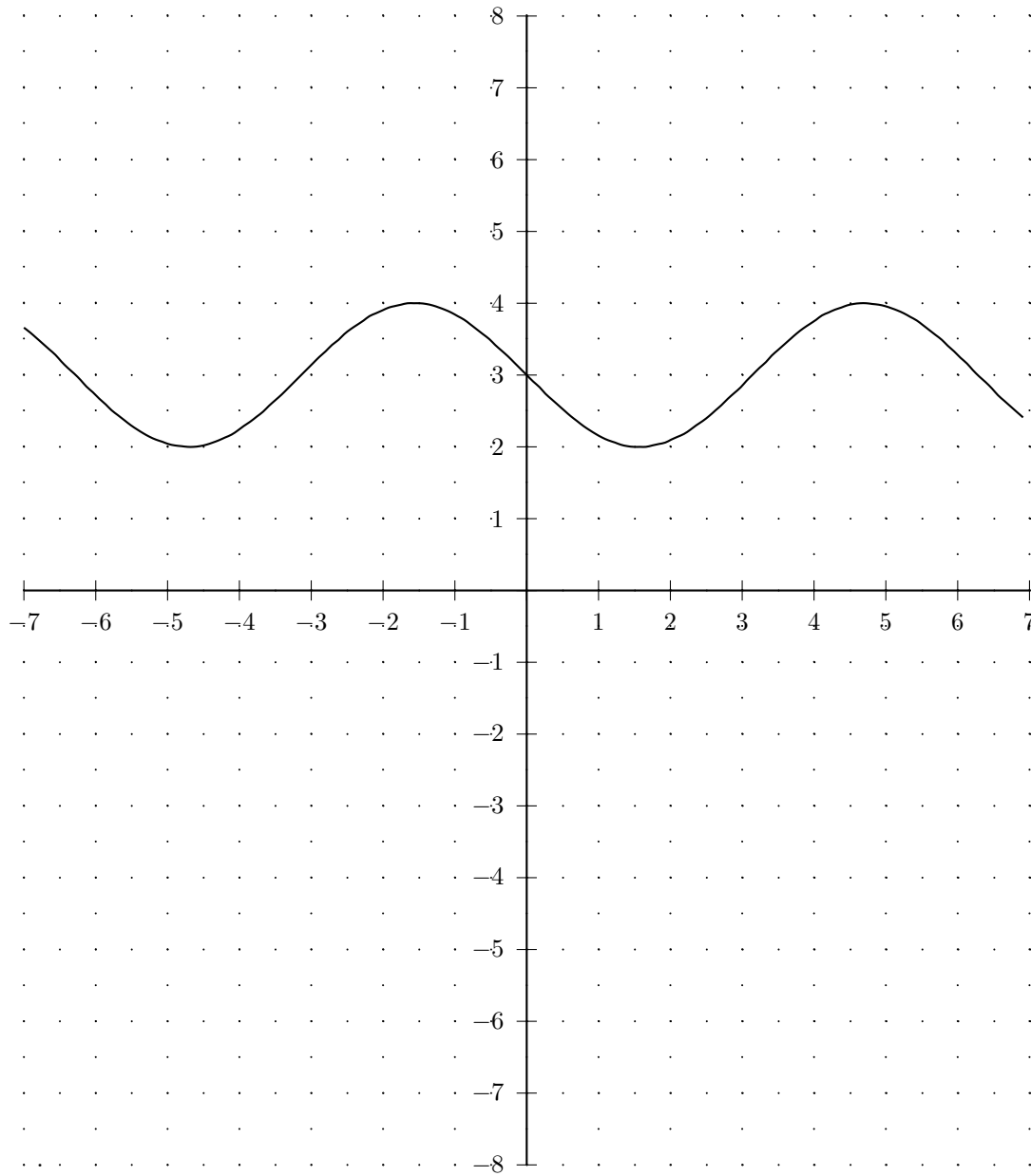
	$x$	$f(x)$
Extremwerte:	-4,713	2
	-1,571	4
	1,571	2
	4,713	4
Wendepunkte:	-6,283	3
	-3,142	3
	-0,023	3,023
	3,142	3
	6,283	3

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	3,657	-0,754	-0,657
$-6\frac{1}{2}$	3,215	-0,977	-0,215
-6	2,721	-0,96	$\frac{19}{68}$
$-5\frac{1}{2}$	2,294	-0,709	0,706
-5	2,041	-0,284	0,959
$-4\frac{1}{2}$	2,022	0,211	0,978
-4	2,243	0,654	0,757
$-3\frac{1}{2}$	2,649	0,936	0,351
-3	3,141	0,99	-0,141
$-2\frac{1}{2}$	3,598	0,801	-0,598
-2	3,909	0,416	-0,909
$-1\frac{1}{2}$	3,997	-0,071	-0,997
-1	3,841	-0,54	-0,841
$-\frac{1}{2}$	3,479	-0,878	-0,479
0	3	-1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	3	-1	0
$\frac{1}{2}$	2,521	-0,878	0,479
1	2,159	-0,54	0,841
$1\frac{1}{2}$	2,003	-0,071	0,997
2	2,091	0,416	0,909
$2\frac{1}{2}$	2,402	0,801	0,598
3	2,859	0,99	0,141
$3\frac{1}{2}$	3,351	0,936	-0,351
4	3,757	0,654	-0,757
$4\frac{1}{2}$	3,978	0,211	-0,978
5	3,959	-0,284	-0,959
$5\frac{1}{2}$	3,706	-0,709	-0,706
6	3,279	-0,96	$-\frac{19}{68}$
$6\frac{1}{2}$	2,785	-0,977	0,215
7	2,343	-0,754	0,657

•Graph der Funktion  $f(x) = \sin(-x) + 3$



## Aufgabe (6)

• Gegeben die Funktion:  $f(x) = \sin(2 \cdot x)$

• Kurvendiskussion

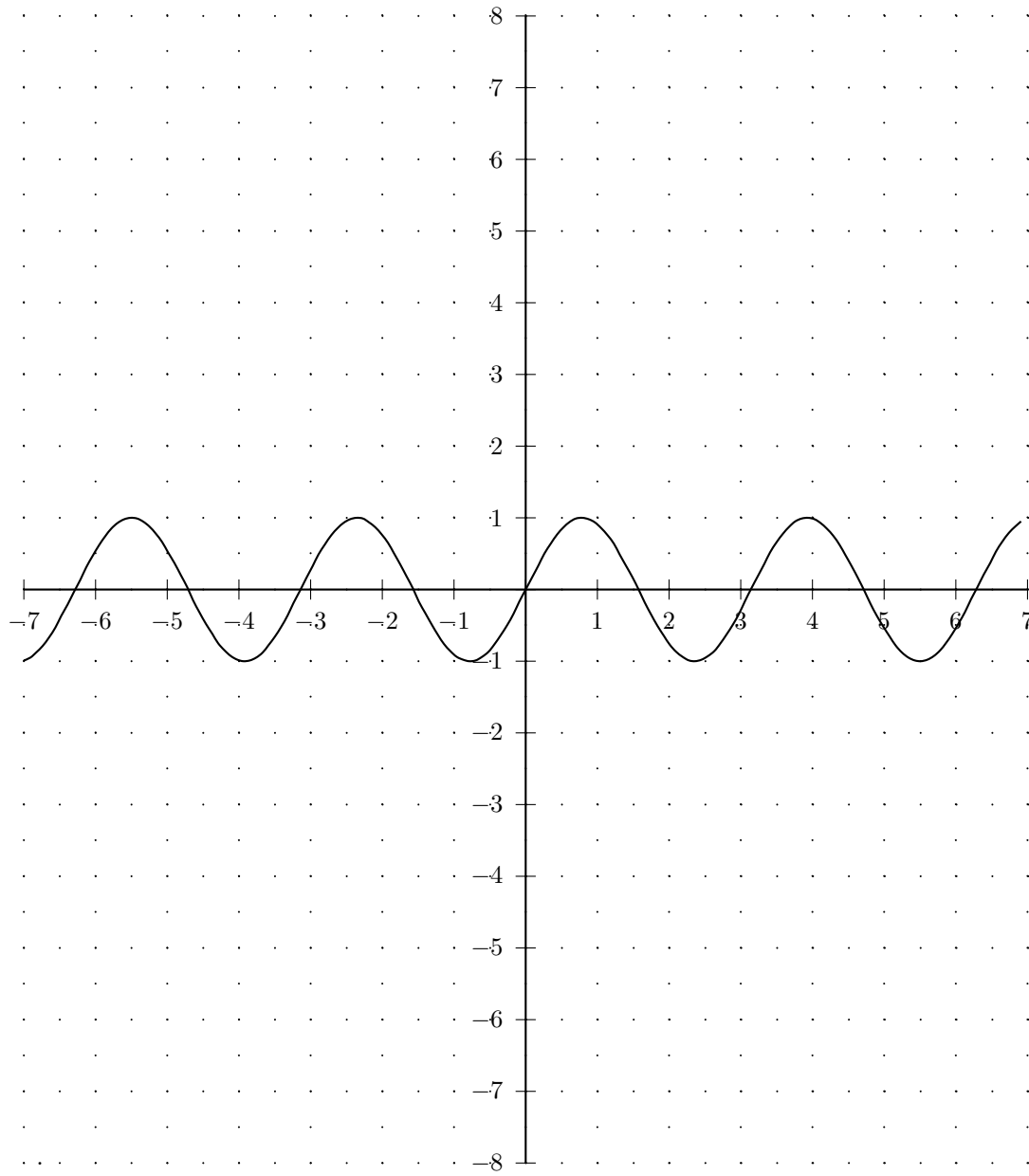
	$x$	$f(x)$
Nullstellen:	-6,283	0,001
	-4,712	0
	-3,142	0
	-1,571	0
	0	-0,001
	1,571	0
	3,142	0
	4,712	0
	6,283	-0,001
Extremwerte:	-5,498	1
	-3,927	-1
	-2,356	1
	-0,785	-1
	0,785	1
	2,356	-1
	3,927	1
	5,498	-1
Wendepunkte:	-6,283	0,001
	-4,712	0
	-3,142	0
	-1,571	0
	-0,023	-0,047
	1,571	0
	3,142	0
	4,712	0
	6,283	-0,001

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,991	0,273	3,962
$-6\frac{1}{2}$	-0,42	1,815	1,681
-6	0,537	1,688	-2,146
$-5\frac{1}{2}$	1	0,009	-4
-5	0,544	-1,678	-2,176
$-4\frac{1}{2}$	-0,412	-1,822	1,648
-4	-0,989	-0,291	3,957
$-3\frac{1}{2}$	-0,657	1,508	2,628
-3	0,279	1,92	-1,118
$-2\frac{1}{2}$	0,959	0,567	-3,836
-2	0,757	-1,307	-3,027
$-1\frac{1}{2}$	-0,141	-1,98	0,564
-1	-0,909	-0,832	3,637
$-\frac{1}{2}$	-0,841	1,081	3,366
0	0	2	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	2	0
$\frac{1}{2}$	0,841	1,081	-3,366
1	0,909	-0,832	-3,637
$1\frac{1}{2}$	0,141	-1,98	-0,564
2	-0,757	-1,307	3,027
$2\frac{1}{2}$	-0,959	0,567	3,836
3	-0,279	1,92	1,118
$3\frac{1}{2}$	0,657	1,508	-2,628
4	0,989	-0,291	-3,957
$4\frac{1}{2}$	0,412	-1,822	-1,648
5	-0,544	-1,678	2,176
$5\frac{1}{2}$	-1	0,009	4
6	-0,537	1,688	2,146
$6\frac{1}{2}$	0,42	1,815	-1,681
7	0,991	0,273	-3,962

•Graph der Funktion  $f(x) = \sin(2 \cdot x)$



## Aufgabe (7)

• Gegeben die Funktion:  $f(x) = \sin\left(\frac{1}{2} \cdot x - 1\right) + 1$

• Kurvendiskussion

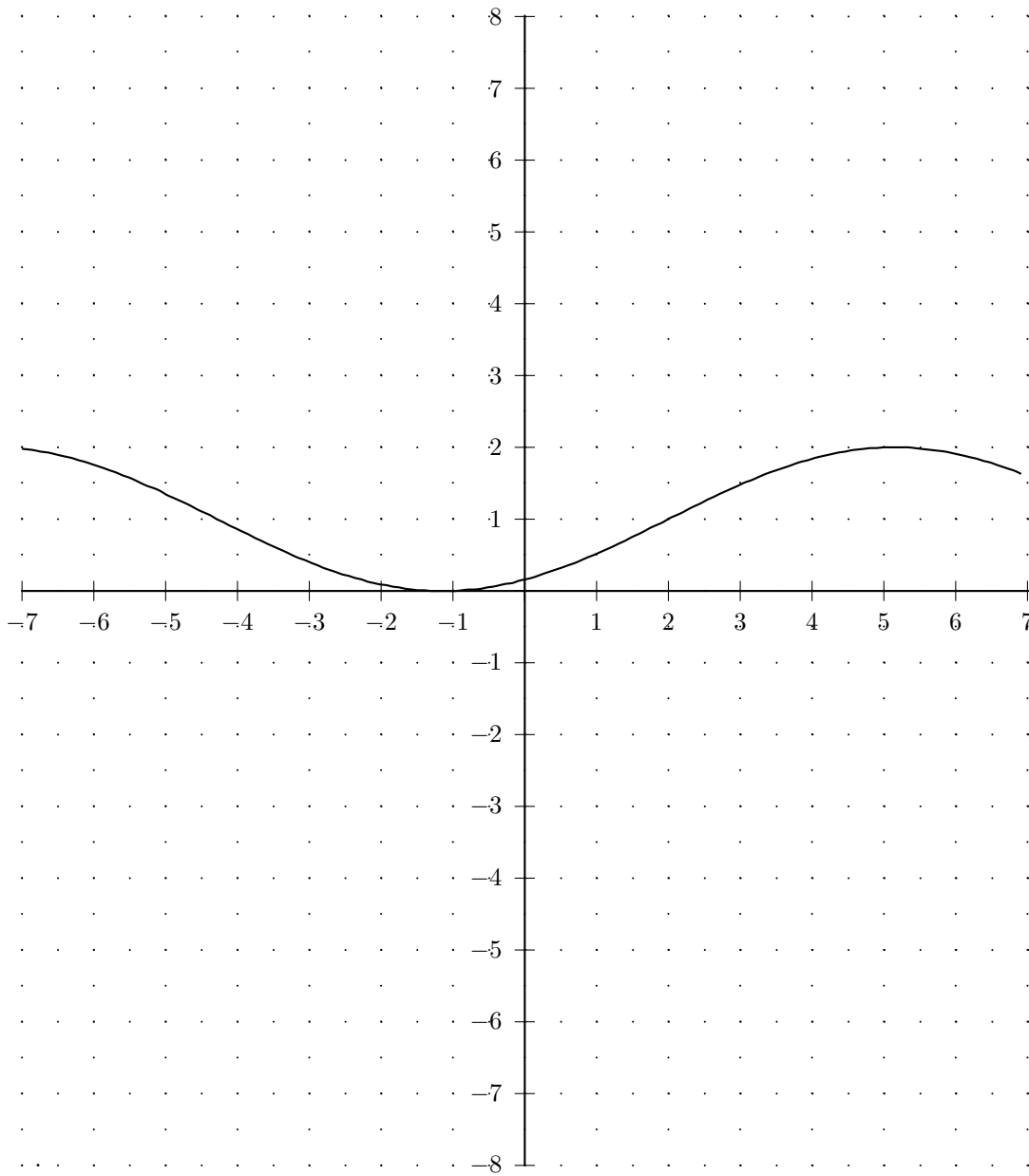
	$x$	$f(x)$
Extremwerte:	-1,142	0
	5,141	2
Wendepunkte:	-4,283	1
	2	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,978	-0,105	-0,244
$-6\frac{1}{2}$	1,895	-0,223	-0,224
-6	1,757	-0,327	-0,189
$-5\frac{1}{2}$	1,572	-0,41	-0,143
-5	1,351	-0,468	-0,088
$-4\frac{1}{2}$	1,108	-0,497	-0,027
-4	0,859	-0,495	0,035
$-3\frac{1}{2}$	0,618	-0,462	0,095
-3	0,402	-0,401	0,15
$-2\frac{1}{2}$	0,222	-0,314	0,195
-2	0,091	-0,208	0,227
$-1\frac{1}{2}$	0,016	-0,089	0,246
-1	0,003	0,035	0,249
$-\frac{1}{2}$	0,051	0,158	0,237
0	0,159	0,27	0,21

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0,159	0,27	0,21
$\frac{1}{2}$	0,318	0,366	0,17
1	0,521	0,439	0,12
$1\frac{1}{2}$	0,753	0,484	0,062
2	1	0,5	0
$2\frac{1}{2}$	1,247	0,484	-0,062
3	1,479	0,439	-0,12
$3\frac{1}{2}$	1,682	0,366	-0,17
4	1,841	0,27	-0,21
$4\frac{1}{2}$	1,949	0,158	-0,237
5	1,997	0,035	-0,249
$5\frac{1}{2}$	1,984	-0,089	-0,246
6	1,909	-0,208	-0,227
$6\frac{1}{2}$	1,778	-0,314	-0,195
7	1,598	-0,401	-0,15

•Graph der Funktion  $f(x) = \sin\left(\frac{1}{2} \cdot x - 1\right) + 1$



## Aufgabe (8)

• Gegeben die Funktion:  $f(x) = 2 \cdot \sin(x - 2) + 1$

• Kurvendiskussion

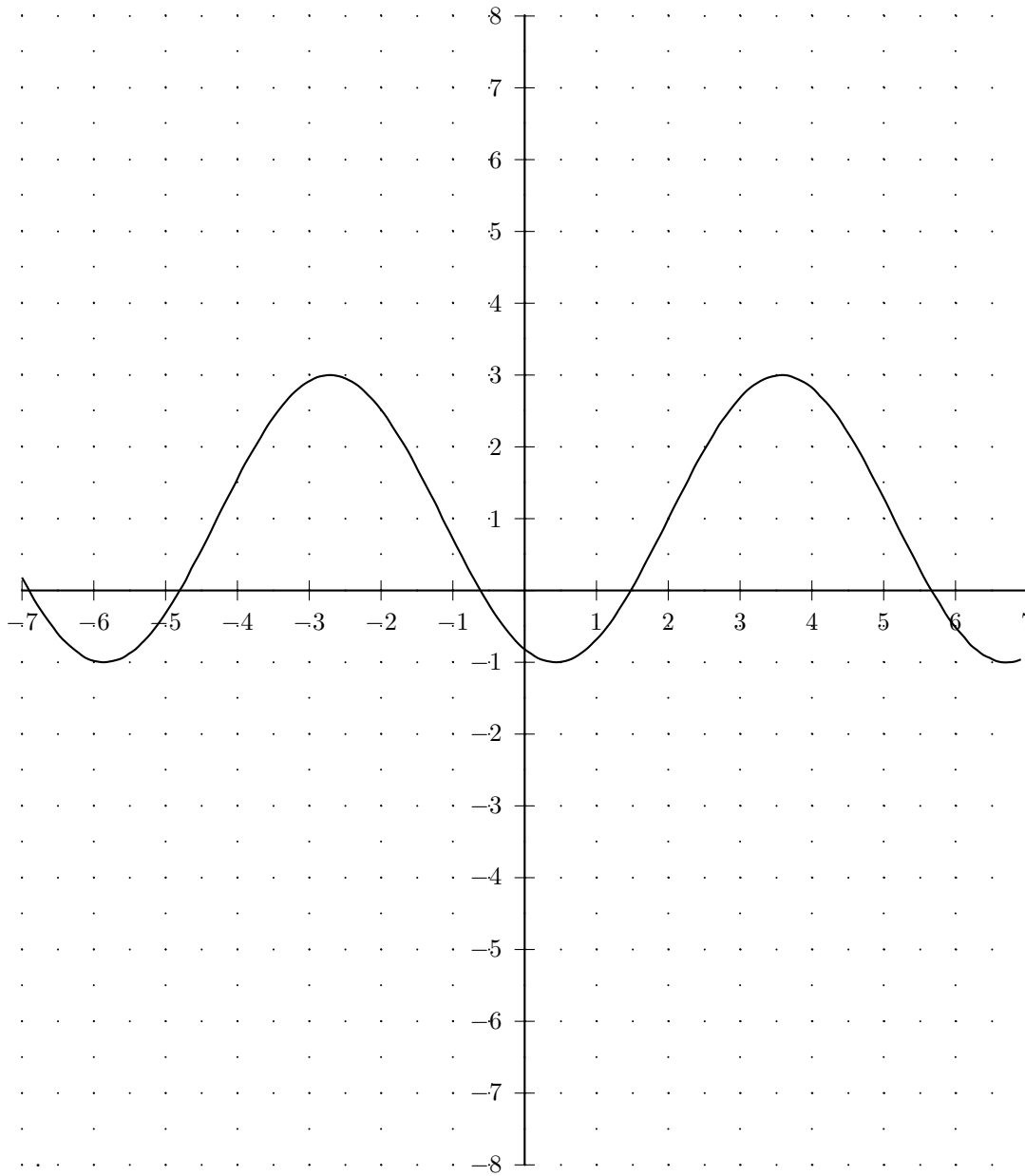
	$x$	$f(x)$
Nullstellen:	-6,901	0
	-4,807	0
	-0,618	0
	1,476	0
	5,665	0
Extremwerte:	-5,854	-1
	$-2\frac{57}{80}$	3
	0,429	-1
	3,571	3
	6,713	-1
Wendepunkte:	-4,283	0,999
	-1,142	1
	2	0,999
	5,142	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,176	-1,822	0,824
$-6\frac{1}{2}$	-0,597	-1,204	1,597
-6	-0,979	-0,291	1,979
$-5\frac{1}{2}$	-0,876	0,693	1,876
-5	-0,314	1,508	1,314
$-4\frac{1}{2}$	0,57	1,953	0,43
-4	1,559	1,92	-0,559
$-3\frac{1}{2}$	2,411	1,417	-1,411
-3	2,918	0,567	-1,918
$-2\frac{1}{2}$	2,955	-0,422	-1,955
-2	2,514	-1,307	-1,514
$-1\frac{1}{2}$	1,702	-1,873	-0,702
-1	0,718	-1,98	0,282
$-\frac{1}{2}$	-0,197	-1,602	1,197
0	-0,819	-0,832	1,819

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	-0,819	-0,832	1,819
$\frac{1}{2}$	-0,995	0,141	1,995
1	-0,683	1,081	1,683
$1\frac{1}{2}$	0,041	1,755	0,959
2	1	2	0
$2\frac{1}{2}$	1,959	1,755	-0,959
3	2,683	1,081	-1,683
$3\frac{1}{2}$	2,995	0,141	-1,995
4	2,819	-0,832	-1,819
$4\frac{1}{2}$	2,197	-1,602	-1,197
5	1,282	-1,98	-0,282
$5\frac{1}{2}$	0,298	-1,873	0,702
6	-0,514	-1,307	1,514
$6\frac{1}{2}$	-0,955	-0,422	1,955
7	-0,918	0,567	1,918

•Graph der Funktion  $f(x) = 2 \cdot \sin(x - 2) + 1$



## Aufgabe (9)

• Gegeben die Funktion:  $f(x) = \frac{1}{3} \cdot \sin(-x)$

• Kurvendiskussion

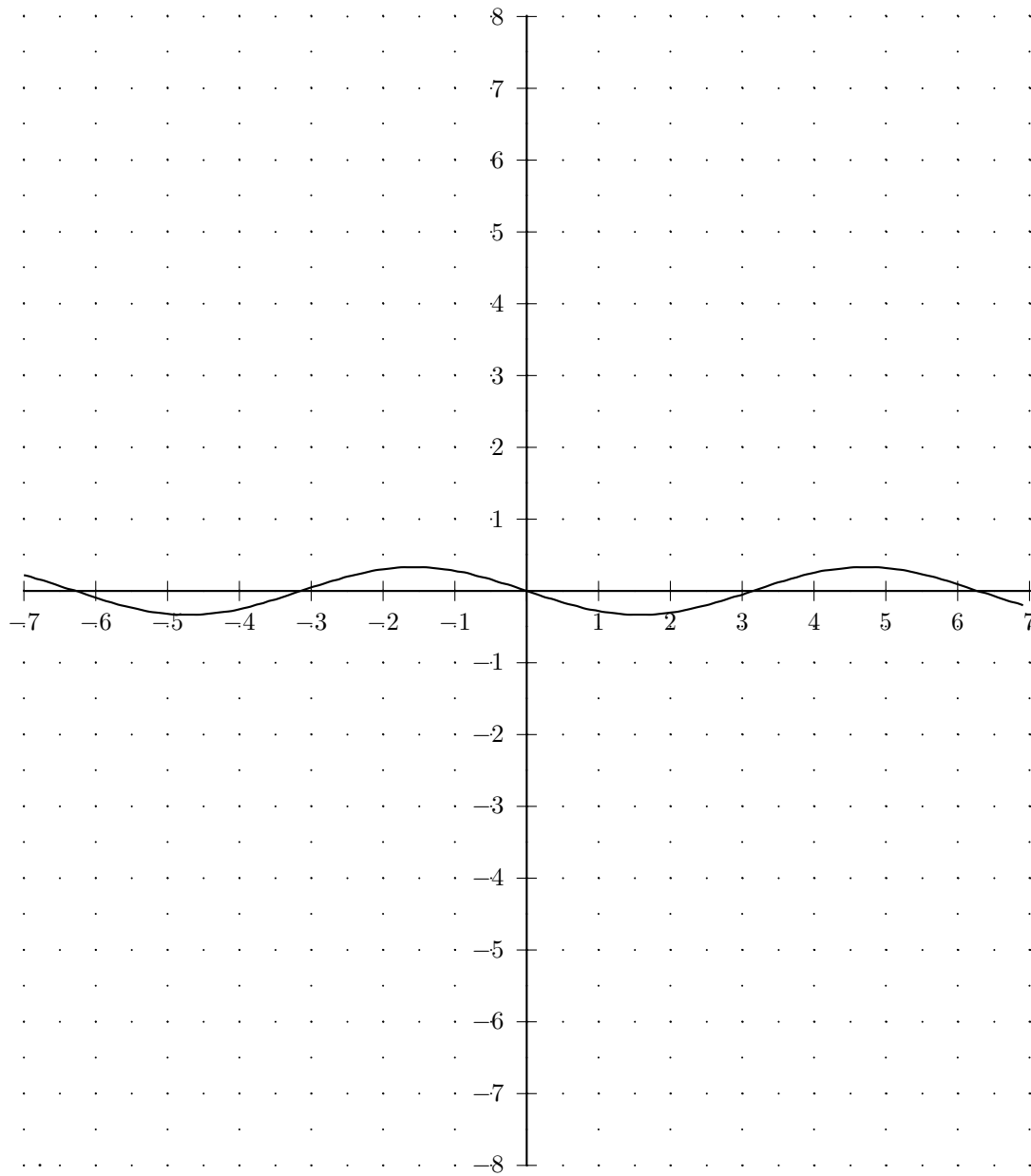
	$x$	$f(x)$
Nullstellen:	-6,283	0
	-3,142	0
	0	0
	3,142	0
	6,283	0
Extremwerte:	-4,713	$-\frac{1}{3}$
	-1,571	$\frac{1}{3}$
	1,571	$-\frac{1}{3}$
	4,713	$\frac{1}{3}$
Wendepunkte:	-6,283	0
	-3,142	0
	-0,023	0,008
	3,142	0
	6,283	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,219	-0,251	-0,219
$-6\frac{1}{2}$	0,072	-0,326	-0,072
-6	-0,093	-0,32	0,093
$-5\frac{1}{2}$	-0,235	-0,236	0,235
-5	-0,32	-0,095	0,32
$-4\frac{1}{2}$	$-\frac{29}{89}$	0,07	0,326
-4	-0,252	0,218	0,252
$-3\frac{1}{2}$	-0,117	0,312	0,117
-3	0,047	0,33	-0,047
$-2\frac{1}{2}$	0,199	0,267	-0,199
-2	0,303	0,139	-0,303
$-1\frac{1}{2}$	0,332	-0,024	-0,332
-1	0,28	-0,18	$-\frac{23}{82}$
$-\frac{1}{2}$	0,16	-0,293	-0,16
0	0	-0,333	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	-0,333	0
$\frac{1}{2}$	-0,16	-0,293	0,16
1	-0,28	-0,18	$\frac{23}{82}$
$1\frac{1}{2}$	-0,332	-0,024	0,332
2	-0,303	0,139	0,303
$2\frac{1}{2}$	-0,199	0,267	0,199
3	-0,047	0,33	0,047
$3\frac{1}{2}$	0,117	0,312	-0,117
4	0,252	0,218	-0,252
$4\frac{1}{2}$	$\frac{29}{89}$	0,07	-0,326
5	0,32	-0,095	-0,32
$5\frac{1}{2}$	0,235	-0,236	-0,235
6	0,093	-0,32	-0,093
$6\frac{1}{2}$	-0,072	-0,326	0,072
7	-0,219	-0,251	0,219

•Graph der Funktion  $f(x) = \frac{1}{3} \cdot \sin(-x)$



## Aufgabe (10)

• Gegeben die Funktion:  $f(x) = -2 \cdot \sin(-x) + 3$

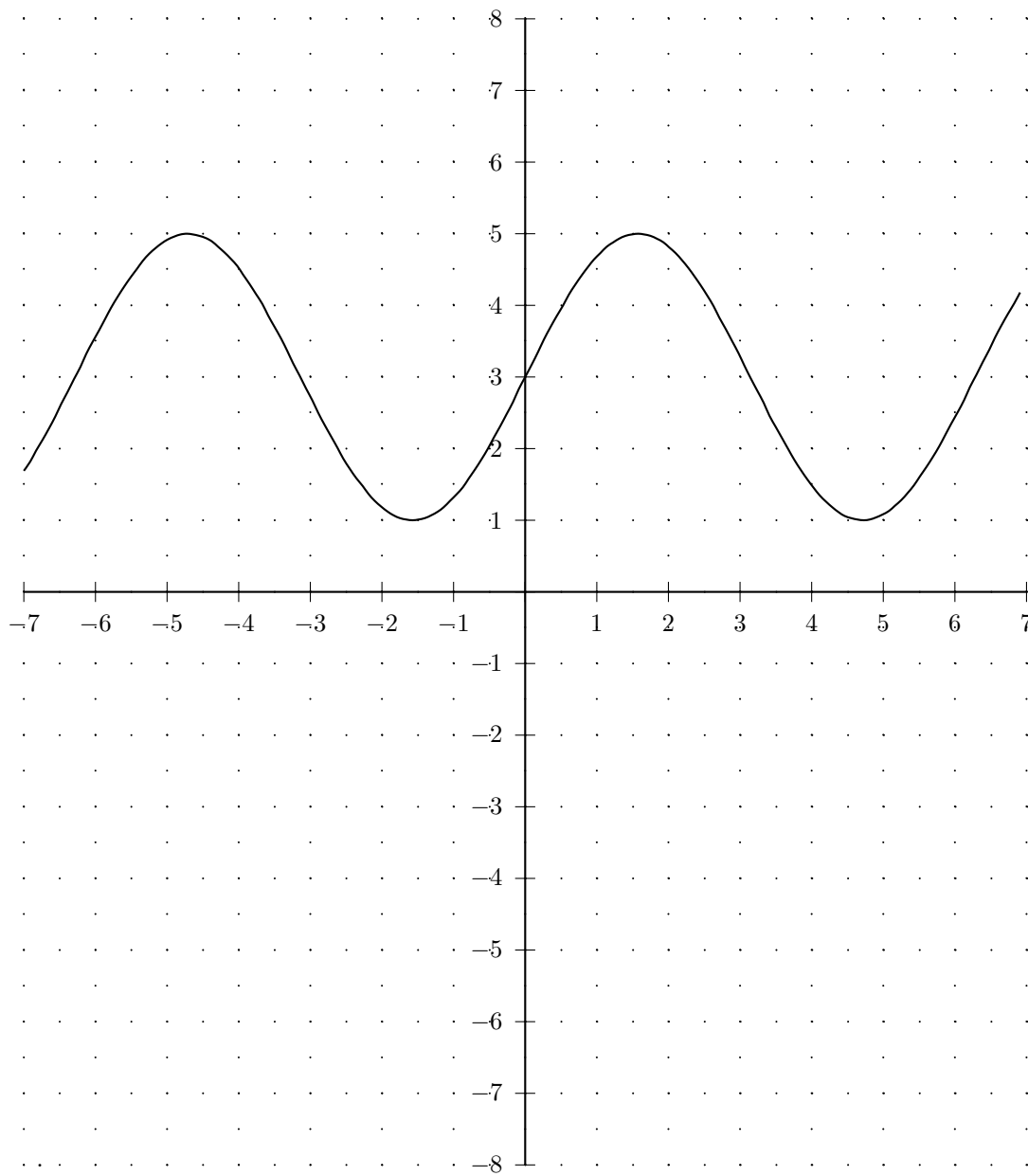
• Kurvendiskussion

	$x$	$f(x)$
Extremwerte:	-4,713	5
	-1,571	1
	1,571	5
	4,713	1
Wendepunkte:	-6,283	3,001
	-3,142	3
	-0,023	2,953
	3,142	3
	6,283	2,999

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,686	1,508	1,314
$-6\frac{1}{2}$	2,57	1,953	0,43
-6	3,559	1,92	-0,559
$-5\frac{1}{2}$	4,411	1,417	-1,411
-5	4,918	0,567	-1,918
$-4\frac{1}{2}$	4,955	-0,422	-1,955
-4	4,514	-1,307	-1,514
$-3\frac{1}{2}$	3,702	-1,873	-0,702
-3	2,718	-1,98	0,282
$-2\frac{1}{2}$	1,803	-1,602	1,197
-2	1,181	-0,832	1,819
$-1\frac{1}{2}$	1,005	0,141	1,995
-1	1,317	1,081	1,683
$-\frac{1}{2}$	2,041	1,755	0,959
0	3	2	0
0	3	2	0
$\frac{1}{2}$	3,959	1,755	-0,959
1	4,683	1,081	-1,683
$1\frac{1}{2}$	4,995	0,141	-1,995
2	4,819	-0,832	-1,819
$2\frac{1}{2}$	4,197	-1,602	-1,197
3	3,282	-1,98	-0,282
$3\frac{1}{2}$	2,298	-1,873	0,702
4	1,486	-1,307	1,514
$4\frac{1}{2}$	1,045	-0,422	1,955
5	1,082	0,567	1,918
$5\frac{1}{2}$	1,589	1,417	1,411
6	2,441	1,92	0,559
$6\frac{1}{2}$	3,43	1,953	-0,43
7	4,314	1,508	-1,314

•Graph der Funktion  $f(x) = -2 \cdot \sin(-x) + 3$



## Aufgabe (11)

• Gegeben die Funktion:  $f(x) = 2 \cdot \sin(x) + 1$

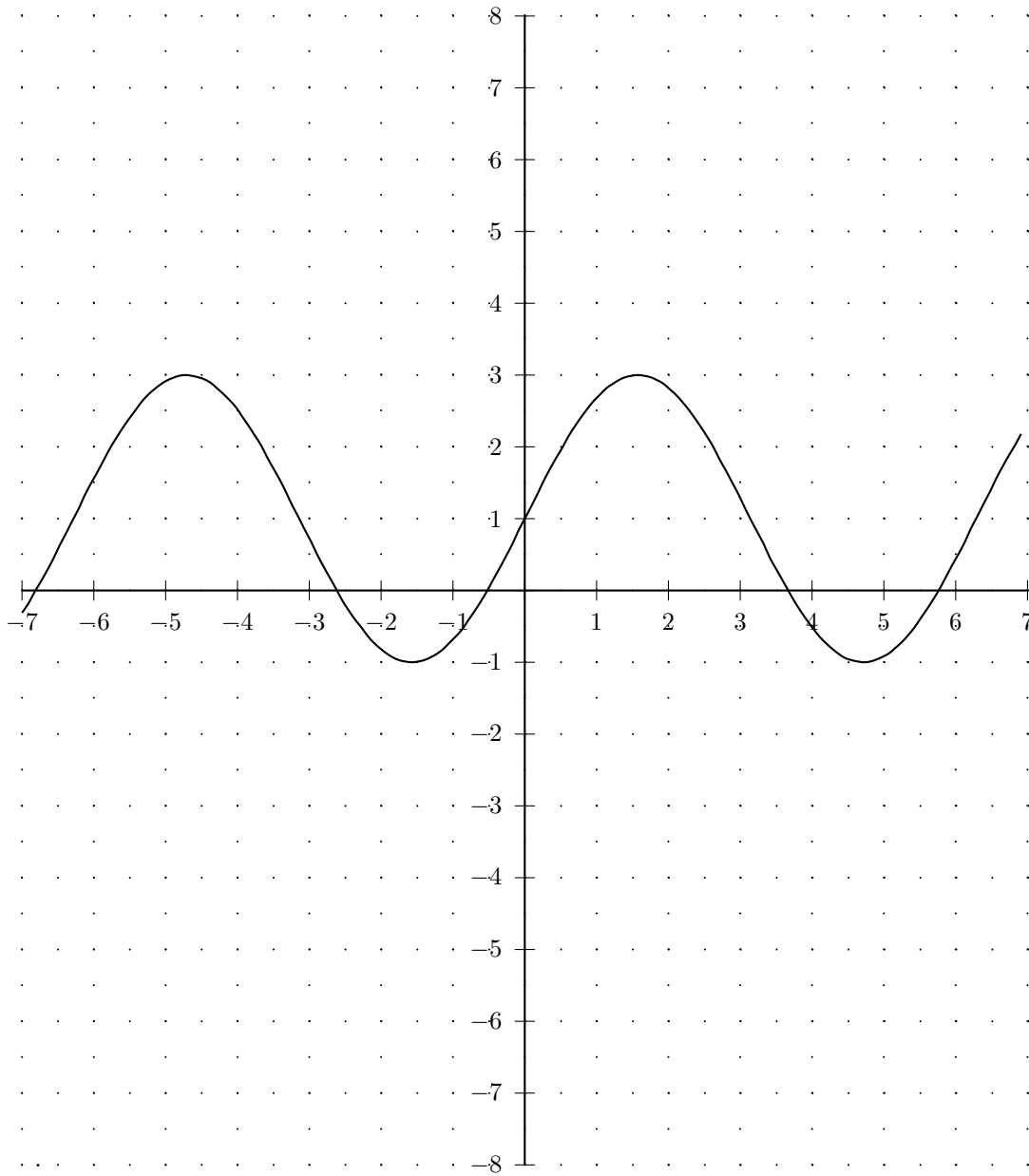
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-6,807	-0,001
	-2,618	0
	-0,524	-0,001
	3,665	0
	5,759	0
	Extremwerte:	-4,713
	-1,571	-1
	1,571	3
	4,713	-1
Wendepunkte:	-6,283	1,001
	-3,142	1
	-0,023	0,953
	3,142	1
	6,283	0,999

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,314	1,508	1,314
$-6\frac{1}{2}$	0,57	1,953	0,43
-6	1,559	1,92	-0,559
$-5\frac{1}{2}$	2,411	1,417	-1,411
-5	2,918	0,567	-1,918
$-4\frac{1}{2}$	2,955	-0,422	-1,955
-4	2,514	-1,307	-1,514
$-3\frac{1}{2}$	1,702	-1,873	-0,702
-3	0,718	-1,98	0,282
$-2\frac{1}{2}$	-0,197	-1,602	1,197
-2	-0,819	-0,832	1,819
$-1\frac{1}{2}$	-0,995	0,141	1,995
-1	-0,683	1,081	1,683
$-\frac{1}{2}$	0,041	1,755	0,959
0	1	2	0
0	1	2	0
$\frac{1}{2}$	1,959	1,755	-0,959
1	2,683	1,081	-1,683
$1\frac{1}{2}$	2,995	0,141	-1,995
2	2,819	-0,832	-1,819
$2\frac{1}{2}$	2,197	-1,602	-1,197
3	1,282	-1,98	-0,282
$3\frac{1}{2}$	0,298	-1,873	0,702
4	-0,514	-1,307	1,514
$4\frac{1}{2}$	-0,955	-0,422	1,955
5	-0,918	0,567	1,918
$5\frac{1}{2}$	-0,411	1,417	1,411
6	0,441	1,92	0,559
$6\frac{1}{2}$	1,43	1,953	-0,43
7	2,314	1,508	-1,314

•Graph der Funktion  $f(x) = 2 \cdot \sin(x) + 1$



## Aufgabe (12)

• Gegeben die Funktion:  $f(x) = -3 \cdot \sin(x - 2) + 1$

• Kurvendiskussion

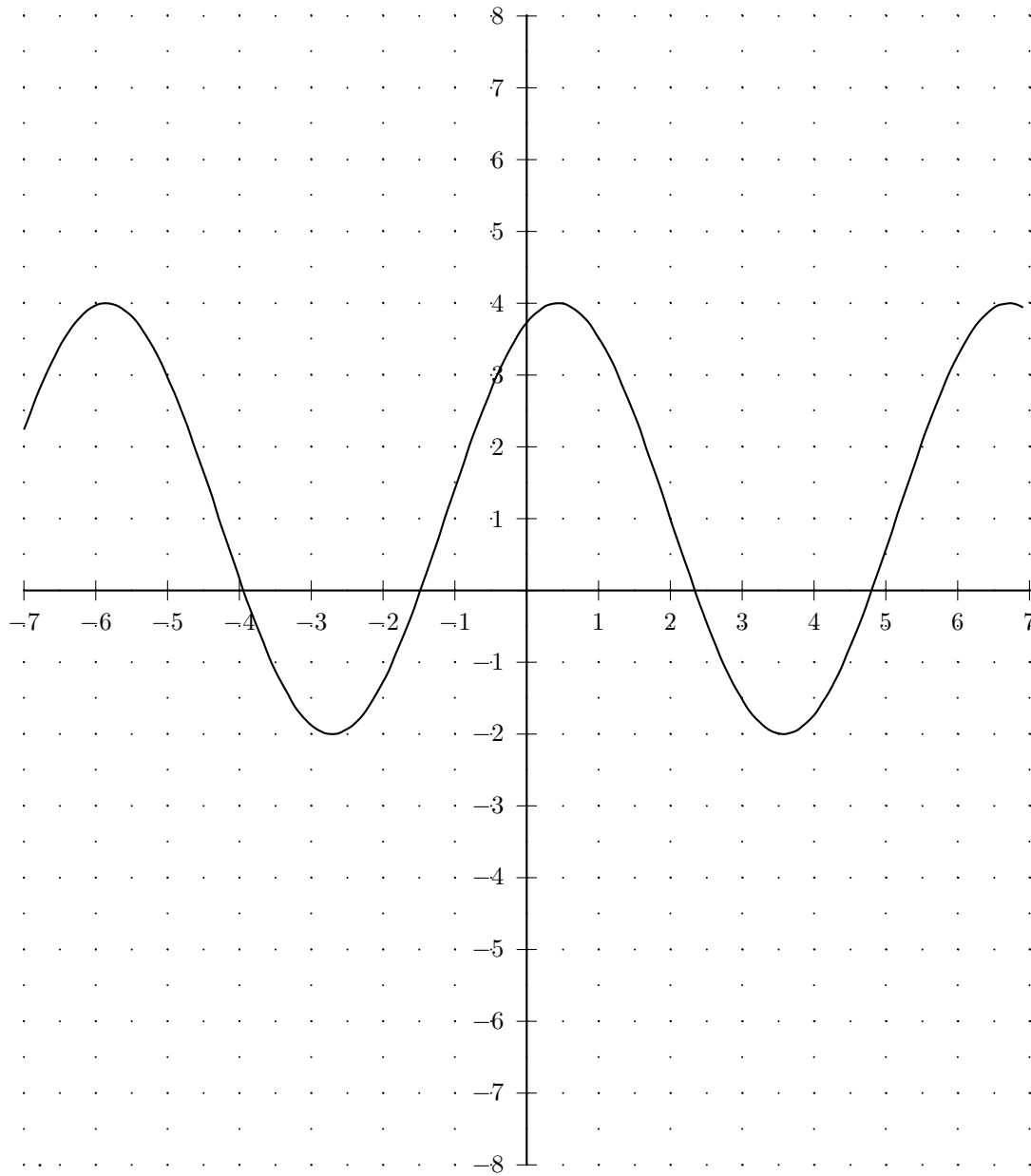
	$x$	$f(x)$
Nullstellen:	-3,944	0,001
	-1,481	0
	2,34	0,001
	4,802	0
Extremwerte:	-5,854	4
	$-2\frac{57}{80}$	-2
	0,429	4
	3,571	-2
	6,713	4
Wendepunkte:	-4,283	1,001
	-1,142	1
	2	1,001
	5,142	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	2,236	2,733	-1,236
$-6\frac{1}{2}$	3,395	1,806	-2,395
-6	3,968	0,436	-2,968
$-5\frac{1}{2}$	3,814	-1,04	-2,814
-5	2,971	-2,262	-1,971
$-4\frac{1}{2}$	1,645	-2,93	-0,645
-4	0,162	-2,88	0,838
$-3\frac{1}{2}$	-1,117	-2,126	2,117
-3	-1,877	-0,851	2,877
$-2\frac{1}{2}$	-1,933	0,632	2,933
-2	-1,27	1,961	2,27
$-1\frac{1}{2}$	-0,052	2,809	1,052
-1	1,423	2,97	-0,423
$-\frac{1}{2}$	2,795	2,403	-1,795
0	3,728	1,248	-2,728

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	3,728	1,248	-2,728
$\frac{1}{2}$	3,992	-0,212	-2,992
1	3,524	-1,621	-2,524
$1\frac{1}{2}$	2,438	-2,633	-1,438
2	1	-3	0
$2\frac{1}{2}$	-0,438	-2,633	1,438
3	-1,524	-1,621	2,524
$3\frac{1}{2}$	-1,992	-0,212	2,992
4	-1,728	1,248	2,728
$4\frac{1}{2}$	-0,795	2,403	1,795
5	0,577	2,97	0,423
$5\frac{1}{2}$	2,052	2,809	-1,052
6	3,27	1,961	-2,27
$6\frac{1}{2}$	3,933	0,632	-2,933
7	3,877	-0,851	-2,877

•Graph der Funktion  $f(x) = -3 \cdot \sin(x - 2) + 1$



## Aufgabe (13)

• Gegeben die Funktion:  $f(x) = 2 \cdot \sin(-x)$

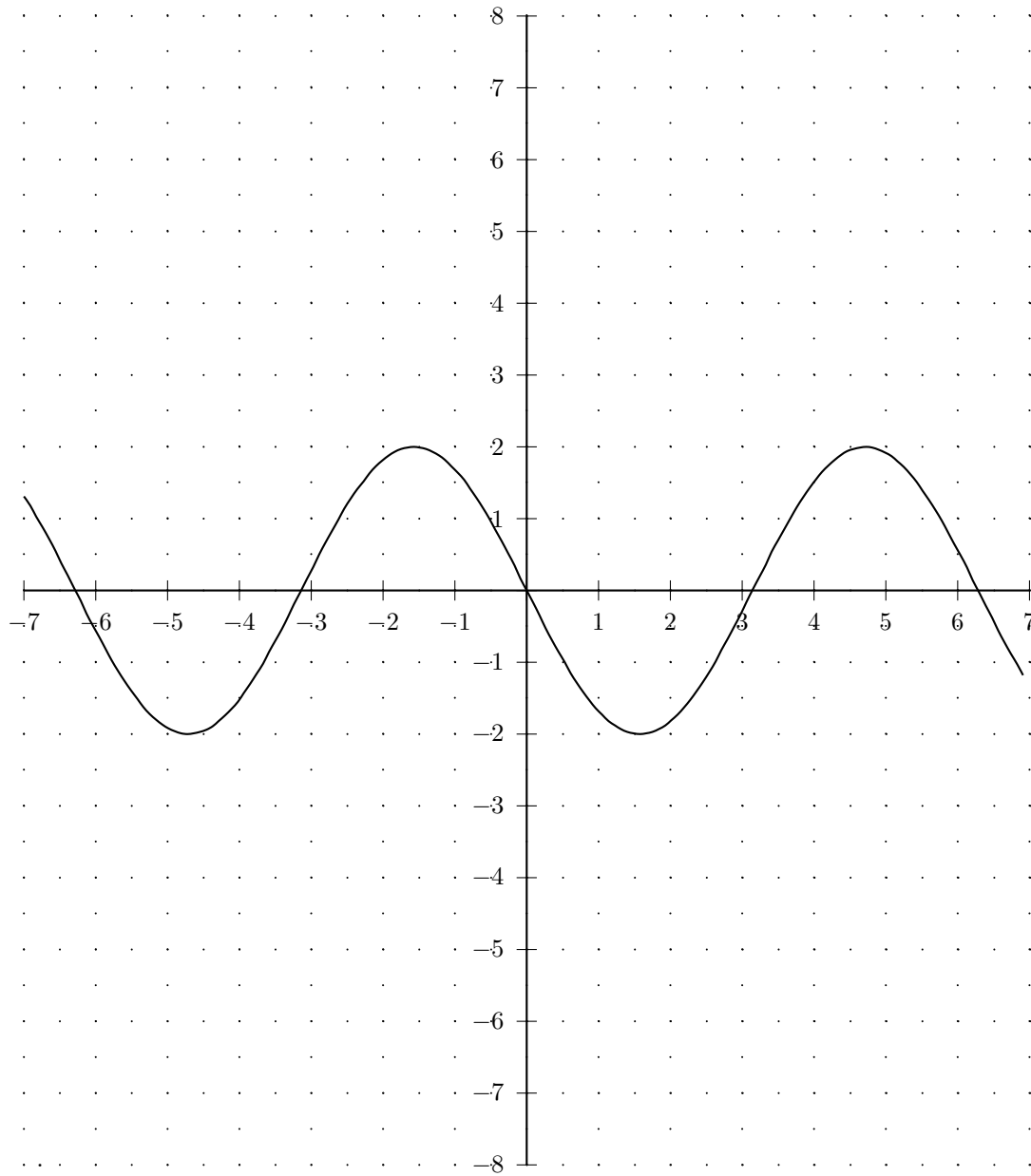
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-6,283	-0,001
	-3,142	0
	0	0,001
	3,142	0
	6,283	0,001
Extremwerte:	-4,713	-2
	-1,571	2
	1,571	-2
	4,713	2
Wendepunkte:	-6,283	-0,001
	-3,142	0
	-0,023	0,047
	3,142	0
	6,283	0,001

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,314	-1,508	-1,314
$-6\frac{1}{2}$	0,43	-1,953	-0,43
-6	-0,559	-1,92	0,559
$-5\frac{1}{2}$	-1,411	-1,417	1,411
-5	-1,918	-0,567	1,918
$-4\frac{1}{2}$	-1,955	0,422	1,955
-4	-1,514	1,307	1,514
$-3\frac{1}{2}$	-0,702	1,873	0,702
-3	0,282	1,98	-0,282
$-2\frac{1}{2}$	1,197	1,602	-1,197
-2	1,819	0,832	-1,819
$-1\frac{1}{2}$	1,995	-0,141	-1,995
-1	1,683	-1,081	-1,683
$-\frac{1}{2}$	0,959	-1,755	-0,959
0	0	-2	0
0	0	-2	0
$\frac{1}{2}$	-0,959	-1,755	0,959
1	-1,683	-1,081	1,683
$1\frac{1}{2}$	-1,995	-0,141	1,995
2	-1,819	0,832	1,819
$2\frac{1}{2}$	-1,197	1,602	1,197
3	-0,282	1,98	0,282
$3\frac{1}{2}$	0,702	1,873	-0,702
4	1,514	1,307	-1,514
$4\frac{1}{2}$	1,955	0,422	-1,955
5	1,918	-0,567	-1,918
$5\frac{1}{2}$	1,411	-1,417	-1,411
6	0,559	-1,92	-0,559
$6\frac{1}{2}$	-0,43	-1,953	0,43
7	-1,314	-1,508	1,314

•Graph der Funktion  $f(x) = 2 \cdot \sin(-x)$



## Aufgabe (14)

• Gegeben die Funktion:  $f(x) = 3 \cdot \sin(-x) + 3$

• Kurvendiskussion

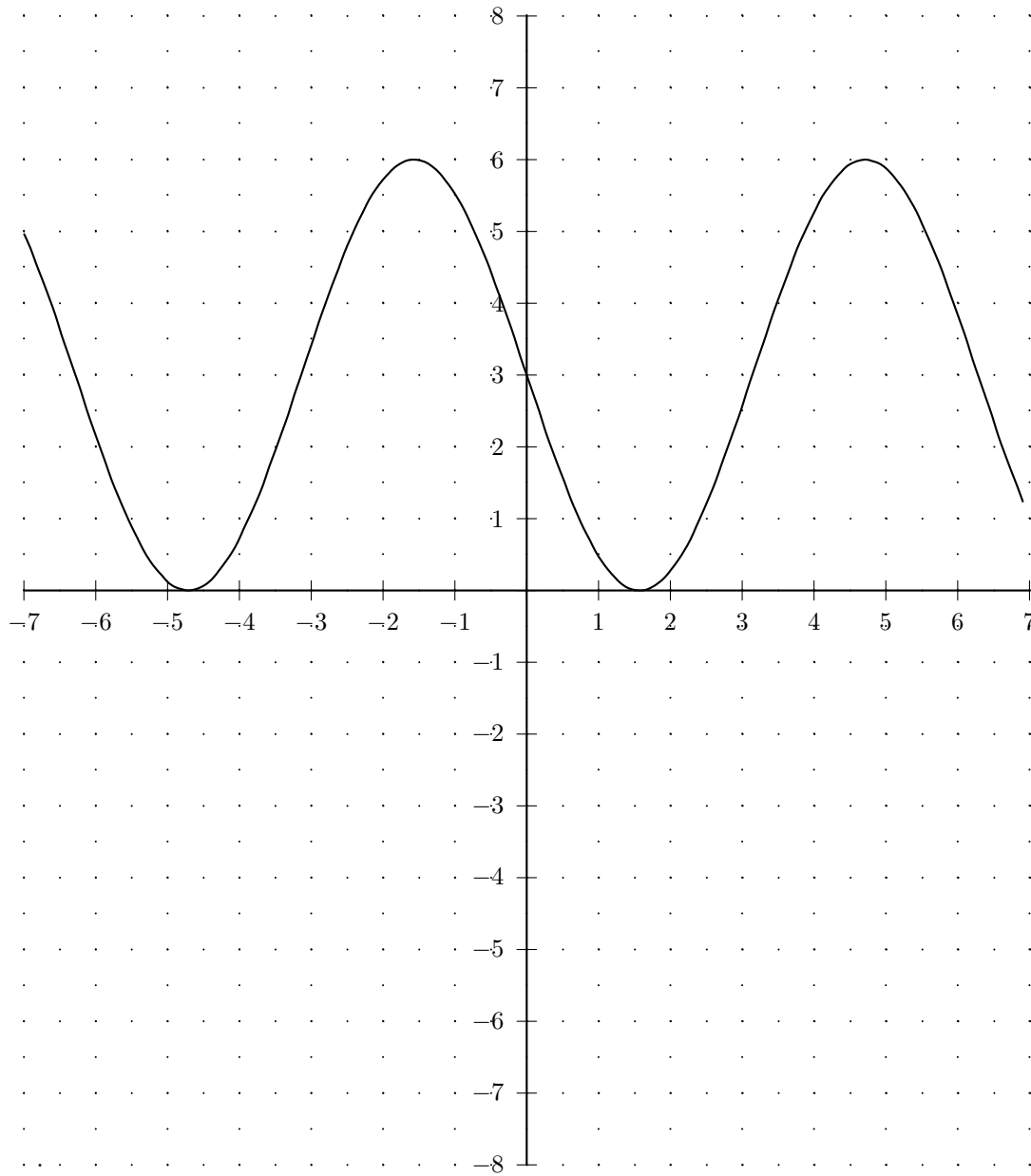
	$x$	$f(x)$
Extremwerte:	-4,713	0
	-1,571	6
	1,571	0
	4,713	6
Wendepunkte:	-6,283	2,999
	-3,142	3
	-0,023	3,07
	3,142	3
	6,283	3,001

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	4,971	-2,262	-1,971
$-6\frac{1}{2}$	3,645	-2,93	-0,645
-6	2,162	-2,88	0,838
$-5\frac{1}{2}$	0,883	-2,126	2,117
-5	0,123	-0,851	2,877
$-4\frac{1}{2}$	0,067	0,632	2,933
-4	0,73	1,961	2,27
$-3\frac{1}{2}$	1,948	2,809	1,052
-3	3,423	2,97	-0,423
$-2\frac{1}{2}$	4,795	2,403	-1,795
-2	5,728	1,248	-2,728
$-1\frac{1}{2}$	5,992	-0,212	-2,992
-1	5,524	-1,621	-2,524
$-\frac{1}{2}$	4,438	-2,633	-1,438
0	3	-3	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	3	-3	0
$\frac{1}{2}$	1,562	-2,633	1,438
1	0,476	-1,621	2,524
$1\frac{1}{2}$	0,008	-0,212	2,992
2	0,272	1,248	2,728
$2\frac{1}{2}$	1,205	2,403	1,795
3	2,577	2,97	0,423
$3\frac{1}{2}$	4,052	2,809	-1,052
4	5,27	1,961	-2,27
$4\frac{1}{2}$	5,933	0,632	-2,933
5	5,877	-0,851	-2,877
$5\frac{1}{2}$	5,117	-2,126	-2,117
6	3,838	-2,88	-0,838
$6\frac{1}{2}$	2,355	-2,93	0,645
7	1,029	-2,262	1,971

- Graph der Funktion  $f(x) = 3 \cdot \sin(-x) + 3$



## Aufgabe (15)

• Gegeben die Funktion:  $f(x) = x \cdot \sin(x)$

• Kurvendiskussion

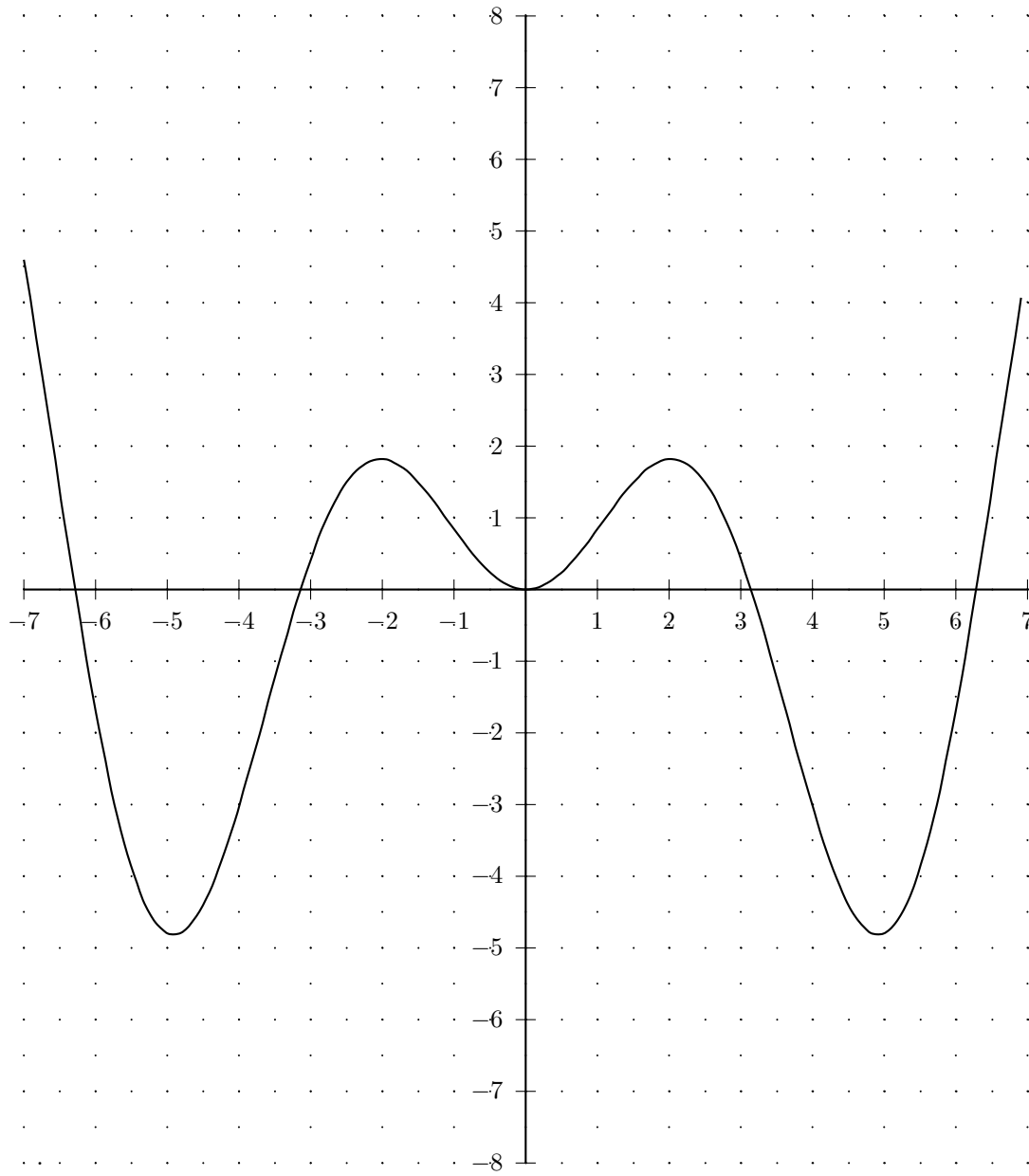
	$x$	$f(x)$
Nullstellen:	-6,283	-0,002
	-3,142	0
	3,142	0
	6,283	-0,002
Extremwerte:	-4,913	-4,814
	-2,029	1,82
	0	0
	2,029	1,82
	4,913	-4,814
Wendepunkte:	-6,578	1,912
	-3,643	-1,752
	-1,077	0,948
	1,077	0,948
	3,643	-1,752
	6,578	1,912

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	4,599	-5,934	-3,091
$-6\frac{1}{2}$	1,398	-6,563	0,555
-6	-1,676	-5,481	3,597
$-5\frac{1}{2}$	-3,88	-3,192	5,298
-5	-4,795	-0,459	5,362
$-4\frac{1}{2}$	-4,399	1,926	3,977
-4	-3,027	3,371	1,72
$-3\frac{1}{2}$	-1,228	3,628	-0,645
-3	0,423	2,829	-2,403
$-2\frac{1}{2}$	1,496	1,404	-3,098
-2	1,819	-0,077	-2,651
$-1\frac{1}{2}$	1,496	-1,104	-1,355
-1	0,841	-1,382	0,239
$-\frac{1}{2}$	0,24	-0,918	1,515
0	0	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	2
$\frac{1}{2}$	0,24	0,918	1,515
1	0,841	1,382	0,239
$1\frac{1}{2}$	1,496	1,104	-1,355
2	1,819	0,077	-2,651
$2\frac{1}{2}$	1,496	-1,404	-3,098
3	0,423	-2,829	-2,403
$3\frac{1}{2}$	-1,228	-3,628	-0,645
4	-3,027	-3,371	1,72
$4\frac{1}{2}$	-4,399	-1,926	3,977
5	-4,795	0,459	5,362
$5\frac{1}{2}$	-3,88	3,192	5,298
6	-1,676	5,481	3,597
$6\frac{1}{2}$	1,398	6,563	0,555
7	4,599	5,934	-3,091

- Graph der Funktion  $f(x) = x \cdot \sin(x)$



## Aufgabe (16)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \sin(x)$

• Kurvendiskussion

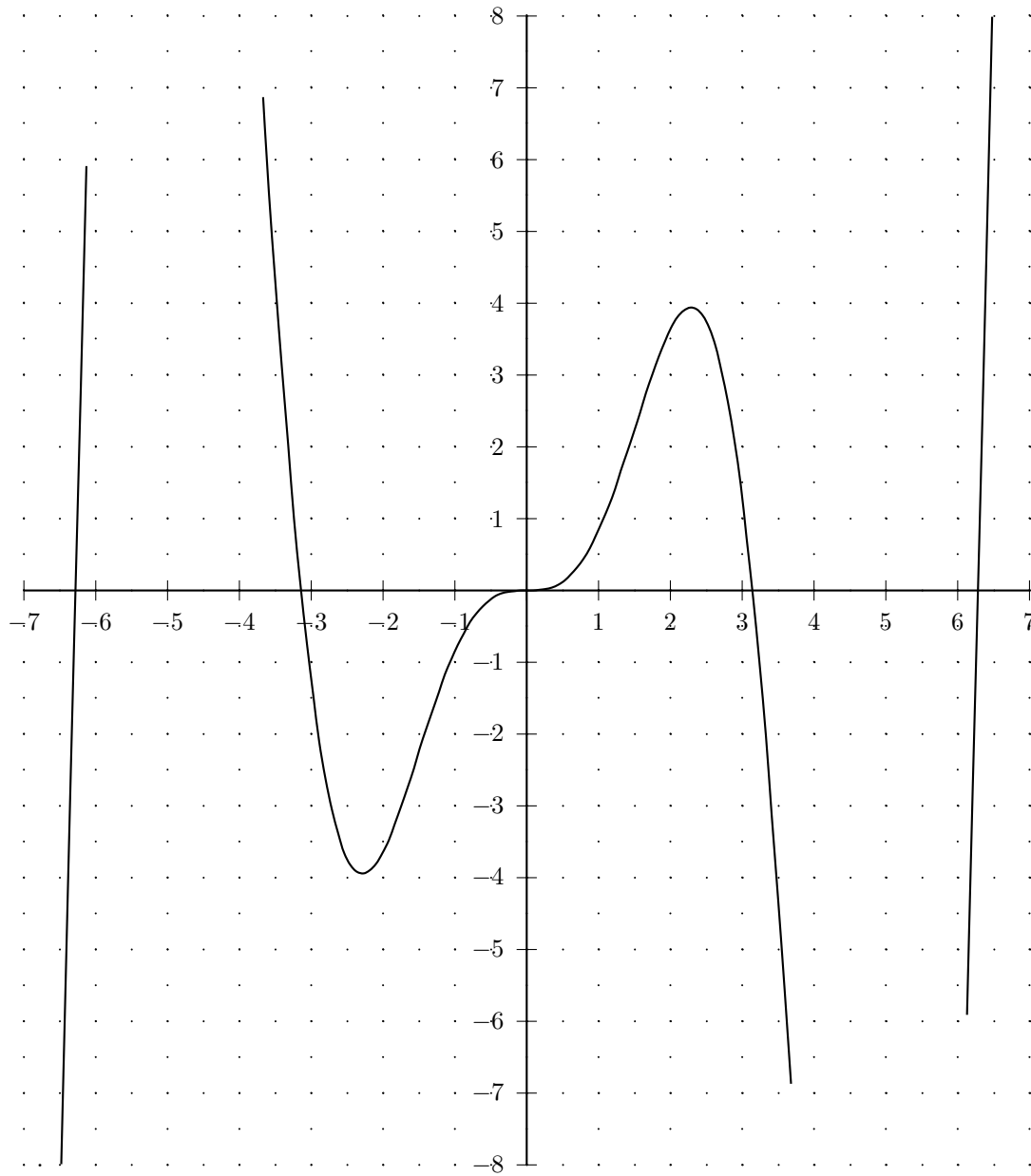
	$x$	$f(x)$
Nullstellen:	-6,283	0,013
	-3,142	0
	0	0
	3,142	0
	6,283	-0,013
Extremwerte:	-5,087	24,083
	-2,289	-3,945
	2,289	3,945
	5,087	-24,083
Wendepunkte:	-6,832	-24,346
	-3,995	12,022
	-1,52	-2,307
	-0,023	0
	1,52	2,307
	3,995	-12,022
	6,832	24,346

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-32,192	46,138	9,769
$-6\frac{1}{2}$	-9,089	44,056	-16,732
-6	10,059	31,213	-32,544
$-5\frac{1}{2}$	21,343	13,676	-35,522
-5	23,973	-2,497	-27,728
$-4\frac{1}{2}$	19,795	-13,066	-14,046
-4	12,109	-16,512	-0,137
$-3\frac{1}{2}$	4,297	-13,927	9,515
-3	-1,27	-8,063	12,867
$-2\frac{1}{2}$	-3,74	-2,015	10,555
-2	-3,637	1,972	5,148
$-1\frac{1}{2}$	-2,244	3,151	-0,175
-1	-0,841	2,223	-3,003
$-\frac{1}{2}$	-0,12	0,699	-2,594
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,12	0,699	2,594
1	0,841	2,223	3,003
$1\frac{1}{2}$	2,244	3,151	0,175
2	3,637	1,972	-5,148
$2\frac{1}{2}$	3,74	-2,015	-10,555
3	1,27	-8,063	-12,867
$3\frac{1}{2}$	-4,297	-13,927	-9,515
4	-12,109	-16,512	0,137
$4\frac{1}{2}$	-19,795	-13,066	14,046
5	-23,973	-2,497	27,728
$5\frac{1}{2}$	-21,343	13,676	35,522
6	-10,059	31,213	32,544
$6\frac{1}{2}$	9,089	44,056	16,732
7	32,192	46,138	-9,769

•Graph der Funktion  $f(x) = x^2 \cdot \sin(x)$



## Aufgabe (17)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \sin(x)$

• Kurvendiskussion

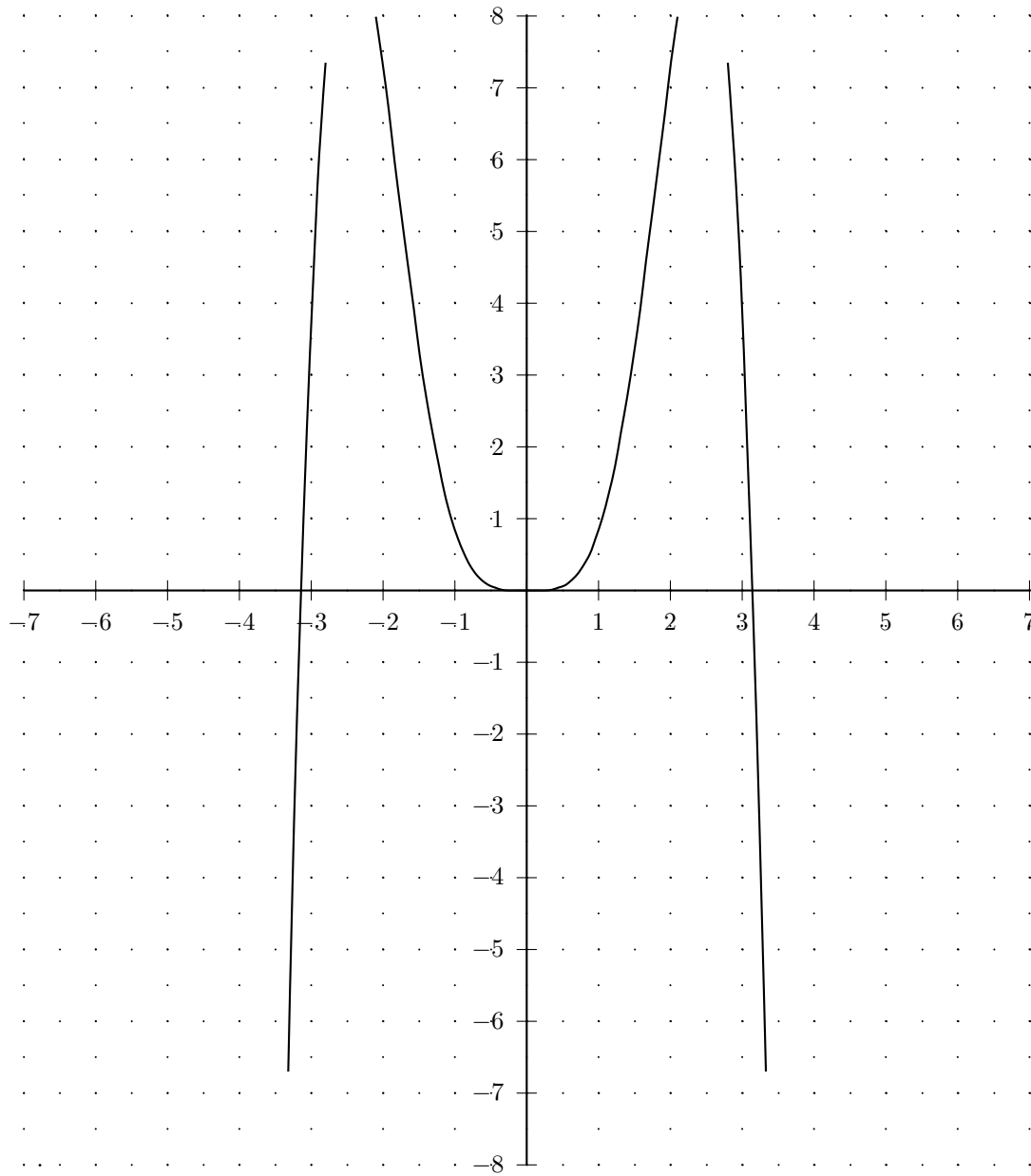
	$x$	$f(x)$
Nullstellen:	-6,283	-0,08
	-3,142	-0,001
	3,142	-0,001
	6,283	-0,08
Extremwerte:	-5,233	-124,317
	-2,456	9,379
	0	0
	2,456	9,379
	5,233	-124,317
Wendepunkte:	-4,267	-70,148
	-1,815	5,798
	1,815	5,798
	4,267	-70,148

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	225,346	-355,155	23,89
$-6\frac{1}{2}$	59,077	-295,457	196,872
-6	-60,354	-177,22	257,687
$-5\frac{1}{2}$	-117,384	-53,88	222,723
-5	-119,866	36,457	133,647
$-4\frac{1}{2}$	-89,077	78,59	37,074
-4	-48,435	78,157	-32,476
$-3\frac{1}{2}$	-15,04	53,041	-61,155
-3	3,81	22,92	-54,729
$-2\frac{1}{2}$	9,351	1,298	-30,417
-2	7,274	-7,582	-6,351
$-1\frac{1}{2}$	3,367	-6,972	6,565
-1	0,841	-3,065	7,449
$-\frac{1}{2}$	0,06	-0,469	2,695
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,06	0,469	2,695
1	0,841	3,065	7,449
$1\frac{1}{2}$	3,367	6,972	6,565
2	7,274	7,582	-6,351
$2\frac{1}{2}$	9,351	-1,298	-30,417
3	3,81	-22,92	-54,729
$3\frac{1}{2}$	-15,04	-53,041	-61,155
4	-48,435	-78,157	-32,476
$4\frac{1}{2}$	-89,077	-78,59	37,074
5	-119,866	-36,457	133,647
$5\frac{1}{2}$	-117,384	53,88	222,723
6	-60,354	177,22	257,687
$6\frac{1}{2}$	59,077	295,457	196,872
7	225,346	355,155	23,89

- Graph der Funktion  $f(x) = x^3 \cdot \sin(x)$



## Aufgabe (18)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \sin(x)$

• Kurvendiskussion

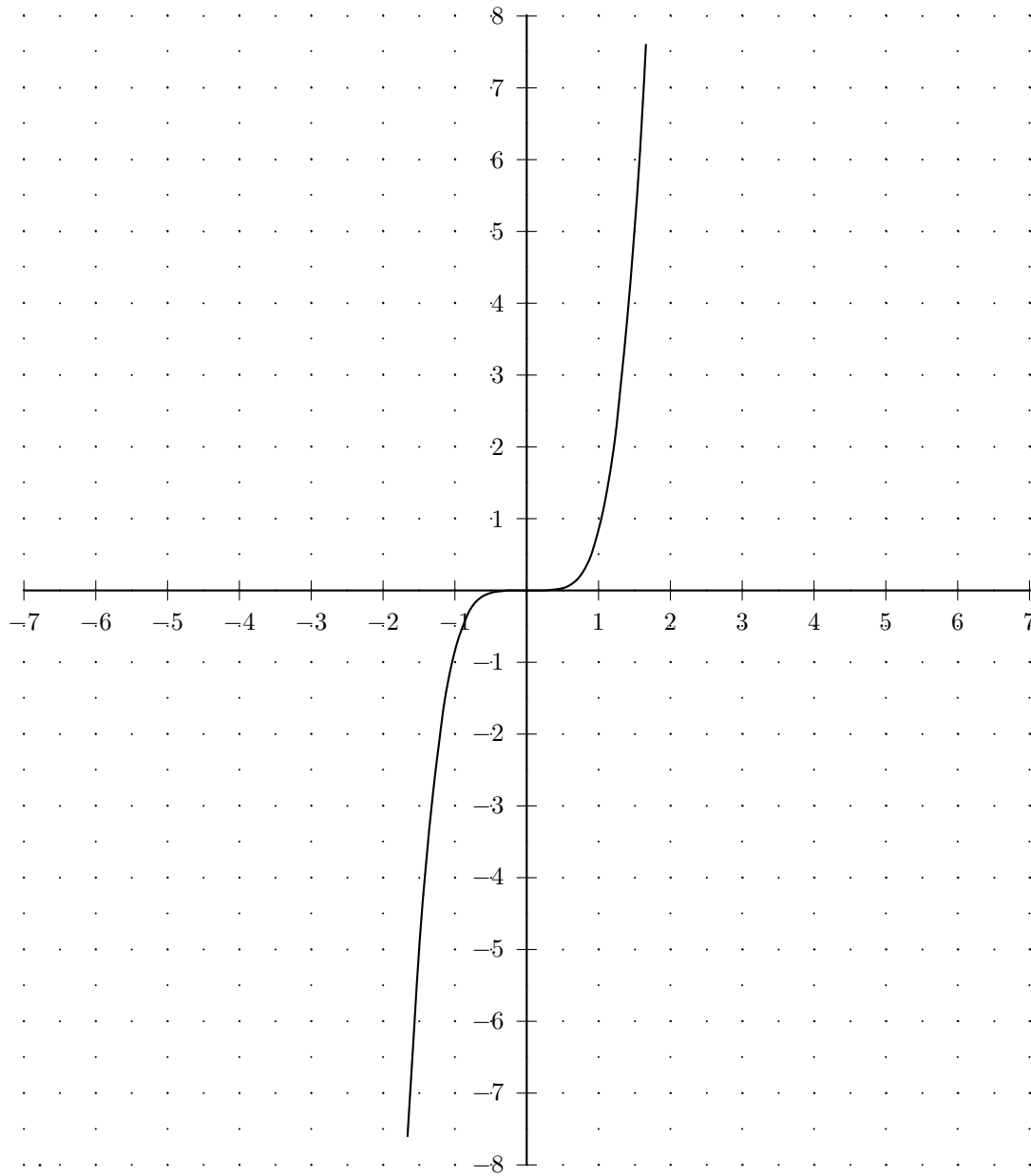
	$x$	$f(x)$
Nullstellen:	-6,283	0,5
	-3,142	0,002
	0	0
	3,142	-0,002
	6,283	-0,5
Extremwerte:	-5,354	658,291
	-2,57	-23,6
	2,57	23,6
	5,354	-658,291
Wendepunkte:	-4,489	396,029
	-2,025	-15,1
	-0,023	0
	2,025	15,1
	4,489	-396,029

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-1577,425	2711,435	-877,542
$-6\frac{1}{2}$	-384,003	1979,558	-1870,581
-6	362,122	1002,981	-1900,562
$-5\frac{1}{2}$	645,613	178,973	-1332,735
-5	599,328	-302,141	-595,32
$-4\frac{1}{2}$	400,848	-442,729	-9,652
-4	193,741	-361,067	286,218
$-3\frac{1}{2}$	52,639	-200,689	320,124
-3	-11,431	-64,955	210,027
$-2\frac{1}{2}$	-23,378	6,105	78,638
-2	-14,549	22,437	-2,461
$-1\frac{1}{2}$	-5,05	13,824	-23,791
-1	-0,841	3,907	-13,579
$-\frac{1}{2}$	-0,03	0,295	-2,286
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,03	0,295	2,286
1	0,841	3,907	13,579
$1\frac{1}{2}$	5,05	13,824	23,791
2	14,549	22,437	2,461
$2\frac{1}{2}$	23,378	6,105	-78,638
3	11,431	-64,955	-210,027
$3\frac{1}{2}$	-52,639	-200,689	-320,124
4	-193,741	-361,067	-286,218
$4\frac{1}{2}$	-400,848	-442,729	9,652
5	-599,328	-302,141	595,32
$5\frac{1}{2}$	-645,613	178,973	1332,735
6	-362,122	1002,981	1900,562
$6\frac{1}{2}$	384,003	1979,558	1870,581
7	1577,425	2711,435	877,542

•Graph der Funktion  $f(x) = x^4 \cdot \sin(x)$



## Aufgabe (19)

• Gegeben die Funktion:  $f(x) = x \cdot \sin(-x)$

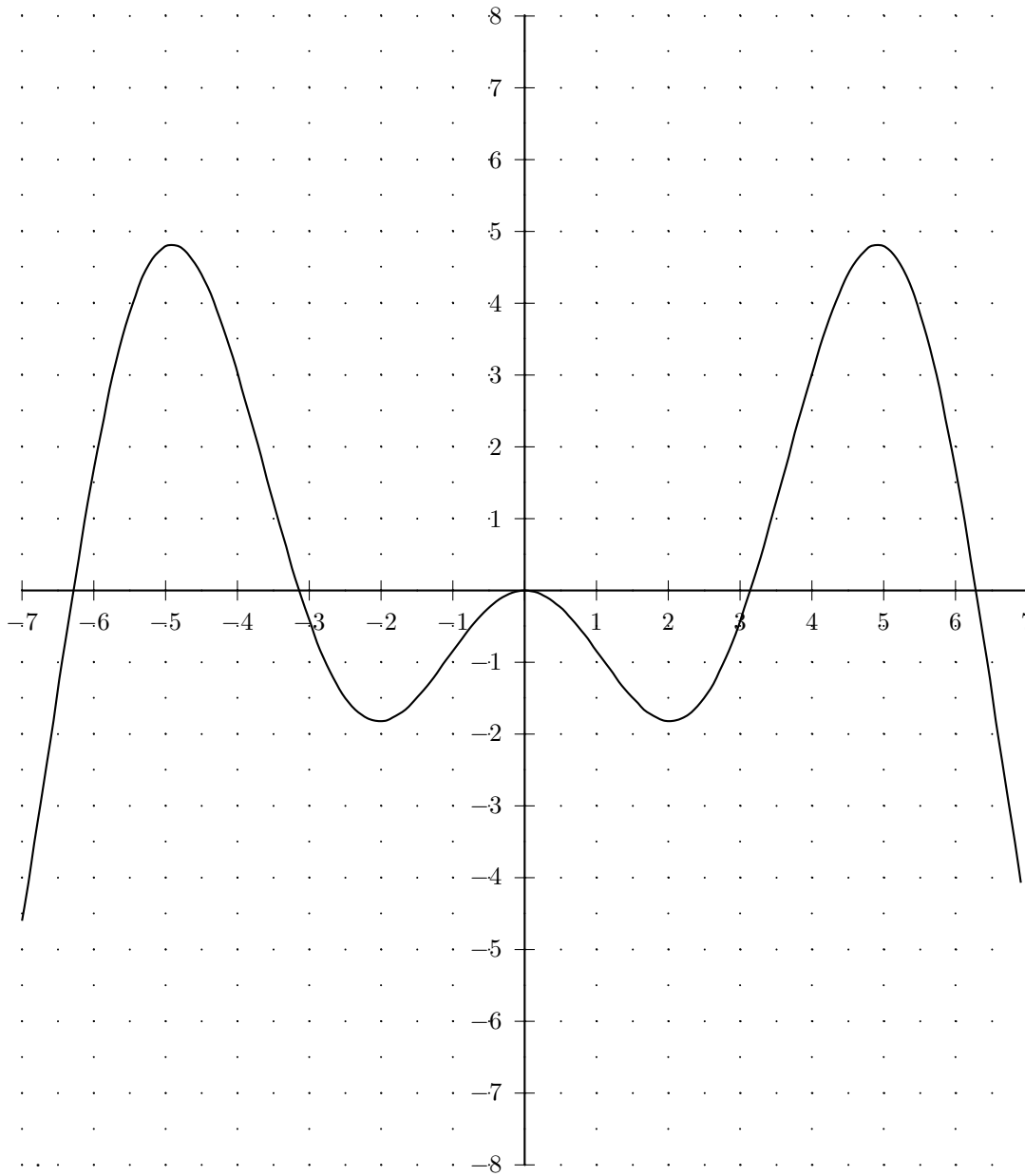
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-6,283	0,002
	-3,142	0
	3,142	0
	6,283	0,002
Extremwerte:	-4,913	4,814
	-2,029	-1,82
	0	0
	2,029	-1,82
	4,913	4,814
Wendepunkte:	-6,578	-1,912
	-3,643	1,752
	-1,077	-0,948
	1,077	-0,948
	3,643	1,752
	6,578	-1,912

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-4,599	5,934	3,091
$-6\frac{1}{2}$	-1,398	6,563	-0,555
-6	1,676	5,481	-3,597
$-5\frac{1}{2}$	3,88	3,192	-5,298
-5	4,795	0,459	-5,362
$-4\frac{1}{2}$	4,399	-1,926	-3,977
-4	3,027	-3,371	-1,72
$-3\frac{1}{2}$	1,228	-3,628	0,645
-3	-0,423	-2,829	2,403
$-2\frac{1}{2}$	-1,496	-1,404	3,098
-2	-1,819	0,077	2,651
$-1\frac{1}{2}$	-1,496	1,104	1,355
-1	-0,841	1,382	-0,239
$-\frac{1}{2}$	-0,24	0,918	-1,515
0	0	0	-2
0	0	0	-2
$\frac{1}{2}$	-0,24	-0,918	-1,515
1	-0,841	-1,382	-0,239
$1\frac{1}{2}$	-1,496	-1,104	1,355
2	-1,819	-0,077	2,651
$2\frac{1}{2}$	-1,496	1,404	3,098
3	-0,423	2,829	2,403
$3\frac{1}{2}$	1,228	3,628	0,645
4	3,027	3,371	-1,72
$4\frac{1}{2}$	4,399	1,926	-3,977
5	4,795	-0,459	-5,362
$5\frac{1}{2}$	3,88	-3,192	-5,298
6	1,676	-5,481	-3,597
$6\frac{1}{2}$	-1,398	-6,563	-0,555
7	-4,599	-5,934	3,091

•Graph der Funktion  $f(x) = x \cdot \sin(-x)$



## Aufgabe (20)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \sin(-x)$

• Kurvendiskussion

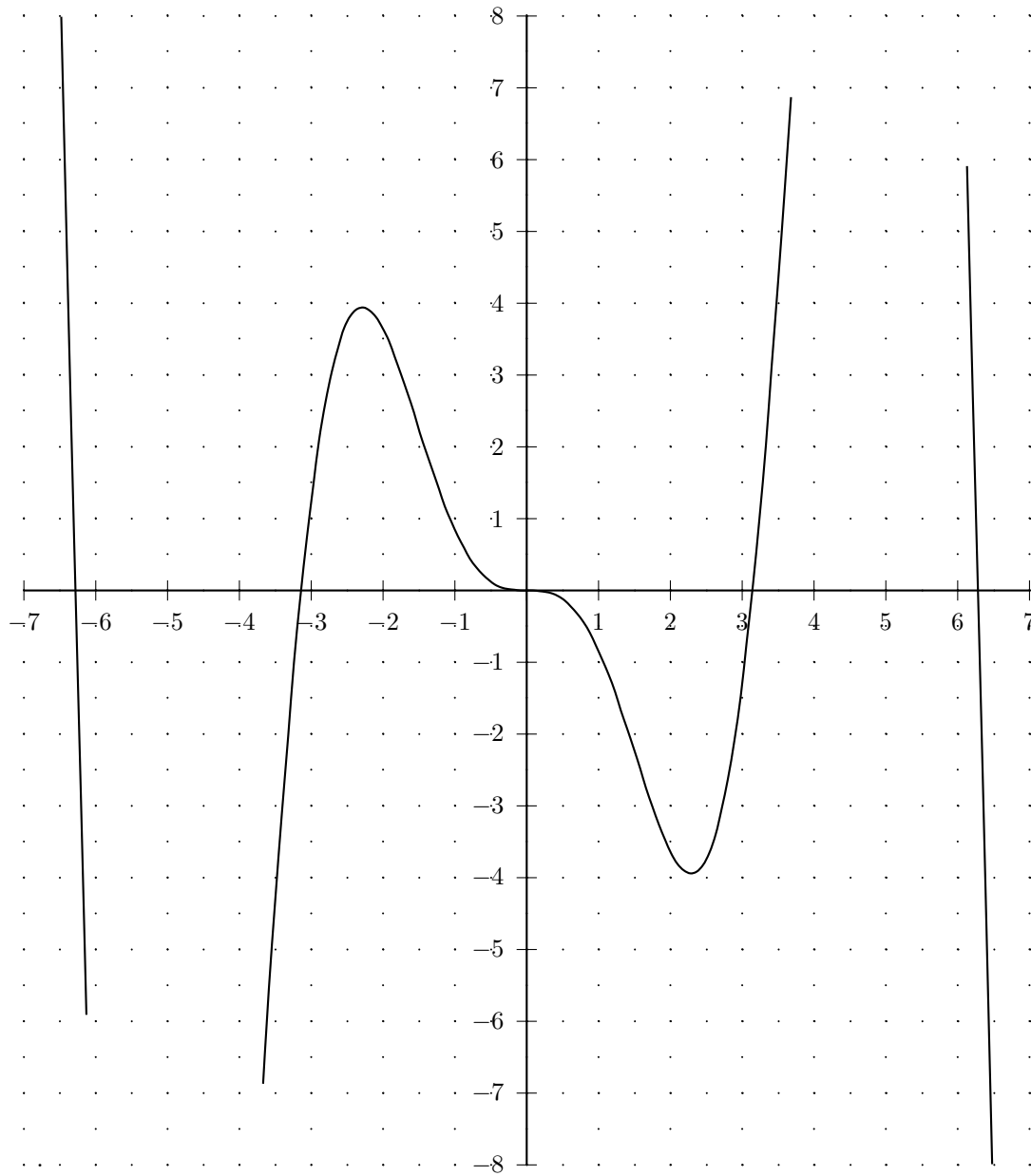
	$x$	$f(x)$
Nullstellen:	-6,283	-0,013
	-3,142	0
	0	0
	3,142	0
	6,283	0,013
Extremwerte:	-5,087	-24,083
	-2,289	3,945
	2,289	-3,945
	5,087	24,083
Wendepunkte:	-6,832	24,346
	-3,995	-12,022
	-1,52	2,307
	-0,023	0
	1,52	-2,307
	3,995	12,022
	6,832	-24,346

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	32,192	-46,138	-9,769
$-6\frac{1}{2}$	9,089	-44,056	16,732
-6	-10,059	-31,213	32,544
$-5\frac{1}{2}$	-21,343	-13,676	35,522
-5	-23,973	2,497	27,728
$-4\frac{1}{2}$	-19,795	13,066	14,046
-4	-12,109	16,512	0,137
$-3\frac{1}{2}$	-4,297	13,927	-9,515
-3	1,27	8,063	-12,867
$-2\frac{1}{2}$	3,74	2,015	-10,555
-2	3,637	-1,972	-5,148
$-1\frac{1}{2}$	2,244	-3,151	0,175
-1	0,841	-2,223	3,003
$-\frac{1}{2}$	0,12	-0,699	2,594
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	-0,12	-0,699	-2,594
1	-0,841	-2,223	-3,003
$1\frac{1}{2}$	-2,244	-3,151	-0,175
2	-3,637	-1,972	5,148
$2\frac{1}{2}$	-3,74	2,015	10,555
3	-1,27	8,063	12,867
$3\frac{1}{2}$	4,297	13,927	9,515
4	12,109	16,512	-0,137
$4\frac{1}{2}$	19,795	13,066	-14,046
5	23,973	2,497	-27,728
$5\frac{1}{2}$	21,343	-13,676	-35,522
6	10,059	-31,213	-32,544
$6\frac{1}{2}$	-9,089	-44,056	-16,732
7	-32,192	-46,138	9,769

•Graph der Funktion  $f(x) = x^2 \cdot \sin(-x)$



## Aufgabe (21)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \sin(-x)$

• Kurvendiskussion

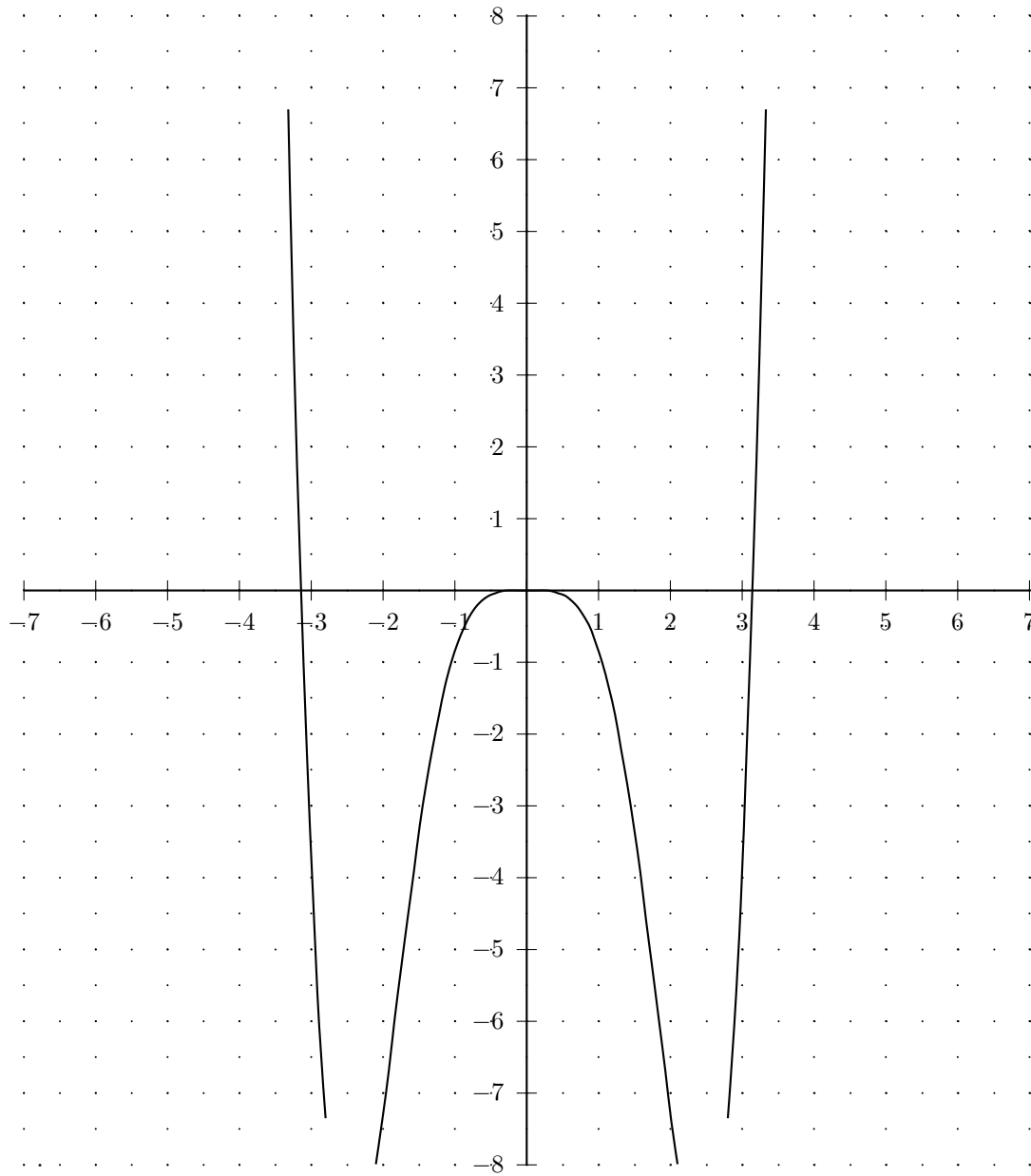
	$x$	$f(x)$
Nullstellen:	-6,283	0,08
	-3,142	0,001
	3,142	0,001
	6,283	0,08
Extremwerte:	-5,233	124,317
	-2,456	-9,379
	0	0
	2,456	-9,379
	5,233	124,317
Wendepunkte:	-4,267	70,148
	-1,815	-5,798
	1,815	-5,798
	4,267	70,148

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-225,346	355,155	-23,89
$-6\frac{1}{2}$	-59,077	295,457	-196,872
-6	60,354	177,22	-257,687
$-5\frac{1}{2}$	117,384	53,88	-222,723
-5	119,866	-36,457	-133,647
$-4\frac{1}{2}$	89,077	-78,59	-37,074
-4	48,435	-78,157	32,476
$-3\frac{1}{2}$	15,04	-53,041	61,155
-3	-3,81	-22,92	54,729
$-2\frac{1}{2}$	-9,351	-1,298	30,417
-2	-7,274	7,582	6,351
$-1\frac{1}{2}$	-3,367	6,972	-6,565
-1	-0,841	3,065	-7,449
$-\frac{1}{2}$	-0,06	0,469	-2,695
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	-0,06	-0,469	-2,695
1	-0,841	-3,065	-7,449
$1\frac{1}{2}$	-3,367	-6,972	-6,565
2	-7,274	-7,582	6,351
$2\frac{1}{2}$	-9,351	1,298	30,417
3	-3,81	22,92	54,729
$3\frac{1}{2}$	15,04	53,041	61,155
4	48,435	78,157	32,476
$4\frac{1}{2}$	89,077	78,59	-37,074
5	119,866	36,457	-133,647
$5\frac{1}{2}$	117,384	-53,88	-222,723
6	60,354	-177,22	-257,687
$6\frac{1}{2}$	-59,077	-295,457	-196,872
7	-225,346	-355,155	-23,89

•Graph der Funktion  $f(x) = x^3 \cdot \sin(-x)$



## Aufgabe (22)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \sin(-x)$

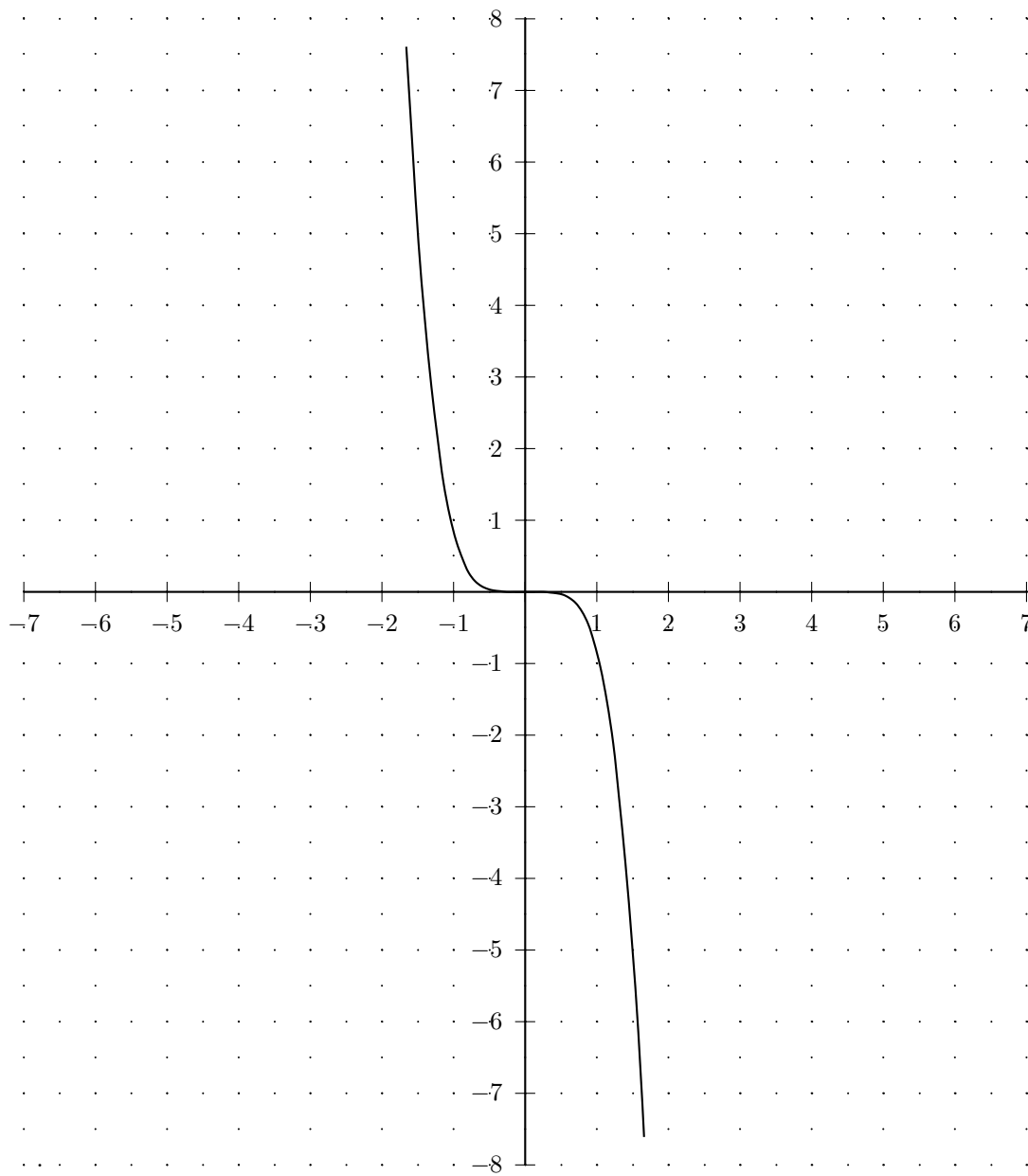
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-6,283	-0,5
	-3,142	-0,002
	0	0
	3,142	0,002
	6,283	0,5
Extremwerte:	-5,354	-658,291
	-2,57	23,6
	2,57	-23,6
	5,354	658,291
Wendepunkte:	-4,489	-396,029
	-2,025	15,1
	-0,023	0
	2,025	-15,1
	4,489	396,029

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1577,425	-2711,435	877,542
$-6\frac{1}{2}$	384,003	-1979,558	1870,581
-6	-362,122	-1002,981	1900,562
$-5\frac{1}{2}$	-645,613	-178,973	1332,735
-5	-599,328	302,141	595,32
$-4\frac{1}{2}$	-400,848	442,729	9,652
-4	-193,741	361,067	-286,218
$-3\frac{1}{2}$	-52,639	200,689	-320,124
-3	11,431	64,955	-210,027
$-2\frac{1}{2}$	23,378	-6,105	-78,638
-2	14,549	-22,437	2,461
$-1\frac{1}{2}$	5,05	-13,824	23,791
-1	0,841	-3,907	13,579
$-\frac{1}{2}$	0,03	-0,295	2,286
0	0	0	0
0	0	0	0
$\frac{1}{2}$	-0,03	-0,295	-2,286
1	-0,841	-3,907	-13,579
$1\frac{1}{2}$	-5,05	-13,824	-23,791
2	-14,549	-22,437	-2,461
$2\frac{1}{2}$	-23,378	-6,105	78,638
3	-11,431	64,955	210,027
$3\frac{1}{2}$	52,639	200,689	320,124
4	193,741	361,067	286,218
$4\frac{1}{2}$	400,848	442,729	-9,652
5	599,328	302,141	-595,32
$5\frac{1}{2}$	645,613	-178,973	-1332,735
6	362,122	-1002,981	-1900,562
$6\frac{1}{2}$	-384,003	-1979,558	-1870,581
7	-1577,425	-2711,435	-877,542

•Graph der Funktion  $f(x) = x^4 \cdot \sin(-x)$



## Aufgabe (23)

• Gegeben die Funktion:  $f(x) = \cos(x)$

• Kurvendiskussion

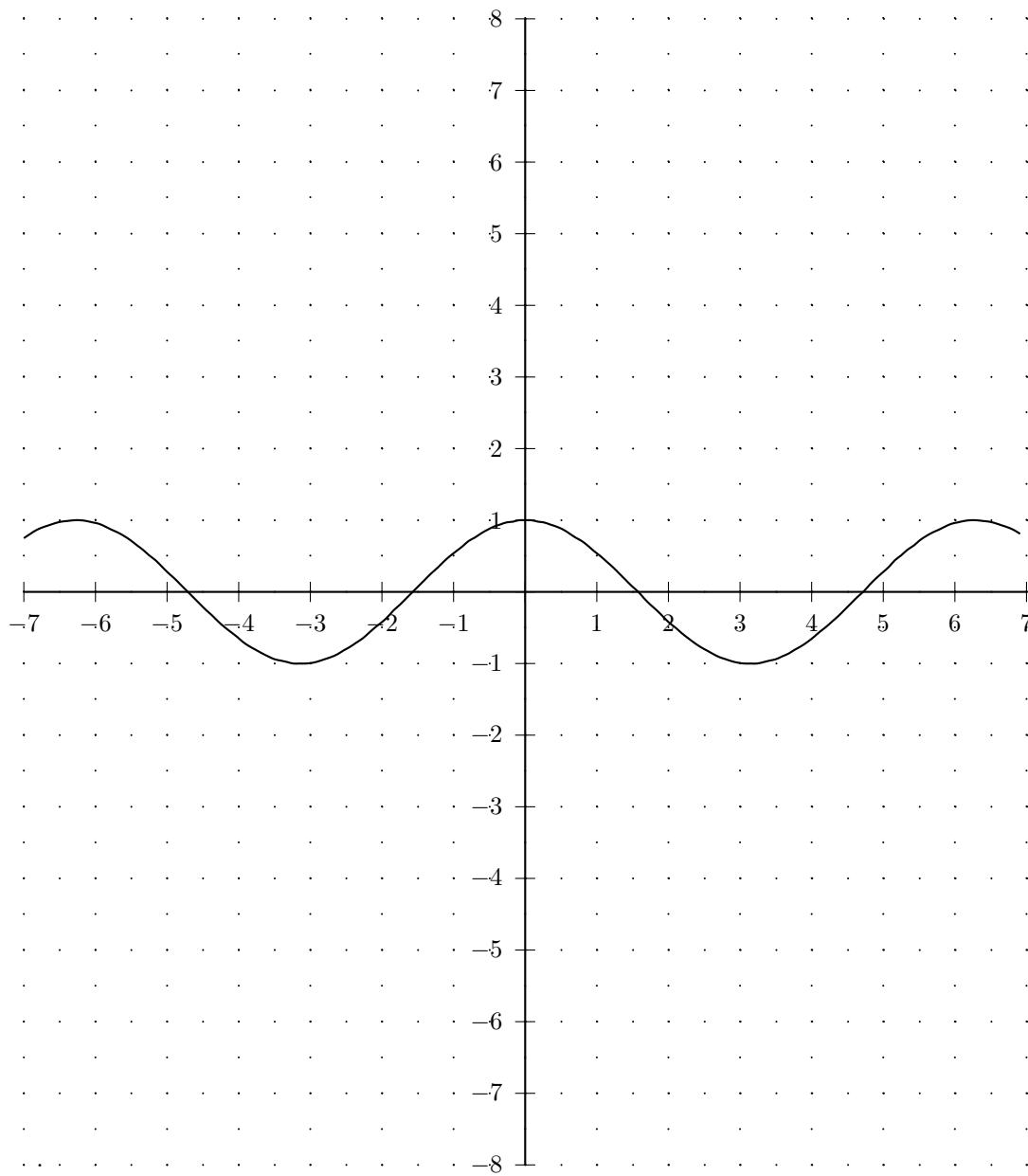
	$x$	$f(x)$
Nullstellen:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0
Extremwerte:	-6,283	1
	-3,141	-1
	0	1
	3,141	-1
	6,283	1
Wendepunkte:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,754	0,657	-0,754
$-6\frac{1}{2}$	0,977	0,215	-0,977
-6	0,96	-0,279	-0,96
$-5\frac{1}{2}$	0,709	-0,706	-0,709
-5	0,284	-0,959	-0,284
$-4\frac{1}{2}$	-0,211	-0,978	0,211
-4	-0,654	-0,757	0,654
$-3\frac{1}{2}$	-0,936	-0,351	0,936
-3	-0,99	0,141	0,99
$-2\frac{1}{2}$	-0,801	0,598	0,801
-2	-0,416	0,909	0,416
$-1\frac{1}{2}$	0,071	0,997	-0,071
-1	0,54	0,841	-0,54
$-\frac{1}{2}$	0,878	0,479	-0,878
0	1	0	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	0	-1
$\frac{1}{2}$	0,878	-0,479	-0,878
1	0,54	-0,841	-0,54
$1\frac{1}{2}$	0,071	-0,997	-0,071
2	-0,416	-0,909	0,416
$2\frac{1}{2}$	-0,801	-0,598	0,801
3	-0,99	-0,141	0,99
$3\frac{1}{2}$	-0,936	0,351	0,936
4	-0,654	0,757	0,654
$4\frac{1}{2}$	-0,211	0,978	0,211
5	0,284	0,959	-0,284
$5\frac{1}{2}$	0,709	0,706	-0,709
6	0,96	0,279	-0,96
$6\frac{1}{2}$	0,977	-0,215	-0,977
7	0,754	-0,657	-0,754

•Graph der Funktion  $f(x) = \cos(x)$



## Aufgabe (24)

• Gegeben die Funktion:  $f(x) = \cos(x) + 1$

• Kurvendiskussion

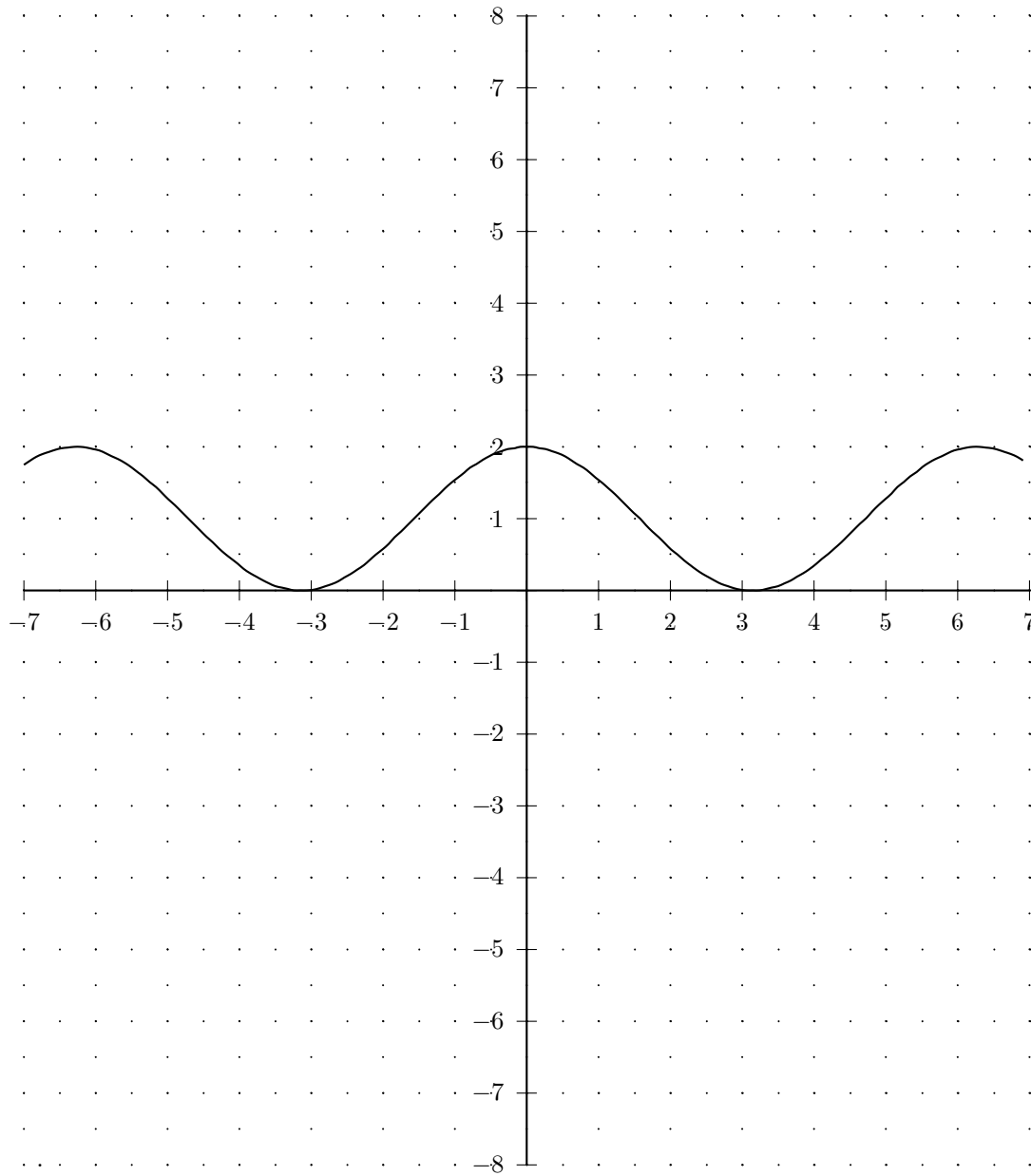
	$x$	$f(x)$
Extremwerte:	-6,283	2
	-3,141	0
	0	2
	3,141	0
	6,283	2
Wendepunkte:	-4,712	1
	-1,571	1
	1,571	1
	4,712	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,754	0,657	-0,754
$-6\frac{1}{2}$	1,977	0,215	-0,977
-6	1,96	-0,279	-0,96
$-5\frac{1}{2}$	1,709	-0,706	-0,709
-5	1,284	-0,959	-0,284
$-4\frac{1}{2}$	0,789	-0,978	0,211
-4	0,346	-0,757	0,654
$-3\frac{1}{2}$	0,064	-0,351	0,936
-3	0,01	0,141	0,99
$-2\frac{1}{2}$	0,199	0,598	0,801
-2	0,584	0,909	0,416
$-1\frac{1}{2}$	1,071	0,997	-0,071
-1	1,54	0,841	-0,54
$-\frac{1}{2}$	1,878	0,479	-0,878
0	2	0	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	2	0	-1
$\frac{1}{2}$	1,878	-0,479	-0,878
1	1,54	-0,841	-0,54
$1\frac{1}{2}$	1,071	-0,997	-0,071
2	0,584	-0,909	0,416
$2\frac{1}{2}$	0,199	-0,598	0,801
3	0,01	-0,141	0,99
$3\frac{1}{2}$	0,064	0,351	0,936
4	0,346	0,757	0,654
$4\frac{1}{2}$	0,789	0,978	0,211
5	1,284	0,959	-0,284
$5\frac{1}{2}$	1,709	0,706	-0,709
6	1,96	0,279	-0,96
$6\frac{1}{2}$	1,977	-0,215	-0,977
7	1,754	-0,657	-0,754

•Graph der Funktion  $f(x) = \cos(x) + 1$



## Aufgabe (25)

• Gegeben die Funktion:  $f(x) = \cos(x - 2) + 1$

• Kurvendiskussion

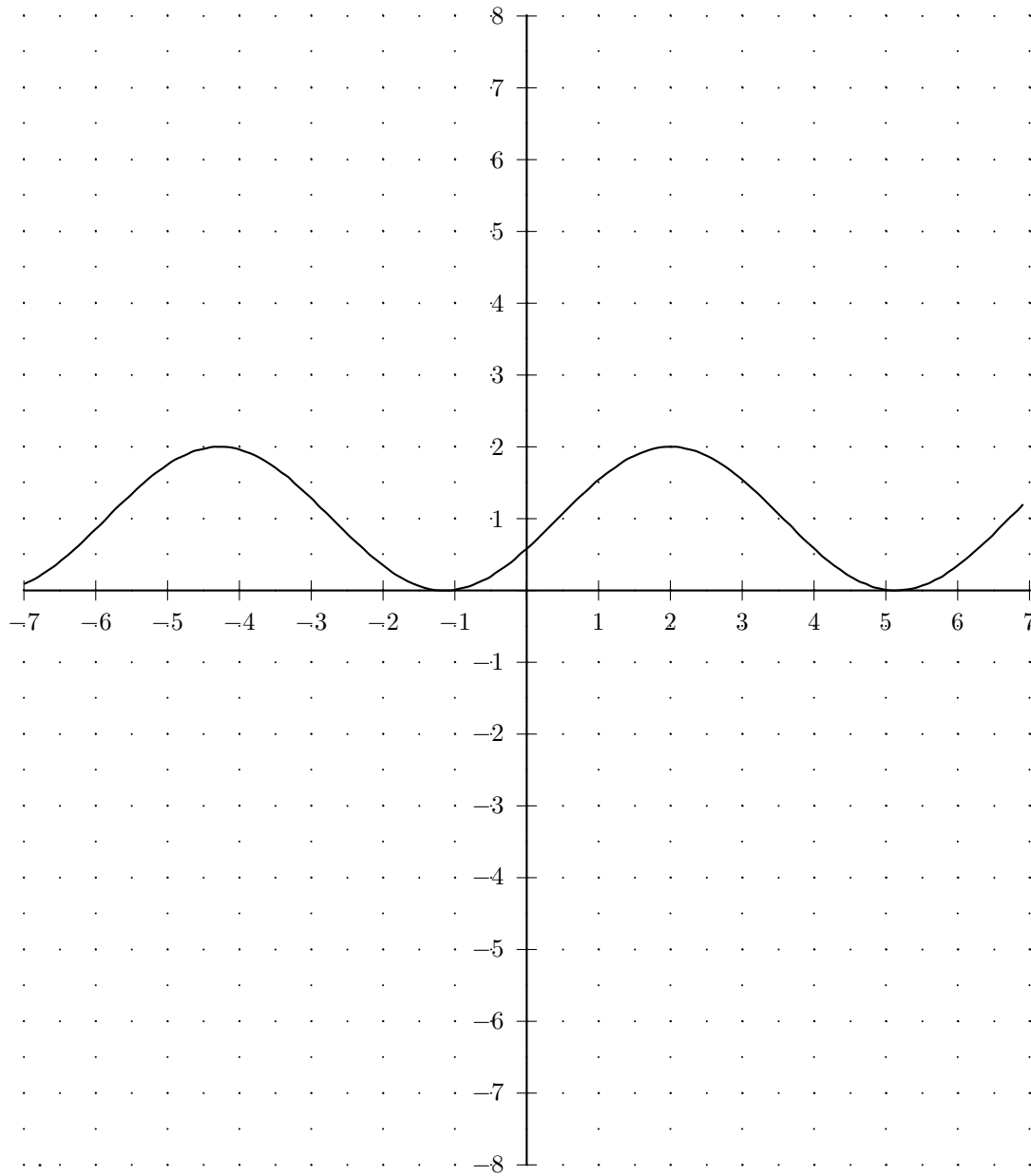
	$x$	$f(x)$
Extremwerte:	-4,283	2
	-1,142	0
	2	2
	5,141	0
Wendepunkte:	-5,854	1
	-2,712	1
	0,429	1
	3,571	1
	6,712	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,089	0,412	0,911
$-6\frac{1}{2}$	0,398	0,798	0,602
-6	0,854	0,989	0,145
$-5\frac{1}{2}$	1,347	0,938	-0,347
-5	1,754	0,657	-0,754
$-4\frac{1}{2}$	1,977	0,215	-0,977
-4	1,96	-0,279	-0,96
$-3\frac{1}{2}$	1,709	-0,706	-0,709
-3	1,284	-0,959	-0,284
$-2\frac{1}{2}$	0,789	-0,978	0,211
-2	0,346	-0,757	0,654
$-1\frac{1}{2}$	0,064	-0,351	0,936
-1	0,01	0,141	0,99
$-\frac{1}{2}$	0,199	0,598	0,801
0	0,584	0,909	0,416

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0,584	0,909	0,416
$\frac{1}{2}$	1,071	0,997	-0,071
1	1,54	0,841	-0,54
$1\frac{1}{2}$	1,878	0,479	-0,878
2	2	0	-1
$2\frac{1}{2}$	1,878	-0,479	-0,878
3	1,54	-0,841	-0,54
$3\frac{1}{2}$	1,071	-0,997	-0,071
4	0,584	-0,909	0,416
$4\frac{1}{2}$	0,199	-0,598	0,801
5	0,01	-0,141	0,99
$5\frac{1}{2}$	0,064	0,351	0,936
6	0,346	0,757	0,654
$6\frac{1}{2}$	0,789	0,978	0,211
7	1,284	0,959	-0,284

- Graph der Funktion  $f(x) = \cos(x - 2) + 1$



## Aufgabe (26)

• Gegeben die Funktion:  $f(x) = \cos(-x)$

• Kurvendiskussion

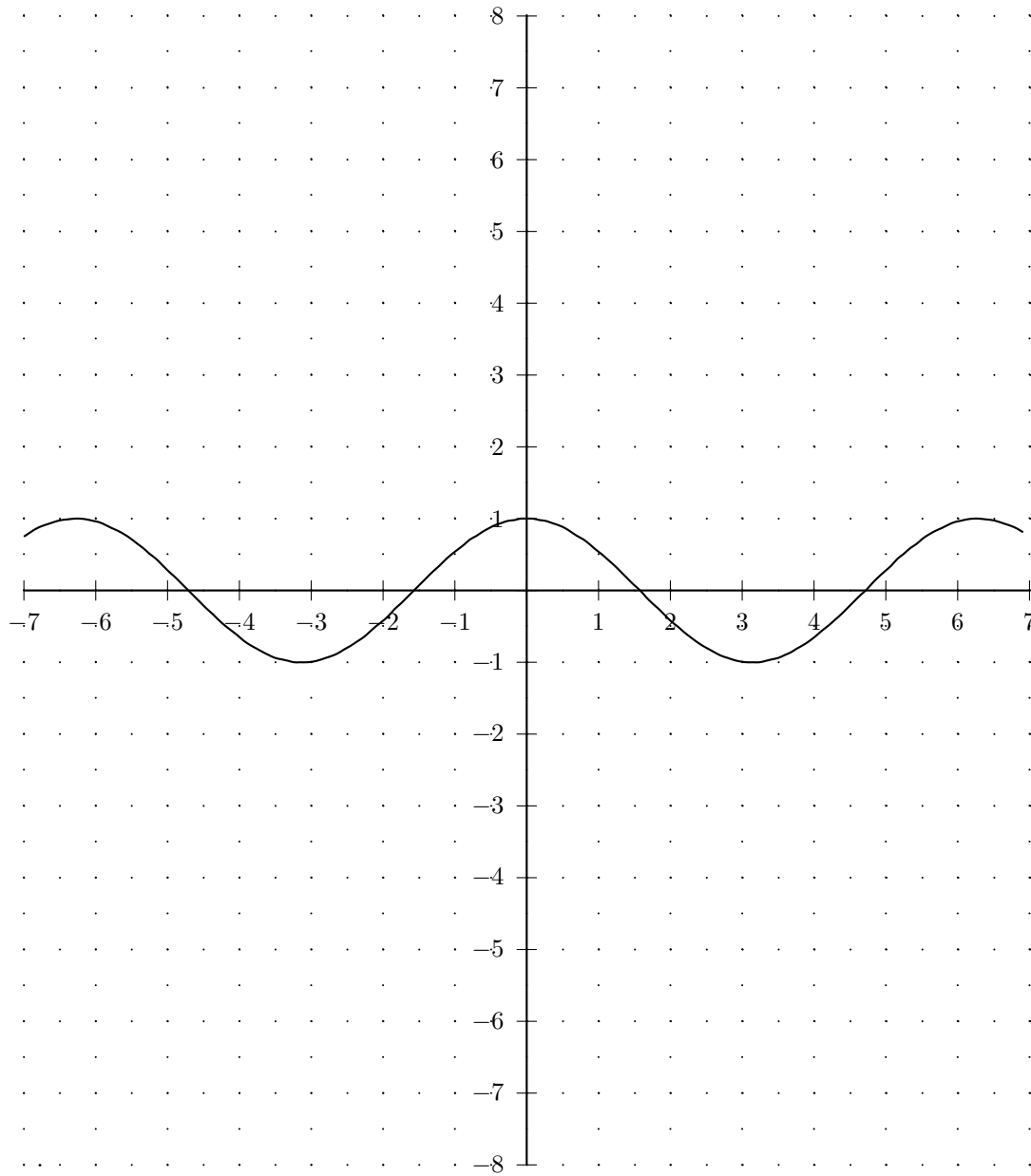
	$x$	$f(x)$
Nullstellen:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0
Extremwerte:	-6,283	1
	-3,141	-1
	0	1
	3,141	-1
	6,283	1
Wendepunkte:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,754	0,657	-0,754
$-6\frac{1}{2}$	0,977	0,215	-0,977
-6	0,96	-0,279	-0,96
$-5\frac{1}{2}$	0,709	-0,706	-0,709
-5	0,284	-0,959	-0,284
$-4\frac{1}{2}$	-0,211	-0,978	0,211
-4	-0,654	-0,757	0,654
$-3\frac{1}{2}$	-0,936	-0,351	0,936
-3	-0,99	0,141	0,99
$-2\frac{1}{2}$	-0,801	0,598	0,801
-2	-0,416	0,909	0,416
$-1\frac{1}{2}$	0,071	0,997	-0,071
-1	0,54	0,841	-0,54
$-\frac{1}{2}$	0,878	0,479	-0,878
0	1	0	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	0	-1
$\frac{1}{2}$	0,878	-0,479	-0,878
1	0,54	-0,841	-0,54
$1\frac{1}{2}$	0,071	-0,997	-0,071
2	-0,416	-0,909	0,416
$2\frac{1}{2}$	-0,801	-0,598	0,801
3	-0,99	-0,141	0,99
$3\frac{1}{2}$	-0,936	0,351	0,936
4	-0,654	0,757	0,654
$4\frac{1}{2}$	-0,211	0,978	0,211
5	0,284	0,959	-0,284
$5\frac{1}{2}$	0,709	0,706	-0,709
6	0,96	0,279	-0,96
$6\frac{1}{2}$	0,977	-0,215	-0,977
7	0,754	-0,657	-0,754

•Graph der Funktion  $f(x) = \cos(-x)$



## Aufgabe (27)

• Gegeben die Funktion:  $f(x) = \cos(-x) + 3$

• Kurvendiskussion

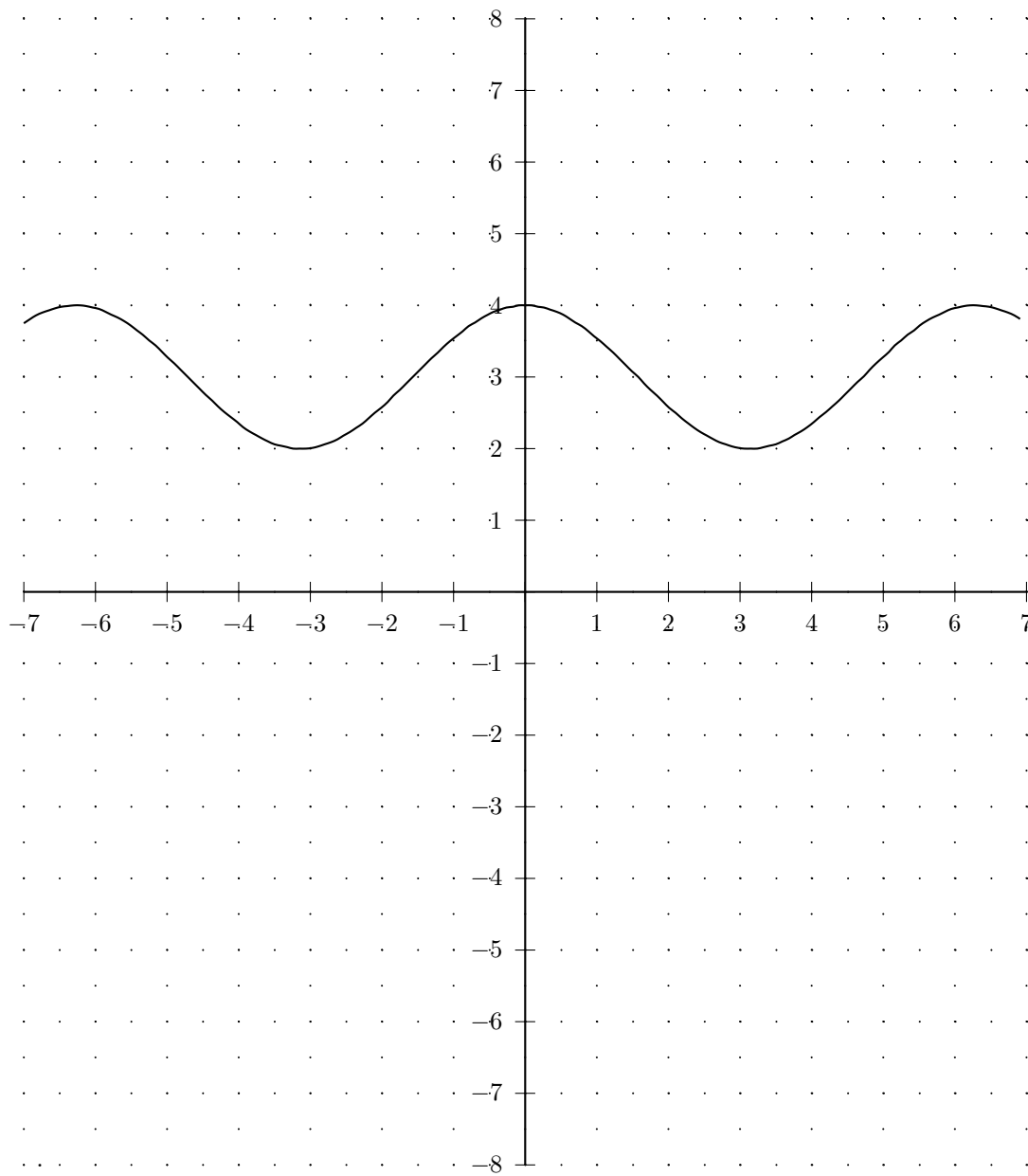
	$x$	$f(x)$
Extremwerte:	-6,283	4
	-3,141	2
	0	4
	3,141	2
	6,283	4
Wendepunkte:	-4,712	3
	-1,571	3
	1,571	3
	4,712	3

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	3,754	0,657	-0,754
$-6\frac{1}{2}$	3,977	0,215	-0,977
-6	3,96	-0,279	-0,96
$-5\frac{1}{2}$	3,709	-0,706	-0,709
-5	3,284	-0,959	-0,284
$-4\frac{1}{2}$	2,789	-0,978	0,211
-4	2,346	-0,757	0,654
$-3\frac{1}{2}$	2,064	-0,351	0,936
-3	2,01	0,141	0,99
$-2\frac{1}{2}$	2,199	0,598	0,801
-2	2,584	0,909	0,416
$-1\frac{1}{2}$	3,071	0,997	-0,071
-1	3,54	0,841	-0,54
$-\frac{1}{2}$	3,878	0,479	-0,878
0	4	0	-1

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	4	0	-1
$\frac{1}{2}$	3,878	-0,479	-0,878
1	3,54	-0,841	-0,54
$1\frac{1}{2}$	3,071	-0,997	-0,071
2	2,584	-0,909	0,416
$2\frac{1}{2}$	2,199	-0,598	0,801
3	2,01	-0,141	0,99
$3\frac{1}{2}$	2,064	0,351	0,936
4	2,346	0,757	0,654
$4\frac{1}{2}$	2,789	0,978	0,211
5	3,284	0,959	-0,284
$5\frac{1}{2}$	3,709	0,706	-0,709
6	3,96	0,279	-0,96
$6\frac{1}{2}$	3,977	-0,215	-0,977
7	3,754	-0,657	-0,754

•Graph der Funktion  $f(x) = \cos(-x) + 3$



## Aufgabe (28)

• Gegeben die Funktion:  $f(x) = \cos(2 \cdot x)$

• Kurvendiskussion

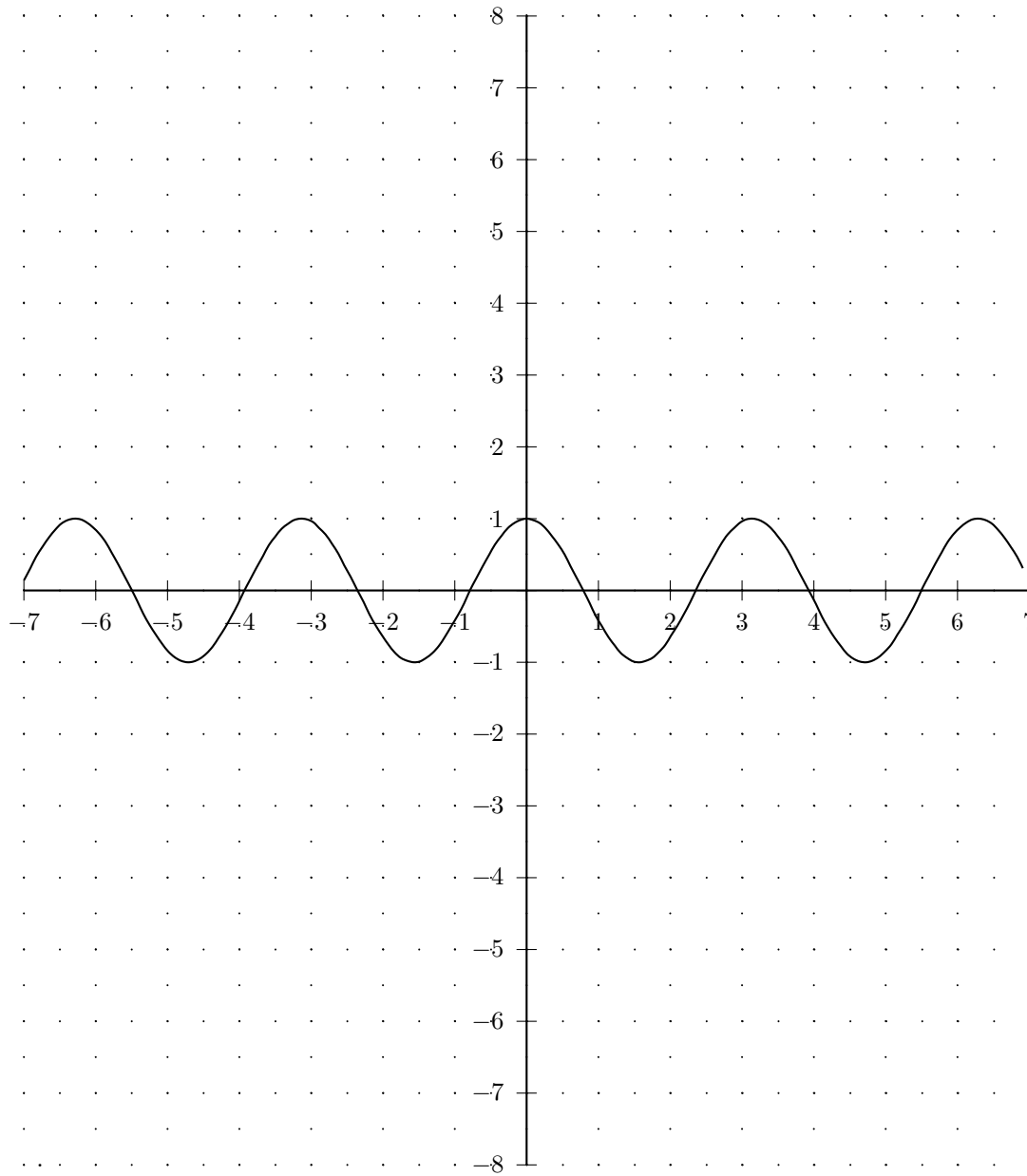
	$x$	$f(x)$
Nullstellen:	-5,498	0
	-3,927	0
	-2,356	0
	-0,786	-0,001
	0,786	-0,001
	2,356	0
	3,927	0
	5,498	0
	Extremwerte:	-6,283
-4,713		-1
-3,141		1
-1,571		-1
0		1
1,571		-1
3,141		1
4,713		-1
6,283		1
Wendepunkte:	-5,498	0
	-3,927	0
	-2,356	0
	-0,786	-0,001
	0,786	-0,001
	2,356	0
	3,927	0
	5,498	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,137	1,981	-0,547
$-6\frac{1}{2}$	0,907	0,84	-3,63
-6	0,844	-1,073	-3,375
$-5\frac{1}{2}$	0,004	-2	-0,018
-5	-0,839	-1,088	3,356
$-4\frac{1}{2}$	-0,911	0,824	3,644
-4	-0,146	1,979	0,582
$-3\frac{1}{2}$	0,754	1,314	-3,015
-3	0,96	-0,559	-3,841
$-2\frac{1}{2}$	0,284	-1,918	-1,135
-2	-0,654	-1,513	2,614
$-1\frac{1}{2}$	-0,99	0,282	3,96
-1	-0,416	1,818	1,665
$-\frac{1}{2}$	0,54	1,683	-2,161
0	1	0	-4

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	0	-4
$\frac{1}{2}$	0,54	-1,683	-2,161
1	-0,416	-1,818	1,665
$1\frac{1}{2}$	-0,99	-0,282	3,96
2	-0,654	1,513	2,614
$2\frac{1}{2}$	0,284	1,918	-1,135
3	0,96	0,559	-3,841
$3\frac{1}{2}$	0,754	-1,314	-3,015
4	-0,146	-1,979	0,582
$4\frac{1}{2}$	-0,911	-0,824	3,644
5	-0,839	1,088	3,356
$5\frac{1}{2}$	0,004	2	-0,018
6	0,844	1,073	-3,375
$6\frac{1}{2}$	0,907	-0,84	-3,63
7	0,137	-1,981	-0,547

•Graph der Funktion  $f(x) = \cos(2 \cdot x)$



## Aufgabe (29)

• Gegeben die Funktion:  $f(x) = \cos\left(\frac{1}{2} \cdot x - 1\right) + 1$

• Kurvendiskussion

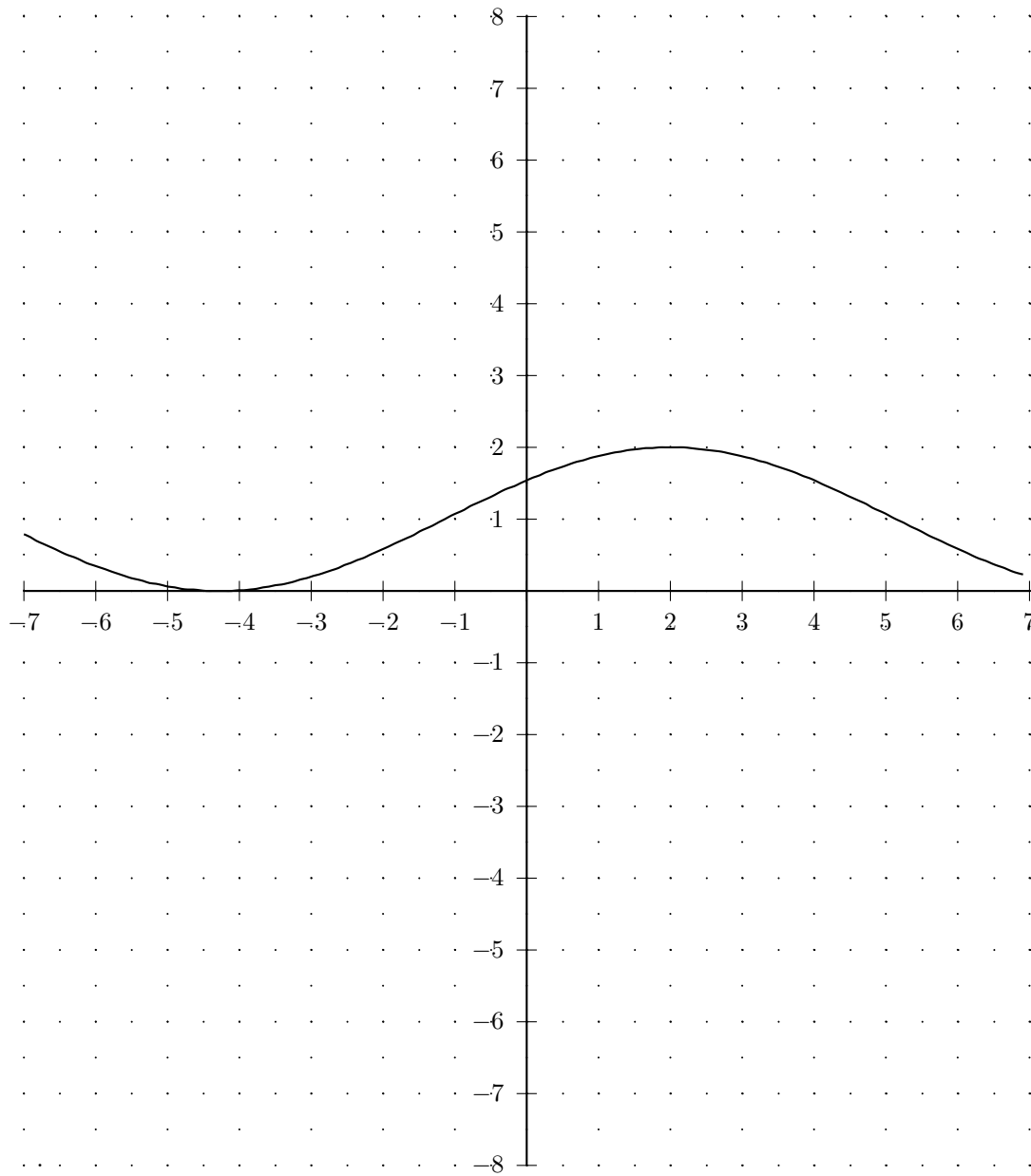
	$x$	$f(x)$
Extremwerte:	-4,283	0
	2	2
Wendepunkte:	-1,142	1
	5,142	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,789	-0,489	0,053
$-6\frac{1}{2}$	0,554	-0,447	0,112
-6	0,346	-0,378	0,163
$-5\frac{1}{2}$	0,179	-0,286	0,205
-5	0,064	-0,175	0,234
$-4\frac{1}{2}$	0,006	-0,054	0,249
-4	0,01	0,071	0,247
$-3\frac{1}{2}$	0,076	0,191	0,231
-3	0,199	0,299	0,2
$-2\frac{1}{2}$	0,372	0,389	0,157
-2	0,584	0,455	0,104
$-1\frac{1}{2}$	0,822	0,492	0,045
-1	1,071	0,499	-0,018
$-\frac{1}{2}$	1,315	0,474	-0,079
0	1,54	0,421	-0,135

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1,54	0,421	-0,135
$\frac{1}{2}$	1,732	0,341	-0,183
1	1,878	0,24	-0,219
$1\frac{1}{2}$	1,969	0,124	-0,242
2	2	0	$-\frac{1}{4}$
$2\frac{1}{2}$	1,969	-0,124	-0,242
3	1,878	-0,24	-0,219
$3\frac{1}{2}$	1,732	-0,341	-0,183
4	1,54	-0,421	-0,135
$4\frac{1}{2}$	1,315	-0,474	-0,079
5	1,071	-0,499	-0,018
$5\frac{1}{2}$	0,822	-0,492	0,045
6	0,584	-0,455	0,104
$6\frac{1}{2}$	0,372	-0,389	0,157
7	0,199	-0,299	0,2

•Graph der Funktion  $f(x) = \cos\left(\frac{1}{2} \cdot x - 1\right) + 1$



## Aufgabe (30)

• Gegeben die Funktion:  $f(x) = 2 \cdot \cos(x - 2) + 1$

• Kurvendiskussion

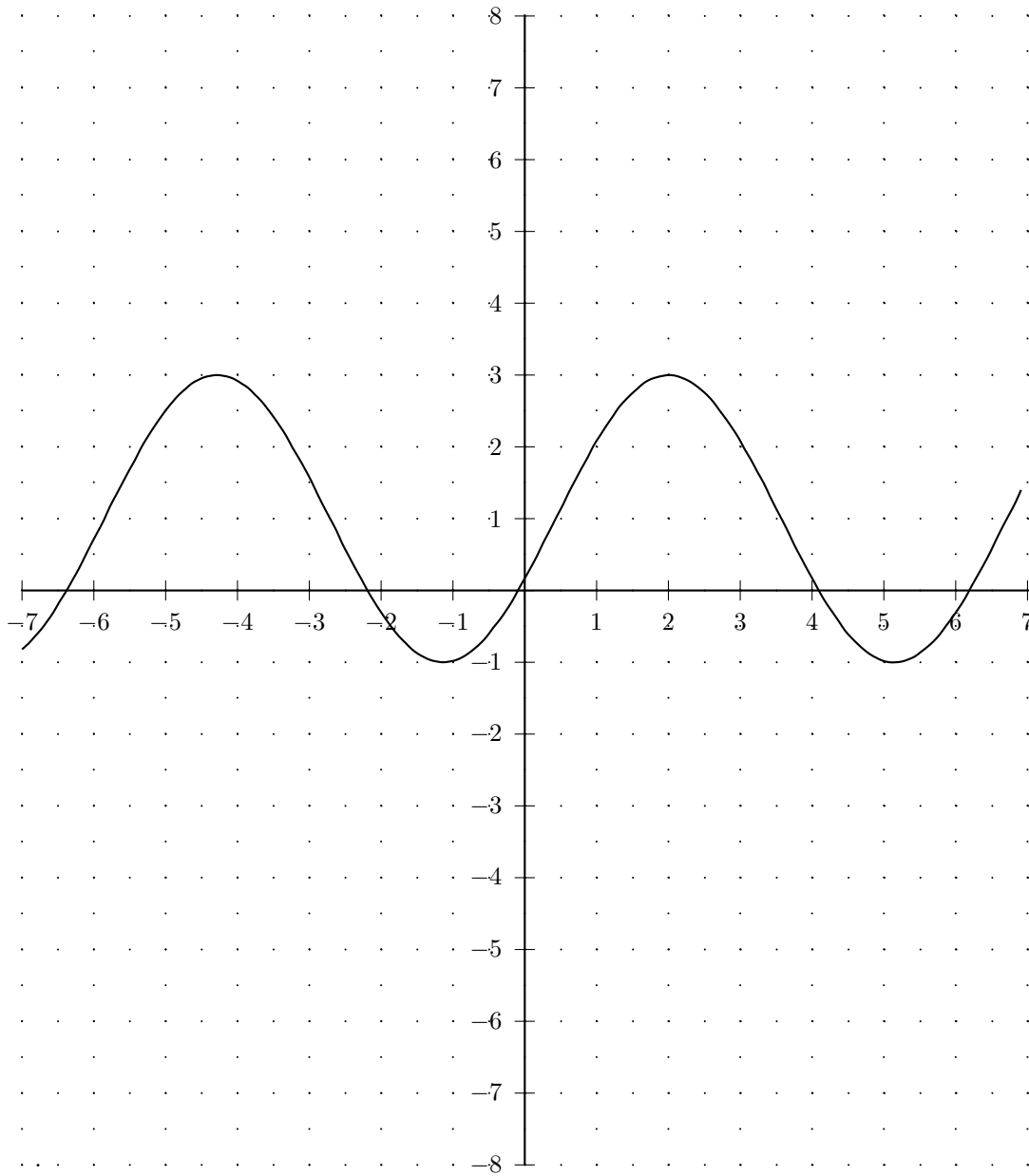
	$x$	$f(x)$
Nullstellen:	-6,378	0
	-2,189	0
	-0,094	0
	4,095	0
	6,189	0
Extremwerte:	-4,283	3
	-1,142	-1
	2	3
	5,141	-1
Wendepunkte:	-5,854	1
	-2,712	0,999
	0,429	1
	3,571	0,999
	6,712	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-0,822	0,824	1,822
$-6\frac{1}{2}$	-0,204	1,597	1,204
-6	0,709	1,979	0,291
$-5\frac{1}{2}$	1,693	1,876	-0,693
-5	2,508	1,314	-1,508
$-4\frac{1}{2}$	2,953	0,43	-1,953
-4	2,92	-0,559	-1,92
$-3\frac{1}{2}$	2,417	-1,411	-1,417
-3	1,567	-1,918	-0,567
$-2\frac{1}{2}$	0,578	-1,955	0,422
-2	-0,307	-1,514	1,307
$-1\frac{1}{2}$	-0,873	-0,702	1,873
-1	-0,98	0,282	1,98
$-\frac{1}{2}$	-0,602	1,197	1,602
0	0,168	1,819	0,832

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0,168	1,819	0,832
$\frac{1}{2}$	1,141	1,995	-0,141
1	2,081	1,683	-1,081
$1\frac{1}{2}$	2,755	0,959	-1,755
2	3	0	-2
$2\frac{1}{2}$	2,755	-0,959	-1,755
3	2,081	-1,683	-1,081
$3\frac{1}{2}$	1,141	-1,995	-0,141
4	0,168	-1,819	0,832
$4\frac{1}{2}$	-0,602	-1,197	1,602
5	-0,98	-0,282	1,98
$5\frac{1}{2}$	-0,873	0,702	1,873
6	-0,307	1,514	1,307
$6\frac{1}{2}$	0,578	1,955	0,422
7	1,567	1,918	-0,567

- Graph der Funktion  $f(x) = 2 \cdot \cos(x - 2) + 1$



## Aufgabe (31)

• Gegeben die Funktion:  $f(x) = \frac{1}{3} \cdot \cos(-x)$

• Kurvendiskussion

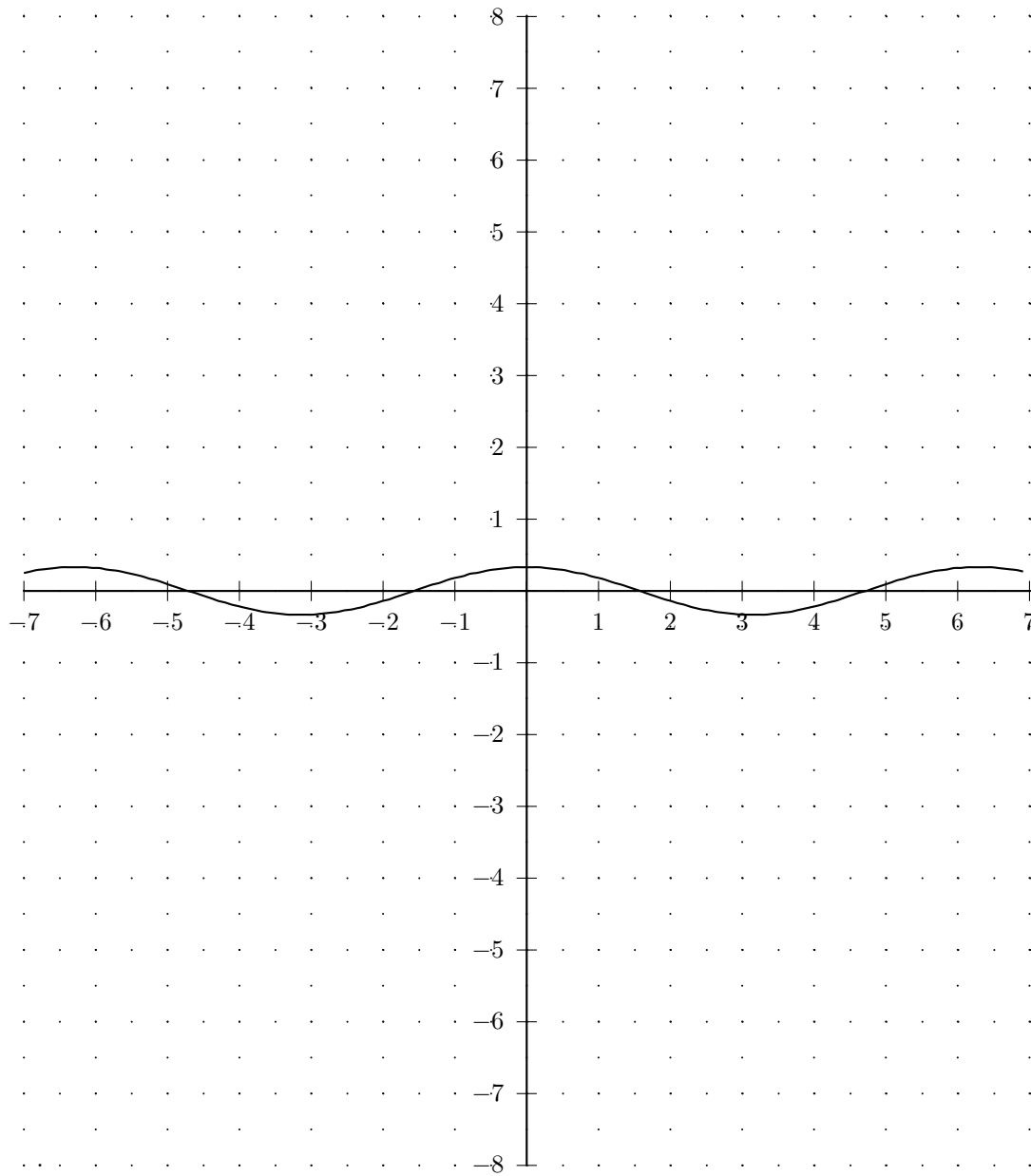
	$x$	$f(x)$
Nullstellen:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0
Extremwerte:	-6,283	$\frac{1}{3}$
	-3,141	$-\frac{1}{3}$
	0	$\frac{1}{3}$
	3,141	$-\frac{1}{3}$
	6,283	$\frac{1}{3}$
Wendepunkte:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	0,251	0,219	-0,251
$-6\frac{1}{2}$	0,326	0,072	-0,326
-6	0,32	-0,093	-0,32
$-5\frac{1}{2}$	0,236	-0,235	-0,236
-5	0,095	-0,32	-0,095
$-4\frac{1}{2}$	-0,07	-0,326	0,07
-4	-0,218	-0,252	0,218
$-3\frac{1}{2}$	-0,312	-0,117	0,312
-3	-0,33	0,047	0,33
$-2\frac{1}{2}$	-0,267	0,199	0,267
-2	-0,139	0,303	0,139
$-1\frac{1}{2}$	0,024	0,332	-0,024
-1	0,18	0,28	-0,18
$-\frac{1}{2}$	0,293	0,16	-0,293
0	$\frac{1}{3}$	0	-0,333

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	$\frac{1}{3}$	0	-0,333
$\frac{1}{2}$	0,293	-0,16	-0,293
1	0,18	-0,28	-0,18
$1\frac{1}{2}$	0,024	-0,332	-0,024
2	-0,139	-0,303	0,139
$2\frac{1}{2}$	-0,267	-0,199	0,267
3	-0,33	-0,047	0,33
$3\frac{1}{2}$	-0,312	0,117	0,312
4	-0,218	0,252	0,218
$4\frac{1}{2}$	-0,07	0,326	0,07
5	0,095	0,32	-0,095
$5\frac{1}{2}$	0,236	0,235	-0,236
6	0,32	0,093	-0,32
$6\frac{1}{2}$	0,326	-0,072	-0,326
7	0,251	-0,219	-0,251

- Graph der Funktion  $f(x) = \frac{1}{3} \cdot \cos(-x)$



## Aufgabe (32)

• Gegeben die Funktion:  $f(x) = -2 \cdot \cos(-x) + 3$

• Kurvendiskussion

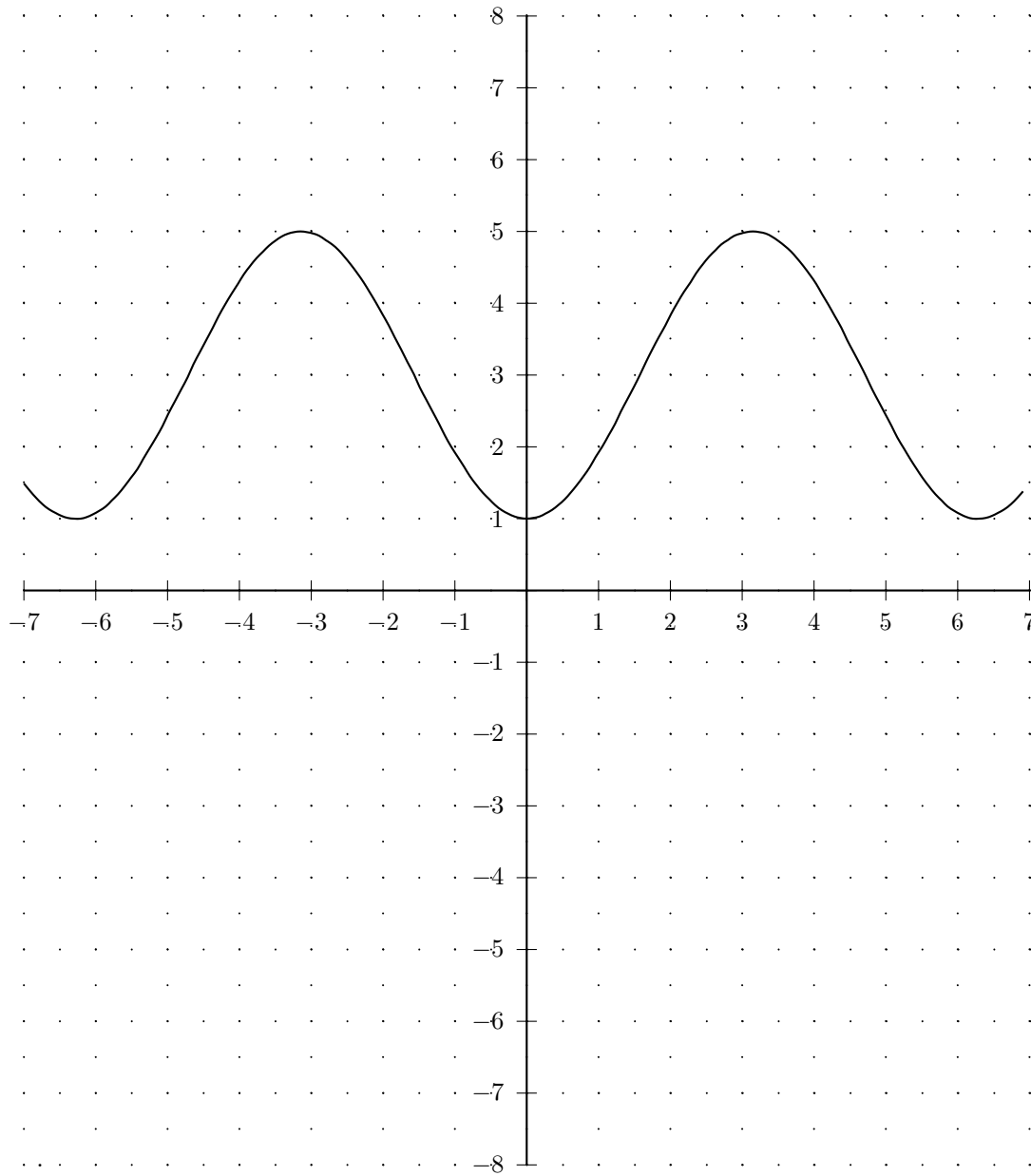
	$x$	$f(x)$
Extremwerte:	-6,283	1
	-3,141	5
	0	1
	3,141	5
	6,283	1
Wendepunkte:	-4,712	3
	-1,571	3
	1,571	3
	4,712	3

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,492	-1,314	1,508
$-6\frac{1}{2}$	1,047	-0,43	1,953
-6	1,08	0,559	1,92
$-5\frac{1}{2}$	1,583	1,411	1,417
-5	2,433	1,918	0,567
$-4\frac{1}{2}$	3,422	1,955	-0,422
-4	4,307	1,514	-1,307
$-3\frac{1}{2}$	4,873	0,702	-1,873
-3	4,98	-0,282	-1,98
$-2\frac{1}{2}$	4,602	-1,197	-1,602
-2	3,832	-1,819	-0,832
$-1\frac{1}{2}$	2,859	-1,995	0,141
-1	1,919	-1,683	1,081
$-\frac{1}{2}$	1,245	-0,959	1,755
0	1	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	1	0	2
$\frac{1}{2}$	1,245	0,959	1,755
1	1,919	1,683	1,081
$1\frac{1}{2}$	2,859	1,995	0,141
2	3,832	1,819	-0,832
$2\frac{1}{2}$	4,602	1,197	-1,602
3	4,98	0,282	-1,98
$3\frac{1}{2}$	4,873	-0,702	-1,873
4	4,307	-1,514	-1,307
$4\frac{1}{2}$	3,422	-1,955	-0,422
5	2,433	-1,918	0,567
$5\frac{1}{2}$	1,583	-1,411	1,417
6	1,08	-0,559	1,92
$6\frac{1}{2}$	1,047	0,43	1,953
7	1,492	1,314	1,508

- Graph der Funktion  $f(x) = -2 \cdot \cos(-x) + 3$



## Aufgabe (33)

• Gegeben die Funktion:  $f(x) = 2 \cdot \cos(x) + 1$

• Kurvendiskussion

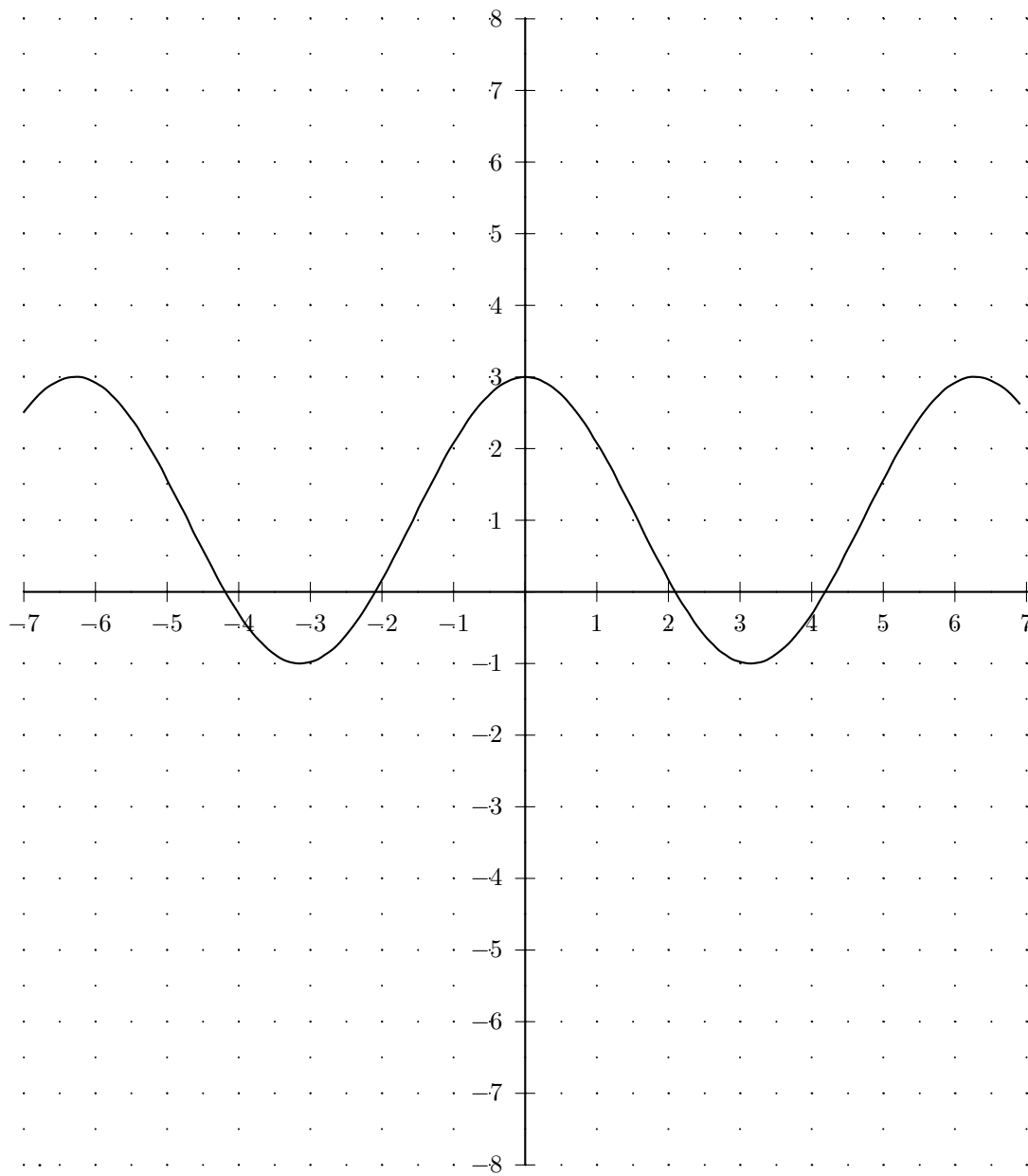
	$x$	$f(x)$
Nullstellen:	-4,189	0
	-2,095	0
	2,095	0
	4,189	0
Extremwerte:	-6,283	3
	-3,141	-1
	0	3
	3,141	-1
	6,283	3
Wendepunkte:	-4,712	1
	-1,571	1
	1,571	1
	4,712	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	2,508	1,314	-1,508
$-6\frac{1}{2}$	2,953	0,43	-1,953
-6	2,92	-0,559	-1,92
$-5\frac{1}{2}$	2,417	-1,411	-1,417
-5	1,567	-1,918	-0,567
$-4\frac{1}{2}$	0,578	-1,955	0,422
-4	-0,307	-1,514	1,307
$-3\frac{1}{2}$	-0,873	-0,702	1,873
-3	-0,98	0,282	1,98
$-2\frac{1}{2}$	-0,602	1,197	1,602
-2	0,168	1,819	0,832
$-1\frac{1}{2}$	1,141	1,995	-0,141
-1	2,081	1,683	-1,081
$-\frac{1}{2}$	2,755	0,959	-1,755
0	3	0	-2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	3	0	-2
$\frac{1}{2}$	2,755	-0,959	-1,755
1	2,081	-1,683	-1,081
$1\frac{1}{2}$	1,141	-1,995	-0,141
2	0,168	-1,819	0,832
$2\frac{1}{2}$	-0,602	-1,197	1,602
3	-0,98	-0,282	1,98
$3\frac{1}{2}$	-0,873	0,702	1,873
4	-0,307	1,514	1,307
$4\frac{1}{2}$	0,578	1,955	0,422
5	1,567	1,918	-0,567
$5\frac{1}{2}$	2,417	1,411	-1,417
6	2,92	0,559	-1,92
$6\frac{1}{2}$	2,953	-0,43	-1,953
7	2,508	-1,314	-1,508

•Graph der Funktion  $f(x) = 2 \cdot \cos(x) + 1$



## Aufgabe (34)

• Gegeben die Funktion:  $f(x) = -3 \cdot \cos(x - 2) + 1$

• Kurvendiskussion

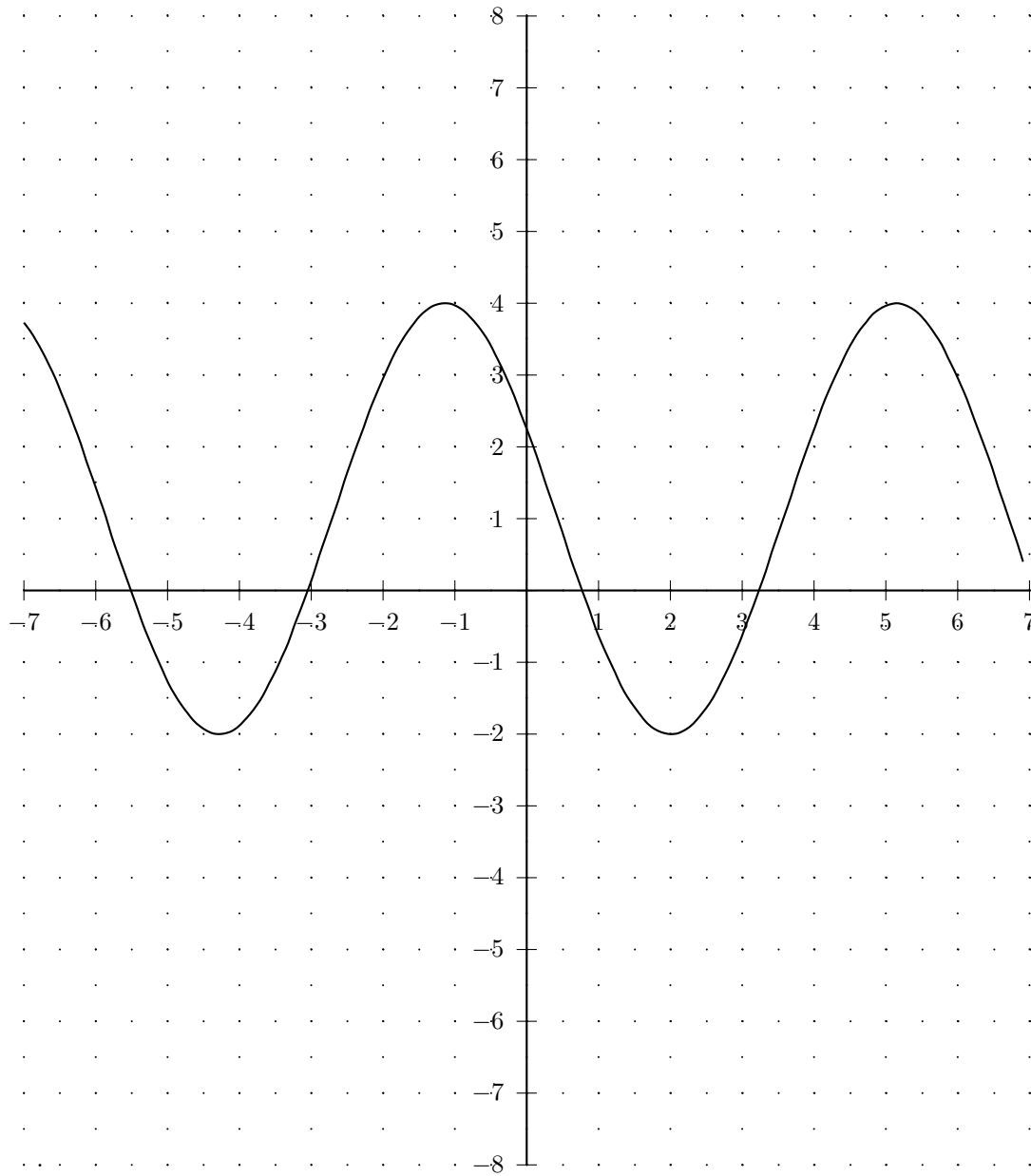
	$x$	$f(x)$
Nullstellen:	-5,514	0,001
	-3,052	0,001
	0,769	0
	3,231	0,001
Extremwerte:	-4,283	-2
	-1,142	4
	2	-2
	5,141	4
Wendepunkte:	-5,854	1
	-2,712	1,001
	0,429	1
	3,571	1,001
	6,712	1

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	3,733	-1,236	-2,733
$-6\frac{1}{2}$	2,806	-2,395	-1,806
-6	1,437	-2,968	-0,436
$-5\frac{1}{2}$	-0,04	-2,814	1,04
-5	-1,262	-1,971	2,262
$-4\frac{1}{2}$	-1,93	-0,645	2,93
-4	-1,881	0,838	2,88
$-3\frac{1}{2}$	-1,126	2,117	2,126
-3	0,149	2,877	0,851
$-2\frac{1}{2}$	1,632	2,933	-0,632
-2	2,961	2,27	-1,961
$-1\frac{1}{2}$	3,809	1,052	-2,809
-1	3,97	-0,423	-2,97
$-\frac{1}{2}$	3,403	-1,795	-2,403
0	2,248	-2,728	-1,248

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	2,248	-2,728	-1,248
$\frac{1}{2}$	0,788	-2,992	0,212
1	-0,621	-2,524	1,621
$1\frac{1}{2}$	-1,633	-1,438	2,633
2	-2	0	3
$2\frac{1}{2}$	-1,633	1,438	2,633
3	-0,621	2,524	1,621
$3\frac{1}{2}$	0,788	2,992	0,212
4	2,248	2,728	-1,248
$4\frac{1}{2}$	3,403	1,795	-2,403
5	3,97	0,423	-2,97
$5\frac{1}{2}$	3,809	-1,052	-2,809
6	2,961	-2,27	-1,961
$6\frac{1}{2}$	1,632	-2,933	-0,632
7	0,149	-2,877	0,851

- Graph der Funktion  $f(x) = -3 \cdot \cos(x - 2) + 1$



## Aufgabe (35)

• Gegeben die Funktion:  $f(x) = 2 \cdot \cos(-x)$

• Kurvendiskussion

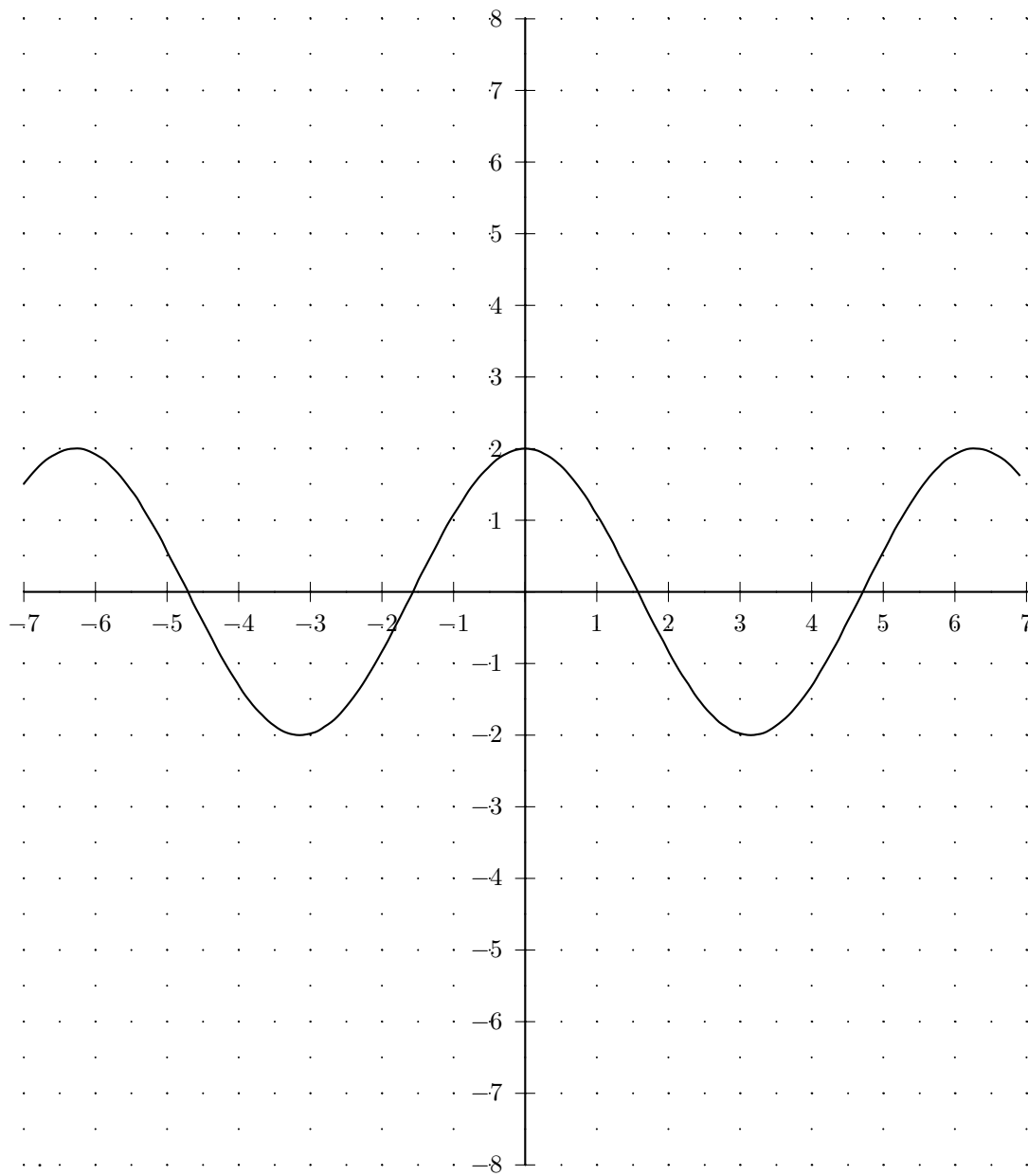
	$x$	$f(x)$
Nullstellen:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0
Extremwerte:	-6,283	2
	-3,141	-2
	0	2
	3,141	-2
	6,283	2
Wendepunkte:	-4,712	0
	-1,571	0
	1,571	0
	4,712	0

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1,508	1,314	-1,508
$-6\frac{1}{2}$	1,953	0,43	-1,953
-6	1,92	-0,559	-1,92
$-5\frac{1}{2}$	1,417	-1,411	-1,417
-5	0,567	-1,918	-0,567
$-4\frac{1}{2}$	-0,422	-1,955	0,422
-4	-1,307	-1,514	1,307
$-3\frac{1}{2}$	-1,873	-0,702	1,873
-3	-1,98	0,282	1,98
$-2\frac{1}{2}$	-1,602	1,197	1,602
-2	-0,832	1,819	0,832
$-1\frac{1}{2}$	0,141	1,995	-0,141
-1	1,081	1,683	-1,081
$-\frac{1}{2}$	1,755	0,959	-1,755
0	2	0	-2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	2	0	-2
$\frac{1}{2}$	1,755	-0,959	-1,755
1	1,081	-1,683	-1,081
$1\frac{1}{2}$	0,141	-1,995	-0,141
2	-0,832	-1,819	0,832
$2\frac{1}{2}$	-1,602	-1,197	1,602
3	-1,98	-0,282	1,98
$3\frac{1}{2}$	-1,873	0,702	1,873
4	-1,307	1,514	1,307
$4\frac{1}{2}$	-0,422	1,955	0,422
5	0,567	1,918	-0,567
$5\frac{1}{2}$	1,417	1,411	-1,417
6	1,92	0,559	-1,92
$6\frac{1}{2}$	1,953	-0,43	-1,953
7	1,508	-1,314	-1,508

- Graph der Funktion  $f(x) = 2 \cdot \cos(-x)$



## Aufgabe (36)

• Gegeben die Funktion:  $f(x) = 3 \cdot \cos(-x) + 3$

• Kurvendiskussion

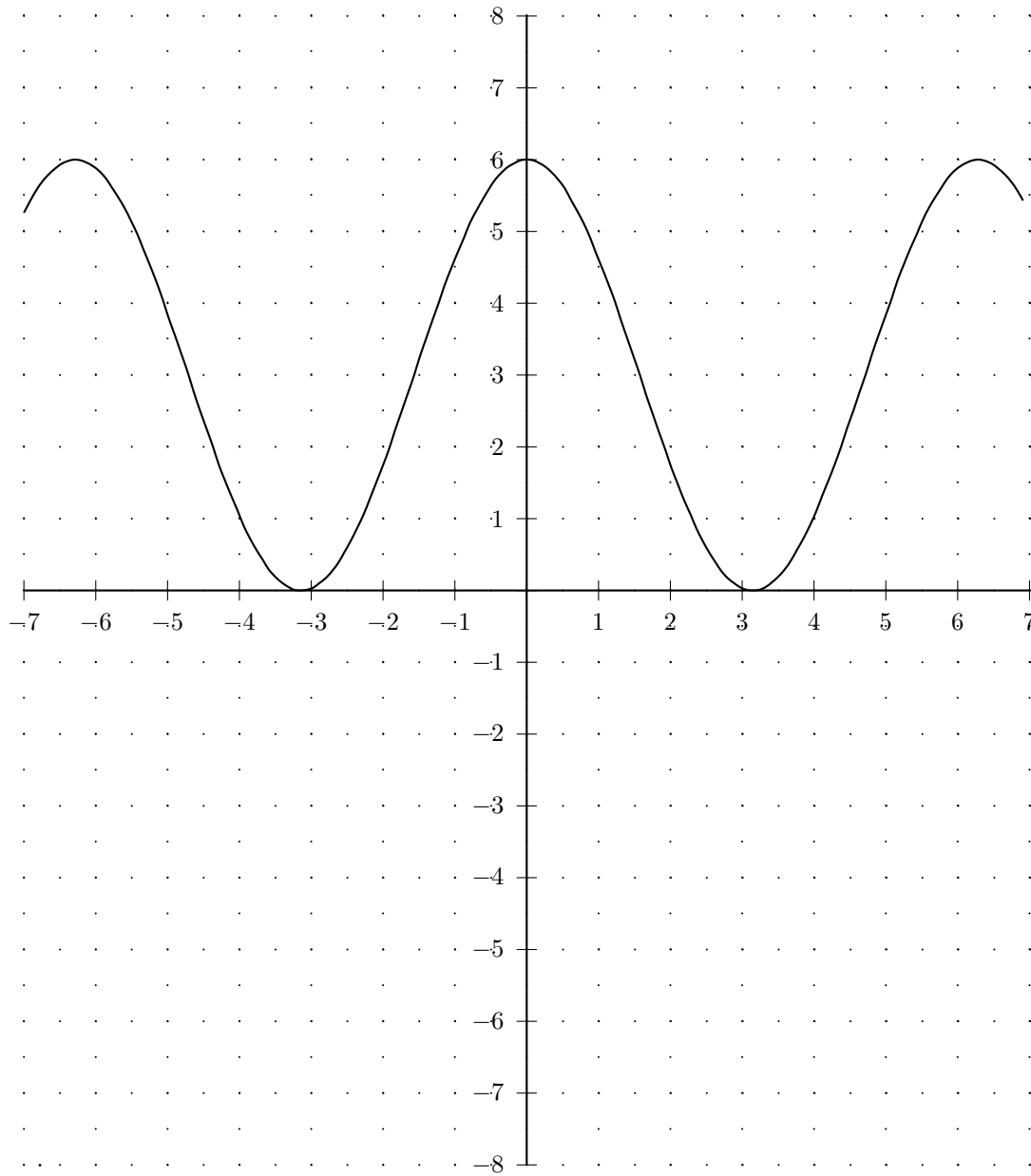
	$x$	$f(x)$
Extremwerte:	-6,283	6
	-3,141	0
	0	6
	3,141	0
	6,283	6
Wendepunkte:	-4,712	3
	-1,571	2,999
	1,571	2,999
	4,712	3

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	5,262	1,971	-2,262
$-6\frac{1}{2}$	5,93	0,645	-2,93
-6	5,881	-0,838	-2,88
$-5\frac{1}{2}$	5,126	-2,117	-2,126
-5	3,851	-2,877	-0,851
$-4\frac{1}{2}$	2,368	-2,933	0,632
-4	1,039	-2,27	1,961
$-3\frac{1}{2}$	0,191	-1,052	2,809
-3	0,03	0,423	2,97
$-2\frac{1}{2}$	0,597	1,795	2,403
-2	1,752	2,728	1,248
$-1\frac{1}{2}$	3,212	2,992	-0,212
-1	4,621	2,524	-1,621
$-\frac{1}{2}$	5,633	1,438	-2,633
0	6	0	-3

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	6	0	-3
$\frac{1}{2}$	5,633	-1,438	-2,633
1	4,621	-2,524	-1,621
$1\frac{1}{2}$	3,212	-2,992	-0,212
2	1,752	-2,728	1,248
$2\frac{1}{2}$	0,597	-1,795	2,403
3	0,03	-0,423	2,97
$3\frac{1}{2}$	0,191	1,052	2,809
4	1,039	2,27	1,961
$4\frac{1}{2}$	2,368	2,933	0,632
5	3,851	2,877	-0,851
$5\frac{1}{2}$	5,126	2,117	-2,126
6	5,881	0,838	-2,88
$6\frac{1}{2}$	5,93	-0,645	-2,93
7	5,262	-1,971	-2,262

- Graph der Funktion  $f(x) = 3 \cdot \cos(-x) + 3$



## Aufgabe (37)

• Gegeben die Funktion:  $f(x) = x \cdot \cos(x)$

• Kurvendiskussion

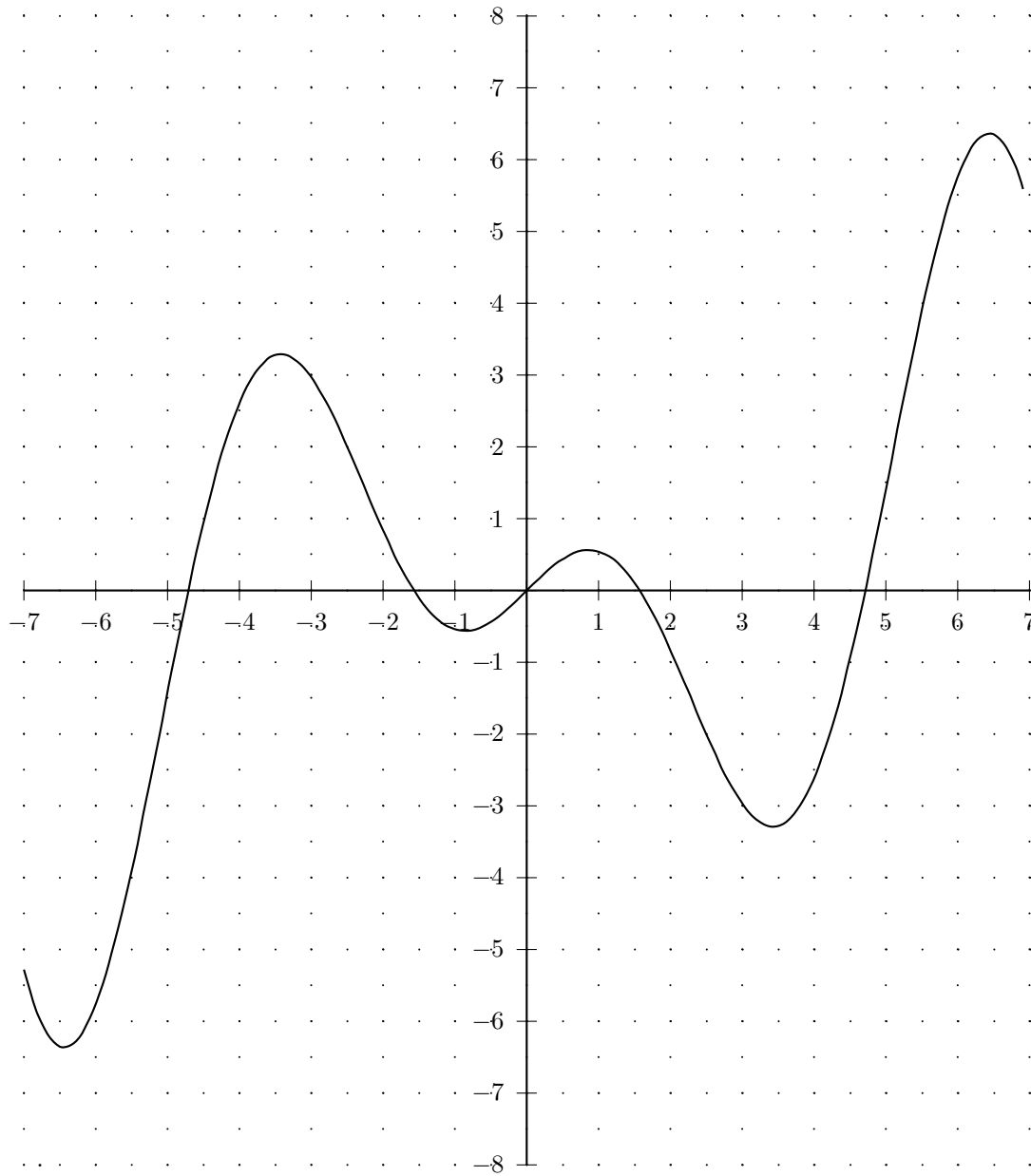
	$x$	$f(x)$
Nullstellen:	-4,712	0,001
	-1,571	0
	0	0
	1,571	0
	4,712	-0,001
Extremwerte:	-6,437	-6,361
	-3,426	3,288
	-0,86	-0,561
	0,86	0,561
	3,426	-3,288
	6,437	6,361
Wendepunkte:	-5,087	-1,862
	-2,289	1,507
	-0,023	-0,023
	2,289	-1,507
	5,087	1,862

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-5,277	-3,845	6,591
$-6\frac{1}{2}$	-6,348	-0,422	6,778
-6	-5,761	2,637	5,202
$-5\frac{1}{2}$	-3,898	4,589	2,487
-5	-1,418	5,078	-0,5
$-4\frac{1}{2}$	0,949	4,188	-2,904
-4	2,615	2,374	-4,128
$-3\frac{1}{2}$	3,278	0,291	-3,979
-3	2,97	-1,413	-2,688
$-2\frac{1}{2}$	2,003	-2,297	-0,806
-2	0,832	-2,235	0,986
$-1\frac{1}{2}$	-0,106	-1,425	2,101
-1	-0,54	-0,301	2,223
$-\frac{1}{2}$	-0,439	0,638	1,398
0	0	1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	1	0
$\frac{1}{2}$	0,439	0,638	-1,398
1	0,54	-0,301	-2,223
$1\frac{1}{2}$	0,106	-1,425	-2,101
2	-0,832	-2,235	-0,986
$2\frac{1}{2}$	-2,003	-2,297	0,806
3	-2,97	-1,413	2,688
$3\frac{1}{2}$	-3,278	0,291	3,979
4	-2,615	2,374	4,128
$4\frac{1}{2}$	-0,949	4,188	2,904
5	1,418	5,078	0,5
$5\frac{1}{2}$	3,898	4,589	-2,487
6	5,761	2,637	-5,202
$6\frac{1}{2}$	6,348	-0,422	-6,778
7	5,277	-3,845	-6,591

- Graph der Funktion  $f(x) = x \cdot \cos(x)$



## Aufgabe (38)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \cos(x)$

• Kurvendiskussion

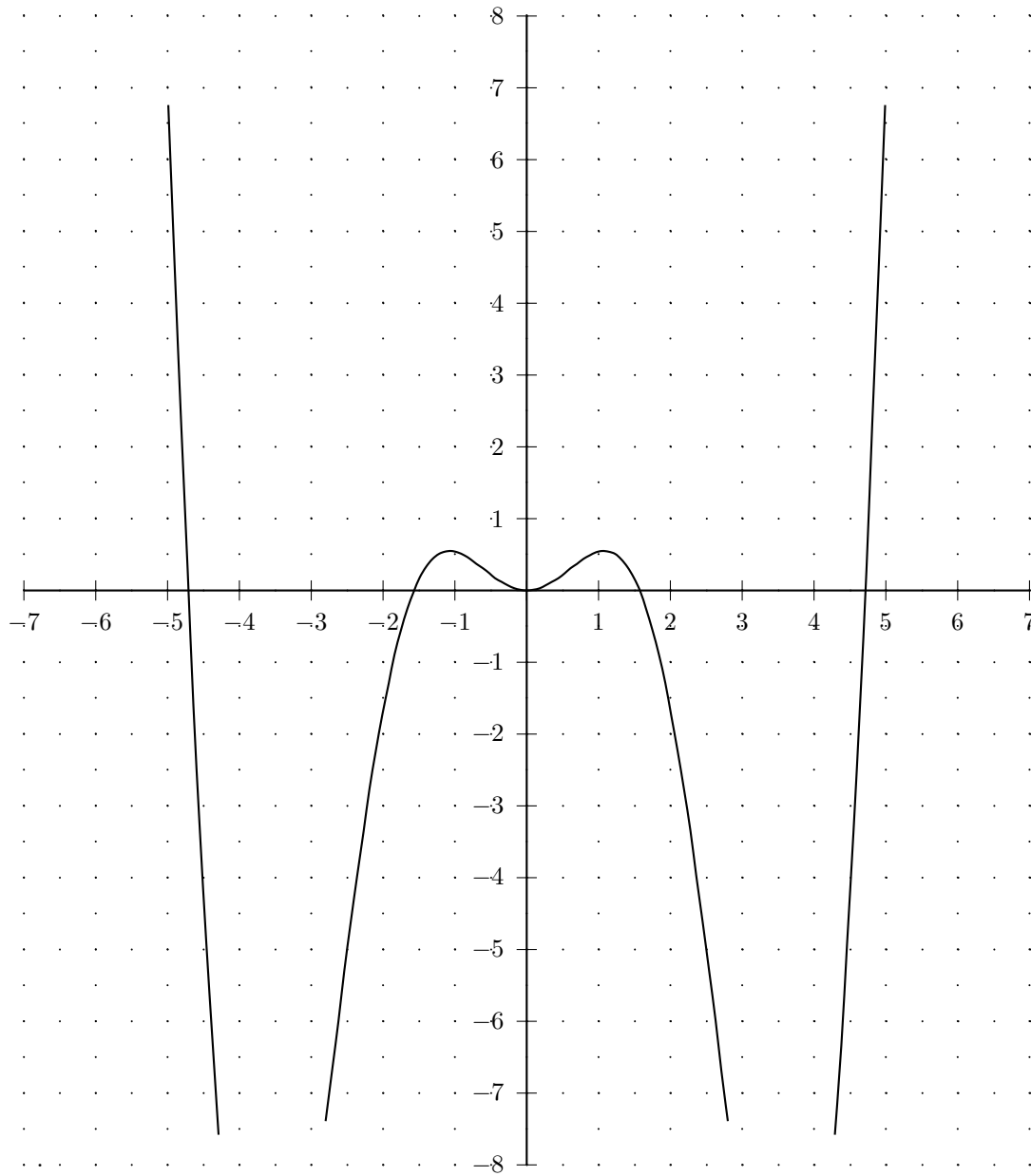
	$x$	$f(x)$
Nullstellen:	-4,712	-0,003
	-1,571	0
	1,571	0
	4,712	-0,003
Extremwerte:	-6,579	41,403
	-3,644	-11,638
	-1,077	0,55
	0	0
	1,077	0,55
	3,644	-11,638
	6,579	41,403
Wendepunkte:	-5,386	18,096
	-2,689	-6,501
	-0,6	0,297
	0,6	0,297
	2,689	-6,501
	5,386	18,096

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	36,941	21,638	-53,828
$-6\frac{1}{2}$	41,261	-3,606	-44,9
-6	34,566	-21,58	-25,94
$-5\frac{1}{2}$	21,437	-29,137	-4,498
-5	7,092	-26,809	12,654
$-4\frac{1}{2}$	-4,269	-17,898	21,442
-4	-10,458	-6,88	21,26
$-3\frac{1}{2}$	-11,472	2,258	14,51
-3	-8,91	7,21	5,237
$-2\frac{1}{2}$	-5,007	7,746	-2,58
-2	-1,665	5,302	-6,442
$-1\frac{1}{2}$	0,159	2,032	-6,003
-1	0,54	-0,239	-2,826
$-\frac{1}{2}$	0,219	-0,758	0,577
0	0	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	2
$\frac{1}{2}$	0,219	0,758	0,577
1	0,54	0,239	-2,826
$1\frac{1}{2}$	0,159	-2,032	-6,003
2	-1,665	-5,302	-6,442
$2\frac{1}{2}$	-5,007	-7,746	-2,58
3	-8,91	-7,21	5,237
$3\frac{1}{2}$	-11,472	-2,258	14,51
4	-10,458	6,88	21,26
$4\frac{1}{2}$	-4,269	17,898	21,442
5	7,092	26,809	12,654
$5\frac{1}{2}$	21,437	29,137	-4,498
6	34,566	21,58	-25,94
$6\frac{1}{2}$	41,261	3,606	-44,9
7	36,941	-21,638	-53,828

- Graph der Funktion  $f(x) = x^2 \cdot \cos(x)$



## Aufgabe (39)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \cos(x)$

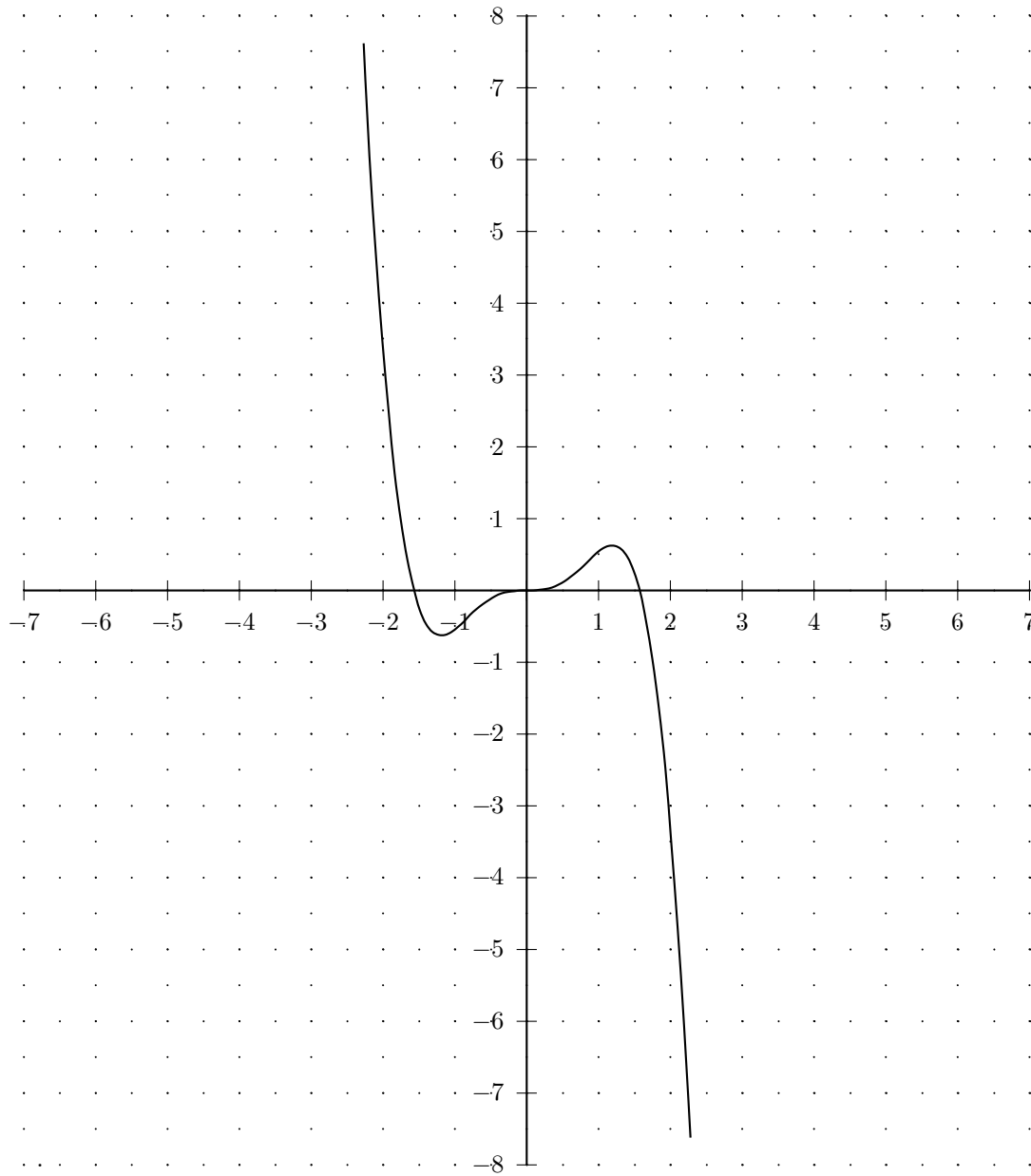
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-4,712	0,016
	-1,571	0,001
	0	0
	1,571	-0,001
	4,712	-0,016
Extremwerte:	-6,704	-275,015
	-3,808	43,405
	-1,192	-0,626
	1,192	0,626
	3,808	-43,405
	6,704	275,015
Wendepunkte:	-5,632	-142,17
	-2,981	26,155
	-0,823	-0,379
	-0,023	0
	0,823	0,379
	2,981	-26,155
	5,632	142,17

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-258,588	-114,527	420,074
$-6\frac{1}{2}$	-268,195	64,698	284,64
-6	-207,397	164,045	112,478
$-5\frac{1}{2}$	-117,905	181,691	-33,534
-5	-35,458	141,138	-116,888
$-4\frac{1}{2}$	19,209	76,272	-132,285
-4	41,833	17,063	-98,798
$-3\frac{1}{2}$	40,151	-19,373	-46,268
-3	26,73	-30,538	-1,29
$-2\frac{1}{2}$	12,518	-24,372	21,941
-2	3,329	-12,268	23,487
$-1\frac{1}{2}$	-0,239	-2,89	13,068
-1	-0,54	0,779	2,348
$-\frac{1}{2}$	-0,11	0,598	-1,804
0	0	0	0
0	0	0	0
$\frac{1}{2}$	0,11	0,598	1,804
1	0,54	0,779	-2,348
$1\frac{1}{2}$	0,239	-2,89	-13,068
2	-3,329	-12,268	-23,487
$2\frac{1}{2}$	-12,518	-24,372	-21,941
3	-26,73	-30,538	1,29
$3\frac{1}{2}$	-40,151	-19,373	46,268
4	-41,833	17,063	98,798
$4\frac{1}{2}$	-19,209	76,272	132,285
5	35,458	141,138	116,888
$5\frac{1}{2}$	117,905	181,691	33,534
6	207,397	164,045	-112,478
$6\frac{1}{2}$	268,195	64,698	-284,64
7	258,588	-114,527	-420,074

•Graph der Funktion  $f(x) = x^3 \cdot \cos(x)$



## Aufgabe (40)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \cos(x)$

• Kurvendiskussion

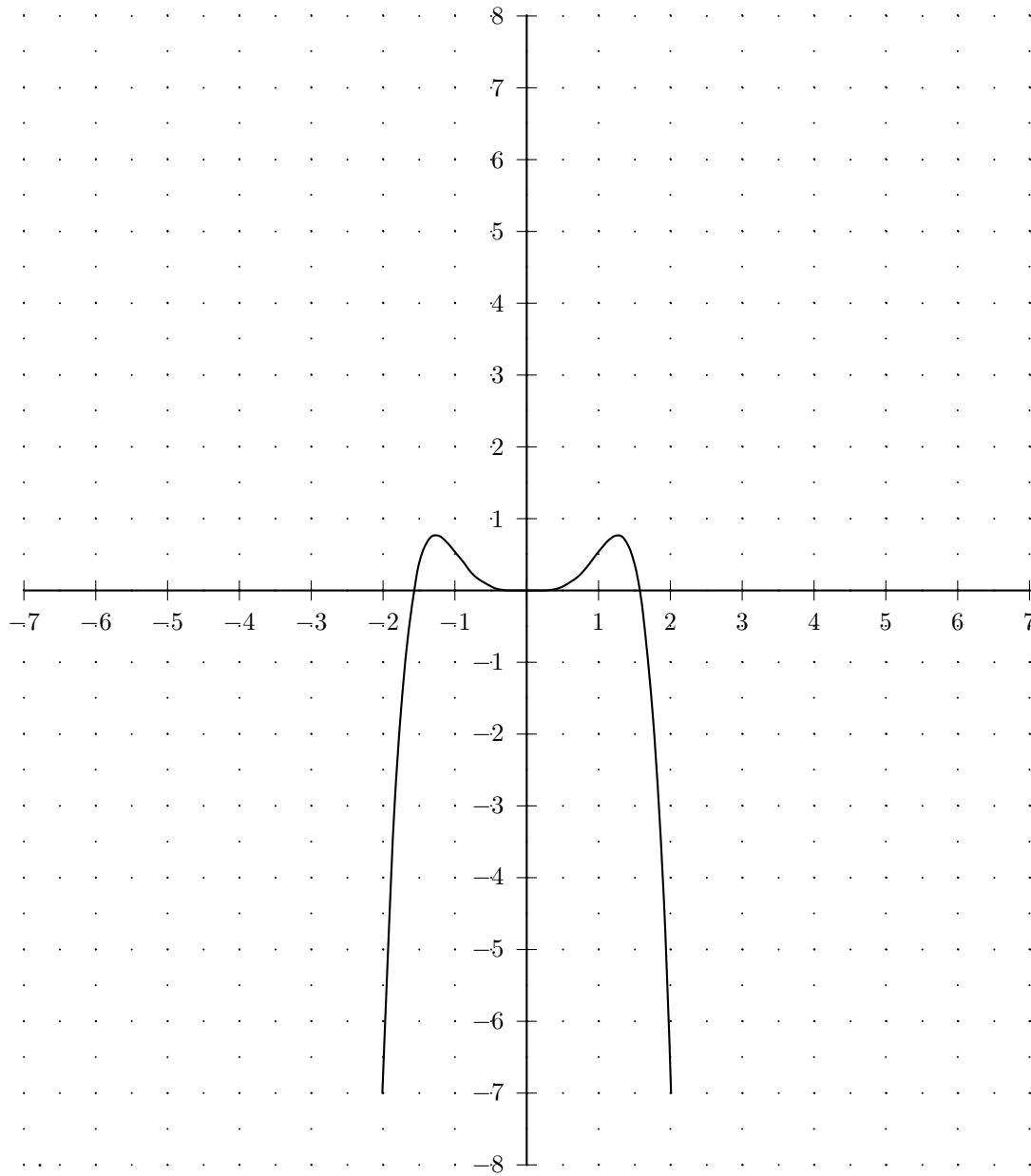
	$x$	$f(x)$
Nullstellen:	-4,712	-0,074
	-1,571	-0,001
	1,571	-0,001
	4,712	-0,074
Extremwerte:	-6,814	1859,151
	-3,935	-168,174
	-1,264	0,771
	0	0
	1,264	0,771
	3,935	-168,174
	6,814	1859,151
Wendepunkte:	-5,841	1052,022
	-3,208	-105,673
	-0,963	0,491
	0,963	0,491
	3,208	-105,673
	5,841	1052,022

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1810,119	543,129	-3169,57
$-6\frac{1}{2}$	1743,27	-688,711	-1720,763
-6	1244,381	-1191,656	-346,78
$-5\frac{1}{2}$	648,477	-1117,206	547,817
-5	177,289	-741,156	866,714
$-4\frac{1}{2}$	-86,439	-324,025	747,827
-4	-167,333	-26,424	429,317
$-3\frac{1}{2}$	-140,527	107,951	123,193
-3	-80,189	118,345	-57,205
$-2\frac{1}{2}$	-31,295	73,45	-103,597
-2	-6,658	27,868	-71,511
$-1\frac{1}{2}$	0,358	4,097	-25,382
-1	0,54	-1,319	-0,789
$-\frac{1}{2}$	0,055	-0,409	2,098
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,055	0,409	2,098
1	0,54	1,319	-0,789
$1\frac{1}{2}$	0,358	-4,097	-25,382
2	-6,658	-27,868	-71,511
$2\frac{1}{2}$	-31,295	-73,45	-103,597
3	-80,189	-118,345	-57,205
$3\frac{1}{2}$	-140,527	-107,951	123,193
4	-167,333	26,424	429,317
$4\frac{1}{2}$	-86,439	324,025	747,827
5	177,289	741,156	866,714
$5\frac{1}{2}$	648,477	1117,206	547,817
6	1244,381	1191,656	-346,78
$6\frac{1}{2}$	1743,27	688,711	-1720,763
7	1810,119	-543,129	-3169,57

•Graph der Funktion  $f(x) = x^4 \cdot \cos(x)$



## Aufgabe (41)

• Gegeben die Funktion:  $f(x) = x \cdot \cos(x)$

• Kurvendiskussion

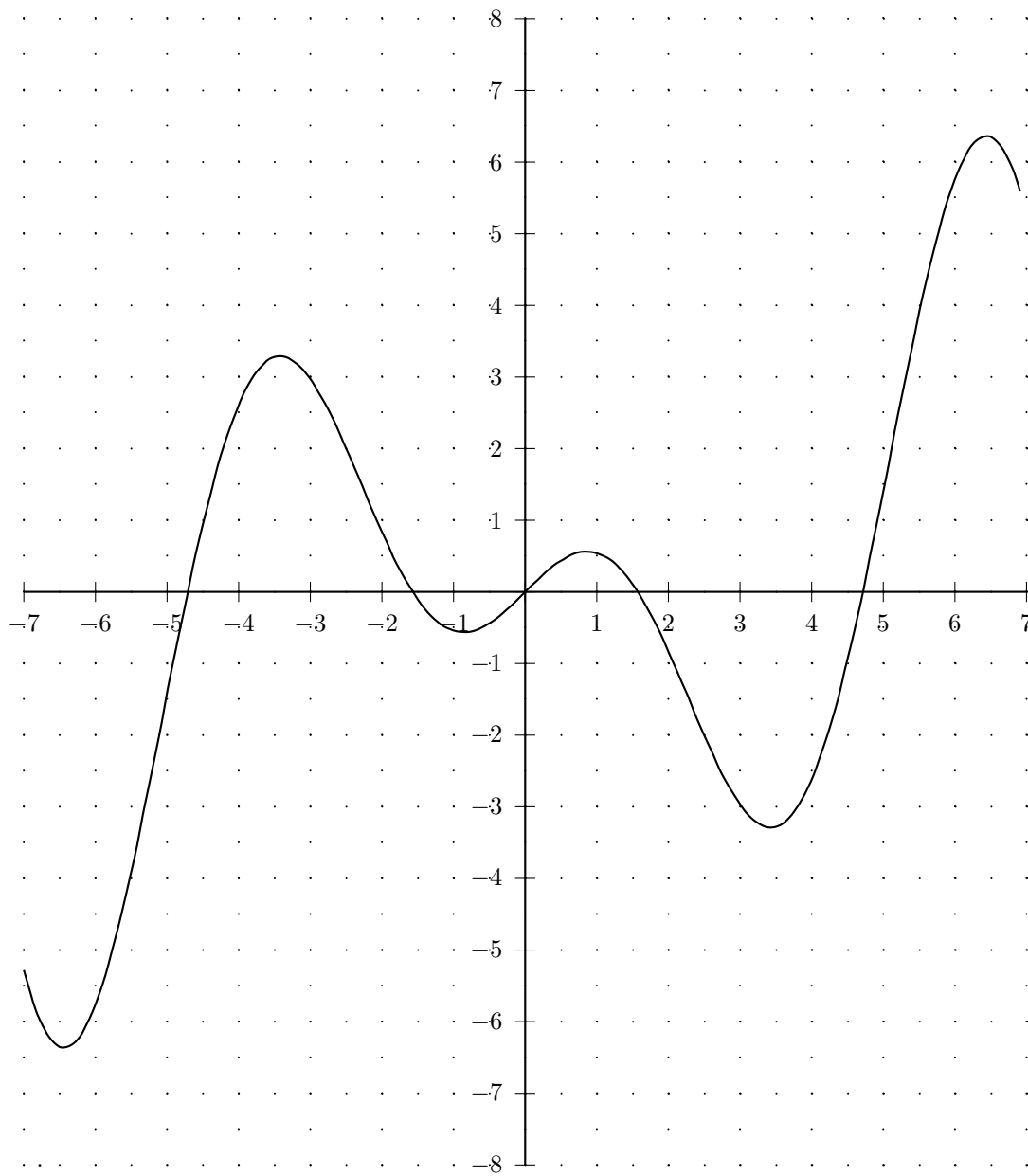
	$x$	$f(x)$
Nullstellen:	-4,712	0,001
	-1,571	0
	0	0
	1,571	0
	4,712	-0,001
	Extremwerte:	-6,437
	-3,426	3,288
	-0,86	-0,561
	0,86	0,561
	3,426	-3,288
	6,437	6,361
Wendepunkte:	-5,087	-1,862
	-2,289	1,507
	-0,023	-0,023
	2,289	-1,507
	5,087	1,862

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-5,277	-3,845	6,591
$-6\frac{1}{2}$	-6,348	-0,422	6,778
-6	-5,761	2,637	5,202
$-5\frac{1}{2}$	-3,898	4,589	2,487
-5	-1,418	5,078	-0,5
$-4\frac{1}{2}$	0,949	4,188	-2,904
-4	2,615	2,374	-4,128
$-3\frac{1}{2}$	3,278	0,291	-3,979
-3	2,97	-1,413	-2,688
$-2\frac{1}{2}$	2,003	-2,297	-0,806
-2	0,832	-2,235	0,986
$-1\frac{1}{2}$	-0,106	-1,425	2,101
-1	-0,54	-0,301	2,223
$-\frac{1}{2}$	-0,439	0,638	1,398
0	0	1	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	1	0
$\frac{1}{2}$	0,439	0,638	-1,398
1	0,54	-0,301	-2,223
$1\frac{1}{2}$	0,106	-1,425	-2,101
2	-0,832	-2,235	-0,986
$2\frac{1}{2}$	-2,003	-2,297	0,806
3	-2,97	-1,413	2,688
$3\frac{1}{2}$	-3,278	0,291	3,979
4	-2,615	2,374	4,128
$4\frac{1}{2}$	-0,949	4,188	2,904
5	1,418	5,078	0,5
$5\frac{1}{2}$	3,898	4,589	-2,487
6	5,761	2,637	-5,202
$6\frac{1}{2}$	6,348	-0,422	-6,778
7	5,277	-3,845	-6,591

•Graph der Funktion  $f(x) = x \cdot \cos(x)$



## Aufgabe (42)

• Gegeben die Funktion:  $f(x) = x^2 \cdot \cos(x)$

• Kurvendiskussion

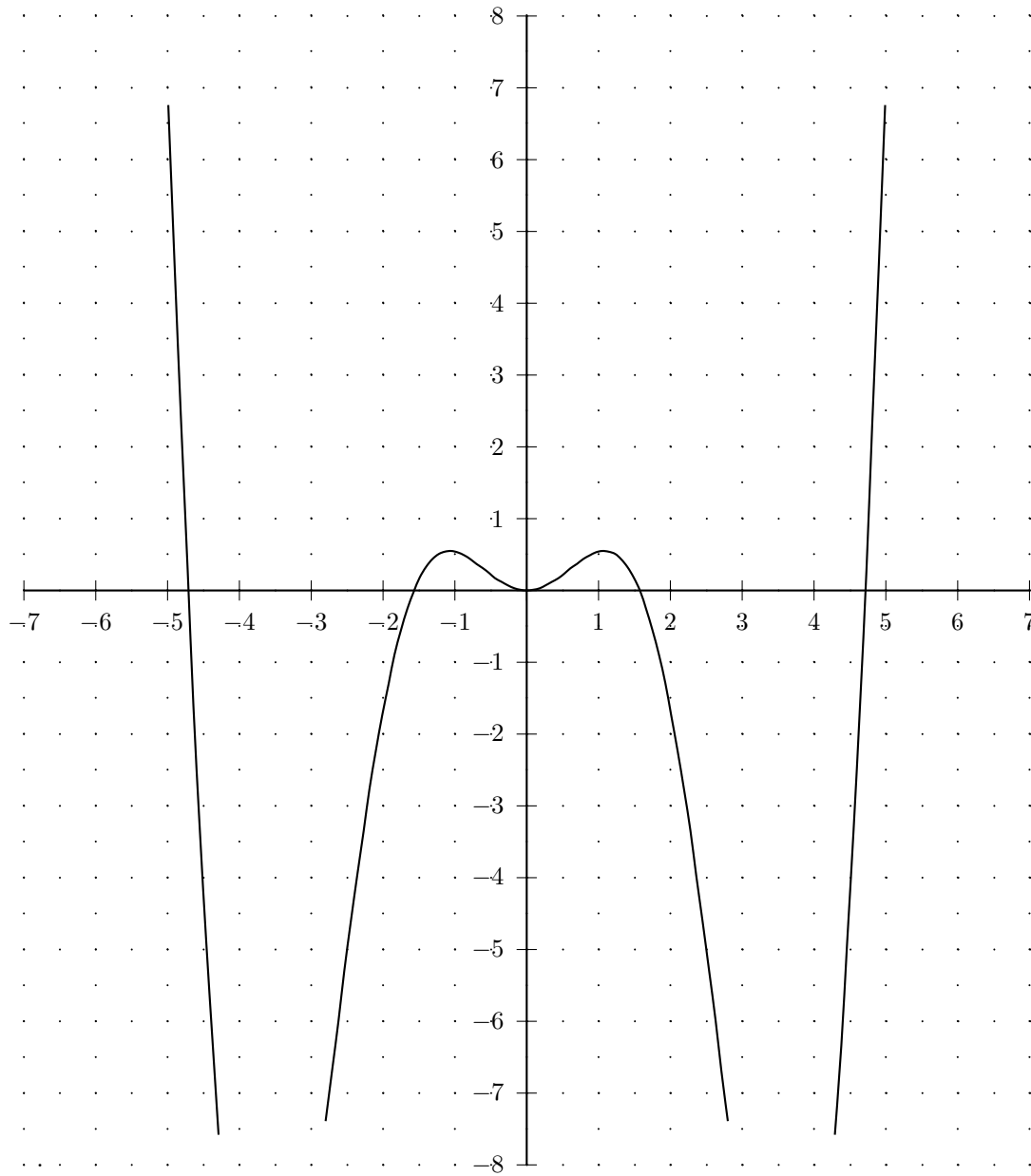
	$x$	$f(x)$
Nullstellen:	-4,712	-0,003
	-1,571	0
	1,571	0
	4,712	-0,003
Extremwerte:	-6,579	41,403
	-3,644	-11,638
	-1,077	0,55
	0	0
	1,077	0,55
	3,644	-11,638
	6,579	41,403
Wendepunkte:	-5,386	18,096
	-2,689	-6,501
	-0,6	0,297
	0,6	0,297
	2,689	-6,501
	5,386	18,096

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	36,941	21,638	-53,828
$-6\frac{1}{2}$	41,261	-3,606	-44,9
-6	34,566	-21,58	-25,94
$-5\frac{1}{2}$	21,437	-29,137	-4,498
-5	7,092	-26,809	12,654
$-4\frac{1}{2}$	-4,269	-17,898	21,442
-4	-10,458	-6,88	21,26
$-3\frac{1}{2}$	-11,472	2,258	14,51
-3	-8,91	7,21	5,237
$-2\frac{1}{2}$	-5,007	7,746	-2,58
-2	-1,665	5,302	-6,442
$-1\frac{1}{2}$	0,159	2,032	-6,003
-1	0,54	-0,239	-2,826
$-\frac{1}{2}$	0,219	-0,758	0,577
0	0	0	2

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	2
$\frac{1}{2}$	0,219	0,758	0,577
1	0,54	0,239	-2,826
$1\frac{1}{2}$	0,159	-2,032	-6,003
2	-1,665	-5,302	-6,442
$2\frac{1}{2}$	-5,007	-7,746	-2,58
3	-8,91	-7,21	5,237
$3\frac{1}{2}$	-11,472	-2,258	14,51
4	-10,458	6,88	21,26
$4\frac{1}{2}$	-4,269	17,898	21,442
5	7,092	26,809	12,654
$5\frac{1}{2}$	21,437	29,137	-4,498
6	34,566	21,58	-25,94
$6\frac{1}{2}$	41,261	3,606	-44,9
7	36,941	-21,638	-53,828

- Graph der Funktion  $f(x) = x^2 \cdot \cos(x)$



## Aufgabe (43)

• Gegeben die Funktion:  $f(x) = x^3 \cdot \cos(x)$

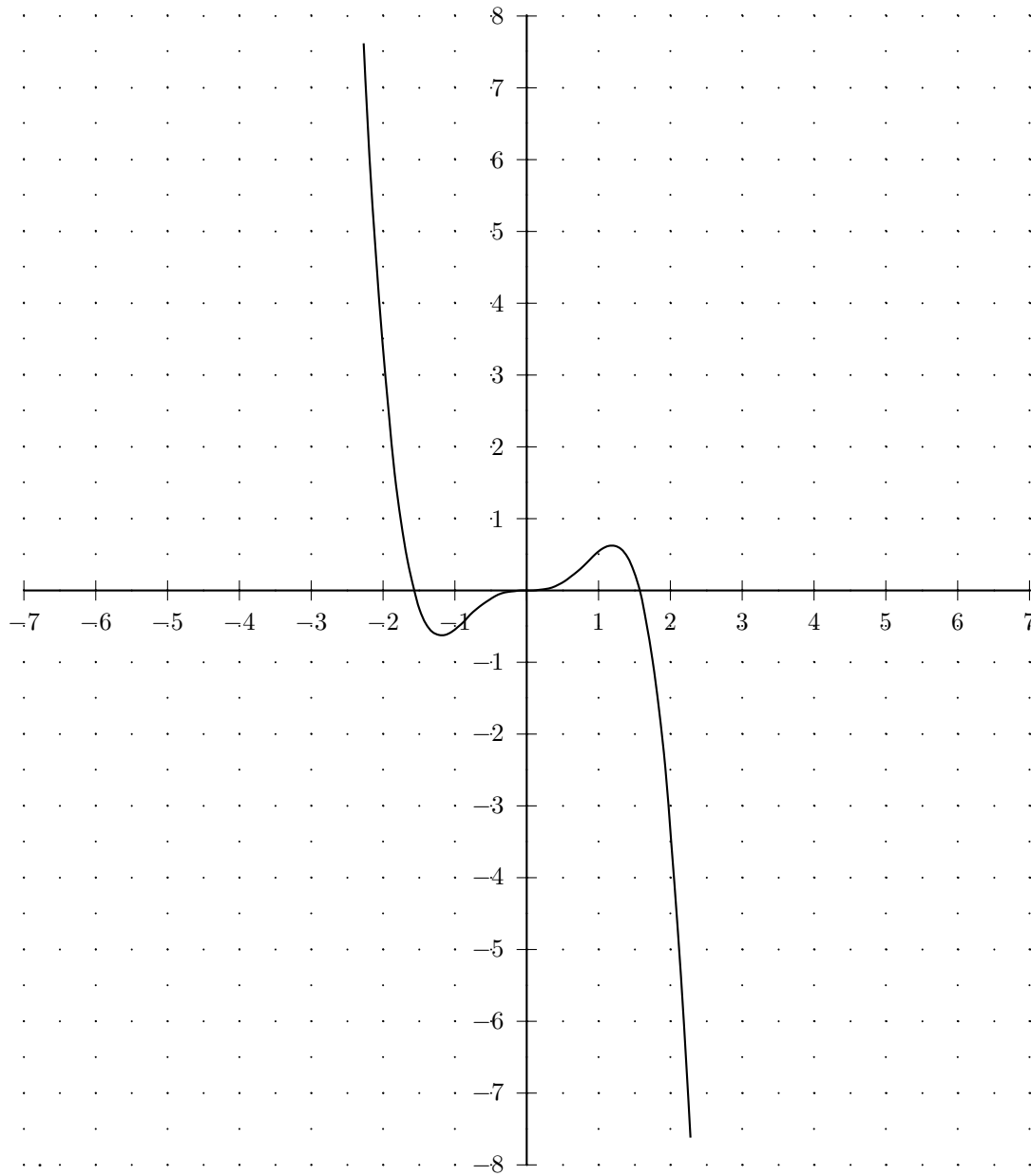
• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-4,712	0,016
	-1,571	0,001
	0	0
	1,571	-0,001
	4,712	-0,016
Extremwerte:	-6,704	-275,015
	-3,808	43,405
	-1,192	-0,626
	1,192	0,626
	3,808	-43,405
	6,704	275,015
Wendepunkte:	-5,632	-142,17
	-2,981	26,155
	-0,823	-0,379
	-0,023	0
	0,823	0,379
	2,981	-26,155
	5,632	142,17

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	-258,588	-114,527	420,074
$-6\frac{1}{2}$	-268,195	64,698	284,64
-6	-207,397	164,045	112,478
$-5\frac{1}{2}$	-117,905	181,691	-33,534
-5	-35,458	141,138	-116,888
$-4\frac{1}{2}$	19,209	76,272	-132,285
-4	41,833	17,063	-98,798
$-3\frac{1}{2}$	40,151	-19,373	-46,268
-3	26,73	-30,538	-1,29
$-2\frac{1}{2}$	12,518	-24,372	21,941
-2	3,329	-12,268	23,487
$-1\frac{1}{2}$	-0,239	-2,89	13,068
-1	-0,54	0,779	2,348
$-\frac{1}{2}$	-0,11	0,598	-1,804
0	0	0	0
0	0	0	0
$\frac{1}{2}$	0,11	0,598	1,804
1	0,54	0,779	-2,348
$1\frac{1}{2}$	0,239	-2,89	-13,068
2	-3,329	-12,268	-23,487
$2\frac{1}{2}$	-12,518	-24,372	-21,941
3	-26,73	-30,538	1,29
$3\frac{1}{2}$	-40,151	-19,373	46,268
4	-41,833	17,063	98,798
$4\frac{1}{2}$	-19,209	76,272	132,285
5	35,458	141,138	116,888
$5\frac{1}{2}$	117,905	181,691	33,534
6	207,397	164,045	-112,478
$6\frac{1}{2}$	268,195	64,698	-284,64
7	258,588	-114,527	-420,074

•Graph der Funktion  $f(x) = x^3 \cdot \cos(x)$



## Aufgabe (44)

• Gegeben die Funktion:  $f(x) = x^4 \cdot \cos(x)$

• Kurvendiskussion

	$x$	$f(x)$
Nullstellen:	-4,712	-0,074
	-1,571	-0,001
	1,571	-0,001
	4,712	-0,074
Extremwerte:	-6,814	1859,151
	-3,935	-168,174
	-1,264	0,771
	0	0
	1,264	0,771
	3,935	-168,174
	6,814	1859,151
Wendepunkte:	-5,841	1052,022
	-3,208	-105,673
	-0,963	0,491
	0,963	0,491
	3,208	-105,673
	5,841	1052,022

• Wertetabelle

$x$	$f(x)$	$f'(x)$	$f''(x)$
-7	1810,119	543,129	-3169,57
$-6\frac{1}{2}$	1743,27	-688,711	-1720,763
-6	1244,381	-1191,656	-346,78
$-5\frac{1}{2}$	648,477	-1117,206	547,817
-5	177,289	-741,156	866,714
$-4\frac{1}{2}$	-86,439	-324,025	747,827
-4	-167,333	-26,424	429,317
$-3\frac{1}{2}$	-140,527	107,951	123,193
-3	-80,189	118,345	-57,205
$-2\frac{1}{2}$	-31,295	73,45	-103,597
-2	-6,658	27,868	-71,511
$-1\frac{1}{2}$	0,358	4,097	-25,382
-1	0,54	-1,319	-0,789
$-\frac{1}{2}$	0,055	-0,409	2,098
0	0	0	0

$x$	$f(x)$	$f'(x)$	$f''(x)$
0	0	0	0
$\frac{1}{2}$	0,055	0,409	2,098
1	0,54	1,319	-0,789
$1\frac{1}{2}$	0,358	-4,097	-25,382
2	-6,658	-27,868	-71,511
$2\frac{1}{2}$	-31,295	-73,45	-103,597
3	-80,189	-118,345	-57,205
$3\frac{1}{2}$	-140,527	-107,951	123,193
4	-167,333	26,424	429,317
$4\frac{1}{2}$	-86,439	324,025	747,827
5	177,289	741,156	866,714
$5\frac{1}{2}$	648,477	1117,206	547,817
6	1244,381	1191,656	-346,78
$6\frac{1}{2}$	1743,27	688,711	-1720,763
7	1810,119	-543,129	-3169,57

- Graph der Funktion  $f(x) = x^4 \cdot \cos(x)$

