Angewandte Mathematik für die Informatik Sheet 4 **Maximilian von Sternberg**

1. (a) $F(x) = \frac{3}{2}\sqrt[3]{x^2} + -\frac{1}{4} \cdot sin(7-4x) + c$

   (b)

$$\begin{aligned}
F(x) &= \int \frac{x^2+1}{x^3+3x}\,dx \\
&= \int \frac{x^2+1}{z \cdot z'}\,dz \\
&= \int \frac{x^2+1}{z \cdot 3(x^2+1)}\,dz \\
&= \int \frac{1}{z \cdot 3}\,dz \\
&= \frac{1}{3}\int \frac{1}{z}\,dz \\
&= \frac{1}{3} ln(|z|) + c \\
&= \frac{ln(|x^3+3x|)}{3} + c
\end{aligned}$$

   (c)

$$\begin{aligned}
F(x) &= \int \frac{x-1}{x^2-1}\,dx \\
&= \int \frac{x-1}{(x+1)(x-1)}\,dx \\
&= \int \frac{1}{x+1}\,dx \\
&= ln(|x+1|) + c
\end{aligned}$$

   (d)

$$\begin{aligned}
F(x) &= \int sin(x) \cdot x\,dx \\
&= -x \cdot cos(x) - \int -cos(x)\,dx \\
&= -x \cdot cos(x) + sin(x) + c
\end{aligned}$$

2.

$$
\begin{aligned}
F(x) &= \int_0^8 \sqrt{1+x^2}\,dx \\
&= \int_{asinh(0))}^{asinh(8)} \sqrt{1+(sinh(u))^2} cosh(u)\,du \\
&= \int_{asinh(0))}^{asinh(8)} \sqrt{cosh^2(u)} cosh(u)\,du \\
&= \int_{asinh(0))}^{asinh(8)} cosh^2(u)\,du \\
&= [\frac{1}{2} cosh(u) sin(u) + \frac{1}{2}u]_{sinh(0)}^{sinh(8)} \\
&= \frac{8}{2} cosh(asinh(8)) + \frac{asinh(8)}{2} \\
&= 33,637267134
\end{aligned}
$$

3.

$$
\begin{aligned}
x+2 &= x^3 - 2x + 2 \qquad | -(x+2) \\
0 &= x^3 - 3x \\
0 &= x(x^2-3) \\
x_1 &= 0 \\
0 &= x^2 - 3 \\
x_{2/3} &= \pm\sqrt{3}
\end{aligned}
$$

$$
\begin{aligned}
A &= |\int_{-\sqrt{3}}^{0} x^3 - 2x + 2 - (x+2)\,dx| + |\int_0^{-\sqrt{3}} x^3 - 2x + 2 + (x+2)\,dx| \\
&= |\int_{-\sqrt{3}}^{0} x^3 - 3x\,dx| + |\int_0^{-\sqrt{3}} x^3 - 3x\,dx| \\
&= |[\frac{1}{4}x^4 - \frac{3}{2}x^2]_{-\sqrt{3}}^{0}| + |[\frac{1}{4}x^4 - \frac{3}{2}x^2]_0^{-\sqrt{3}}| \\
&= \frac{9}{2}
\end{aligned}
$$

4. (a) We have to find a c which corresponds to the appropriate value that the function stays continuos. As for my hand I have provided the functions in julia. x(300) = 20550

   (b) In beschleunigung.jl

   (c) The steps are only an arbitrary sample in the function. Therefore if we use a lower step size the accuracy of our guess will become worse.

5. (a)

$$
\begin{aligned}
V &= \int_0^8 \int_{-4}^4 -\sqrt{\frac{5}{4}} \cdot x^2 + 2y + 80 \, dy \, dx \\
&= \int_0^8 [\frac{-\sqrt{5} \cdot x^2 y}{2} + y^2 + 80y]_{-4}^4 \, dx \\
&= \int_0^8 640 - 4\sqrt{5} \cdot x^2 \, dx \\
&= [-\frac{4}{3}\sqrt{5} \cdot x^3 + 640x]_0^8 \\
&= 5120 - \frac{2048\sqrt{5}}{3}
\end{aligned}
$$

(b)

$$
S = \int_0^8 \int_{-4}^4 |(1, 0, \partial_x f)^T \times (0, 1, \partial_y)^T| \, dy \, dx
$$