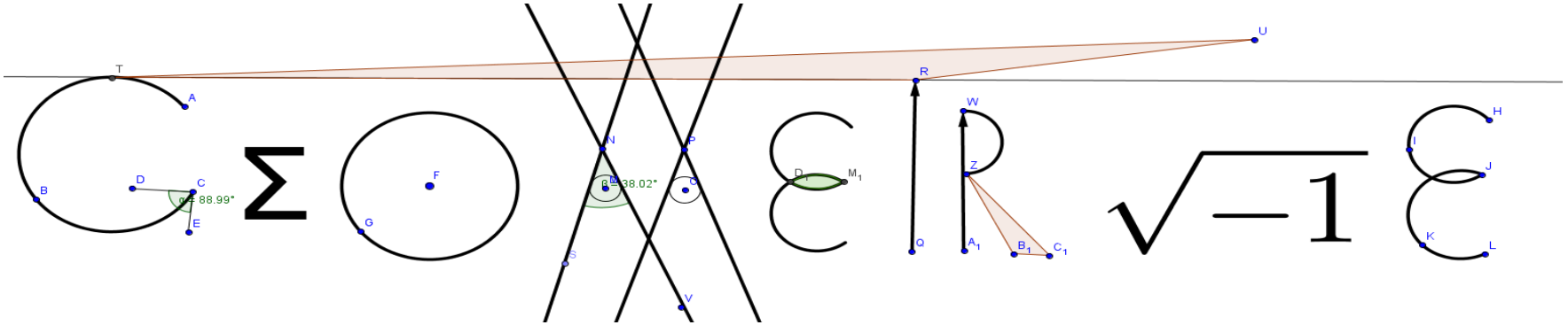
Projekt 6:



Wie konstruiert man ein Autobahnkreuz?

Kursleitung:

Florian Buchegger

Teilnehmer:

Klara Bernauer, Lukas Hageneder, Josué Elias Lazarte Huiza, Isabelle Otto, Christa Popova, Dominik Schaffer, Marlene Schininger, Anna Schranz, Celestine Stockinger, Marlene Stockinger, Augustin Zuljevic

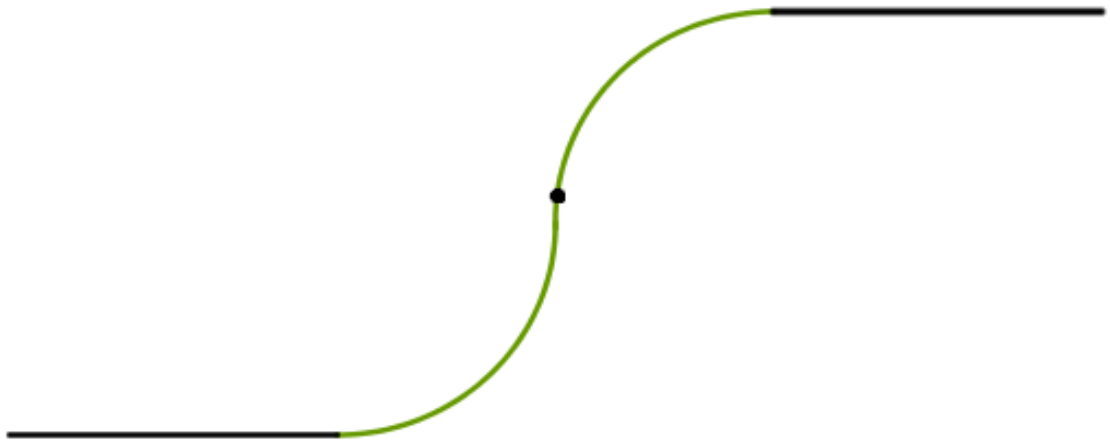
Aufgabenstellung und Umsetzung

zwei Straßen verbinden:

Aufgabenstellung und Umsetzung

zwei Straßen verbinden:

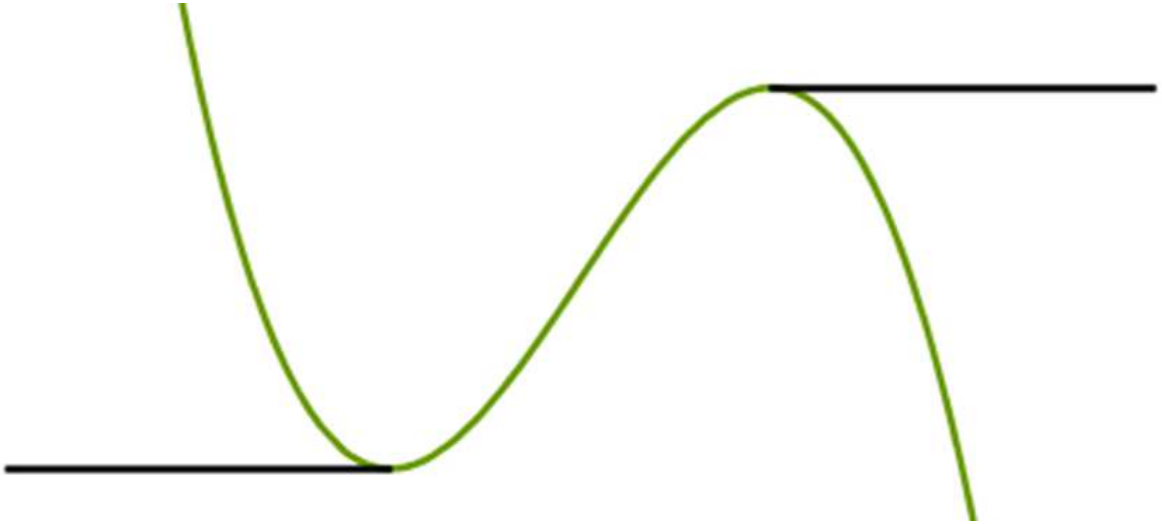
- durch Kreisbögen



Aufgabenstellung und Umsetzung

zwei Straßen verbinden:

- durch Kreisbögen
- durch eine Polynomfunktion



Aufgabenstellung und Umsetzung

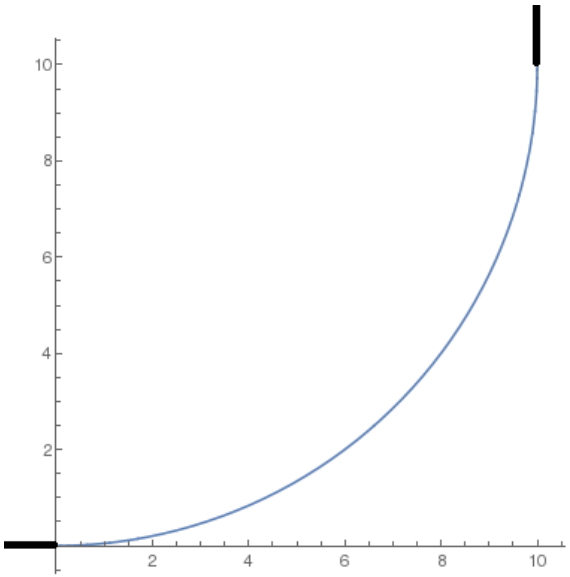
zwei Straßen verbinden

- durch Kreisbögen
- durch eine Polynomfunktion
- durch eine parametrische Kurve

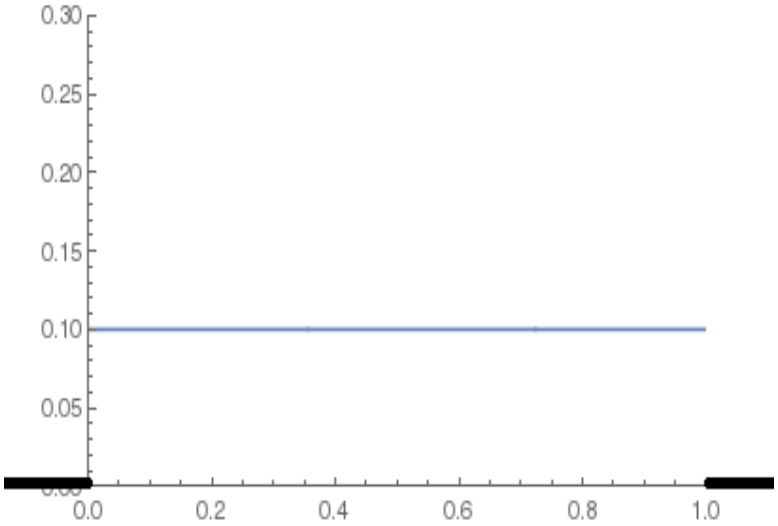
Kriterien

- Das Einlenken sollte nicht ruckartig sein.

Kurve



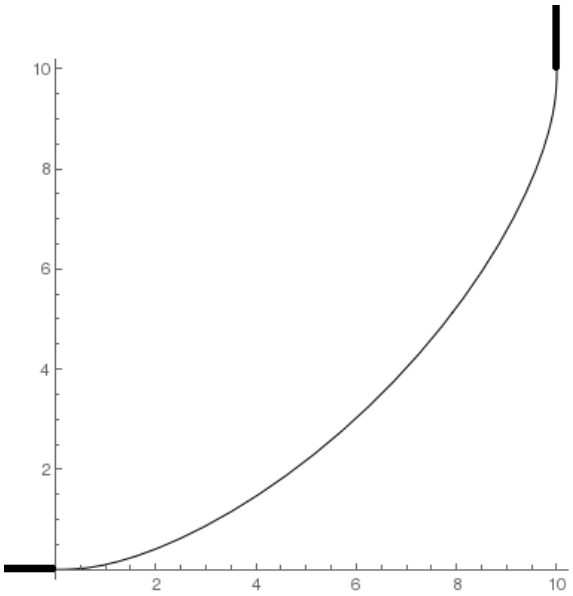
Krümmung



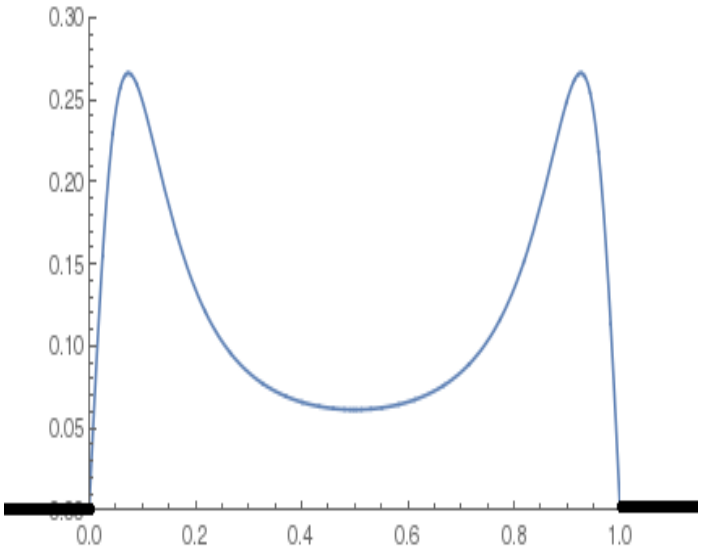
Kriterien

- Das Einlenken sollte nicht ruckartig sein.
- Krümmung sollte nicht zu hoch sein, sonst: Schleudergefahr!

Kurve



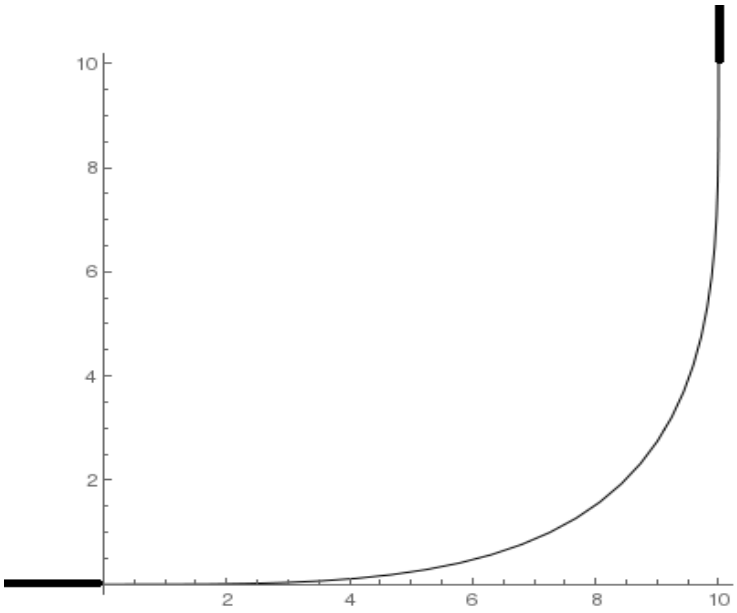
Krümmung



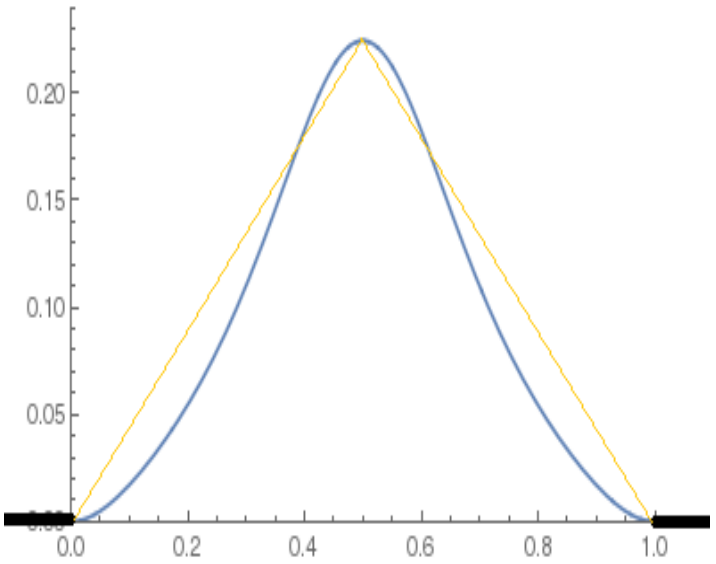
Kriterien

- Das Einlenken sollte nicht ruckartig sein.
- Krümmung sollte nicht zu hoch sein, sonst: Schleudergefahr!
- Das Einlenken soll möglichst gleichmäßig sein.

Kurve

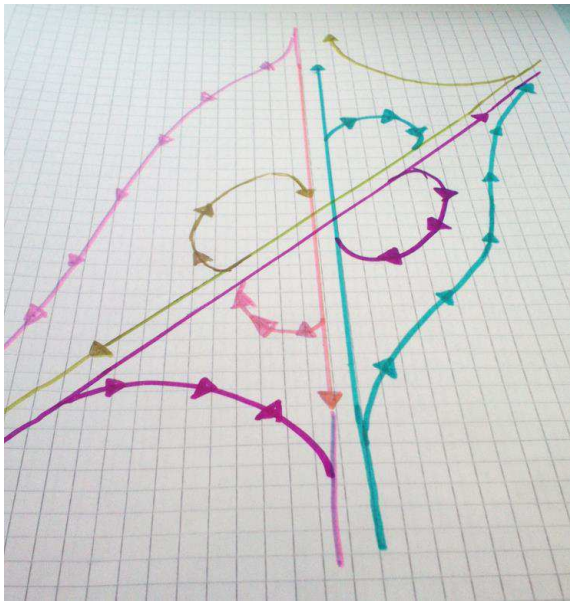


Krümmung

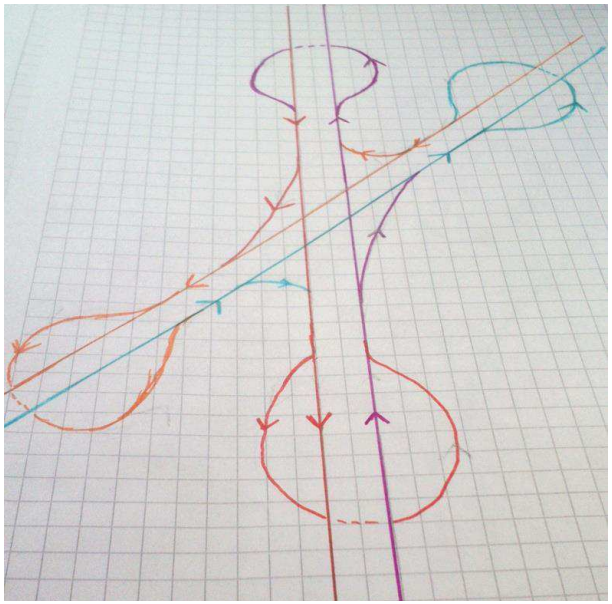


Wie konstruiert man ein Autobahnkreuz?

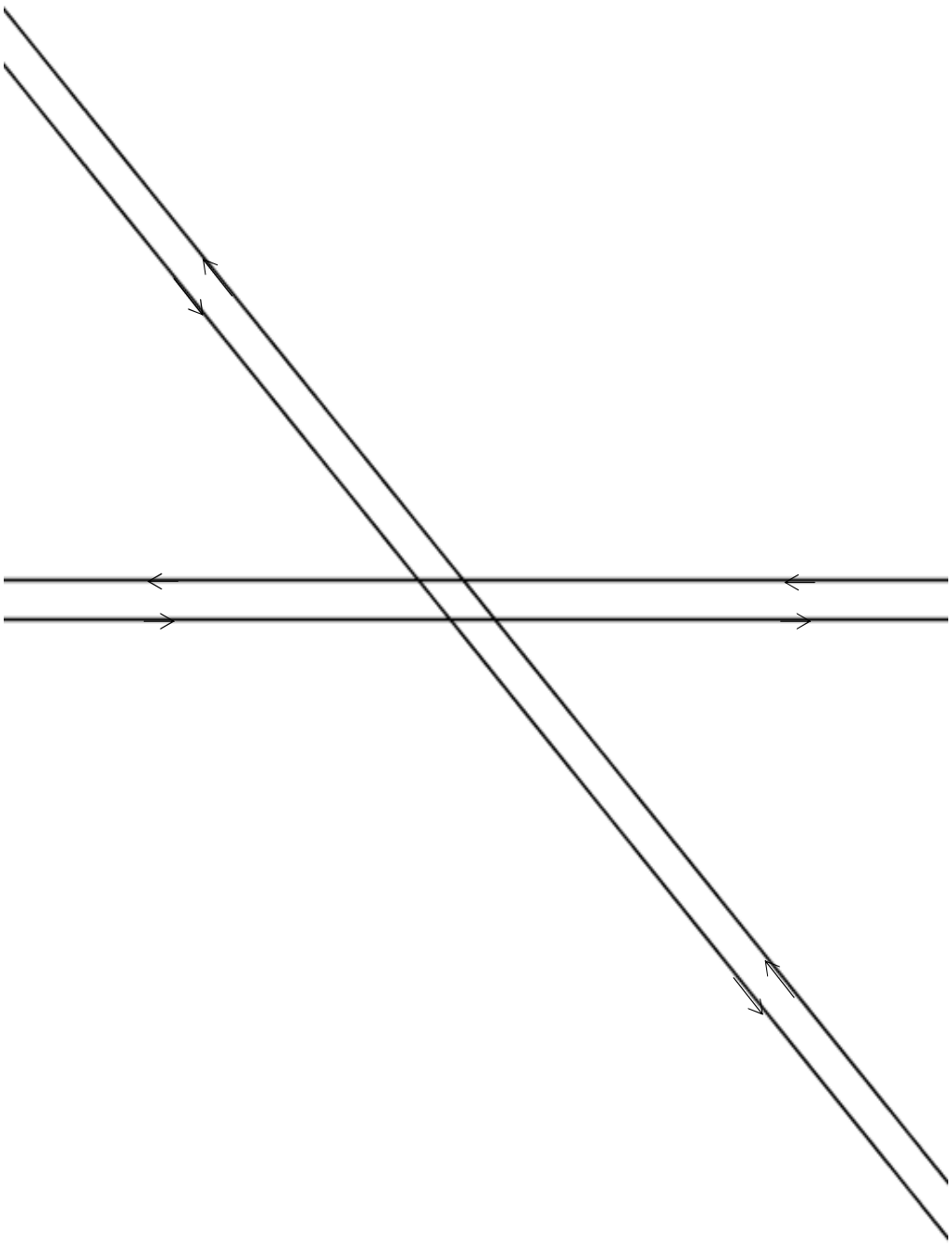
Erste Variante: Kleeblatt

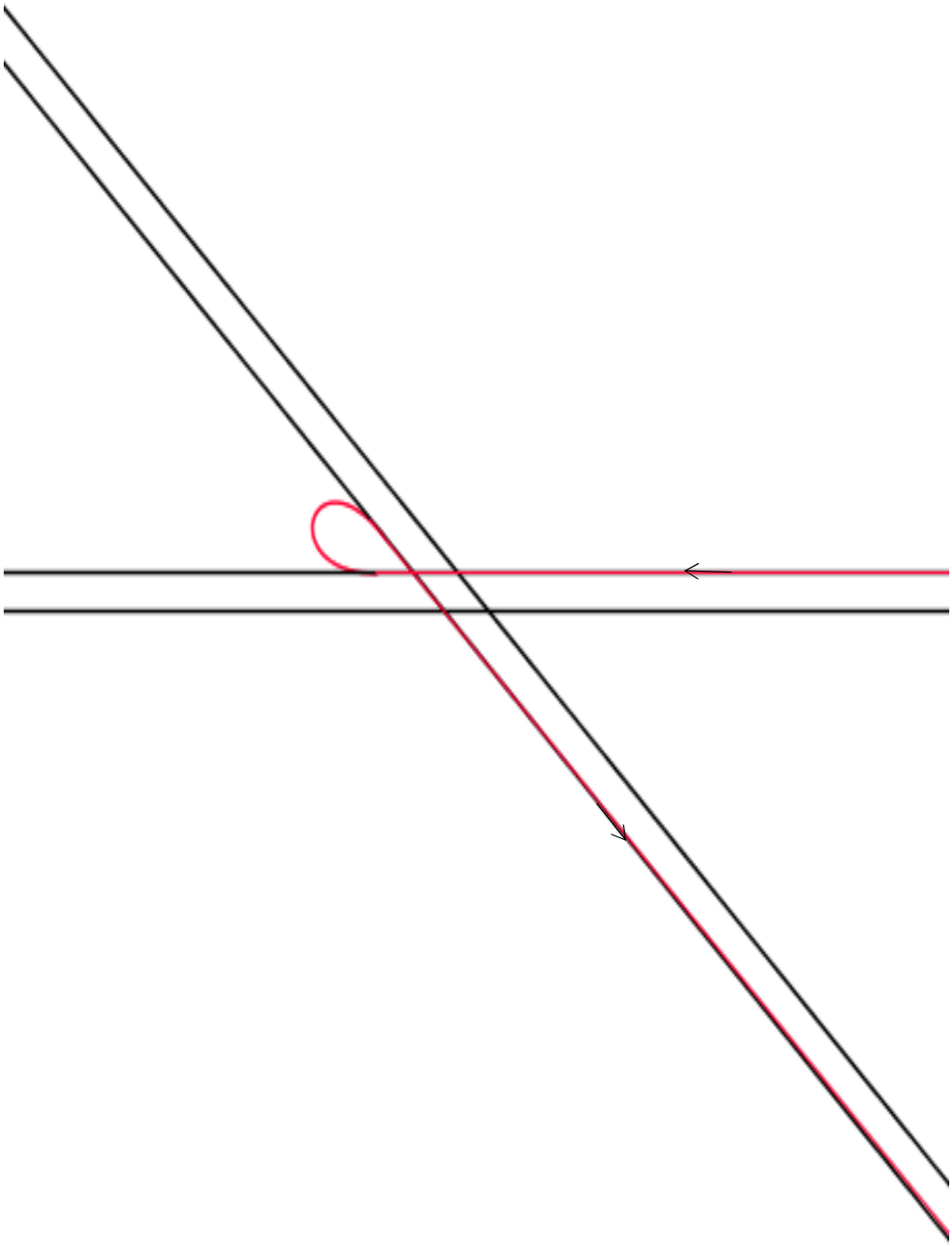


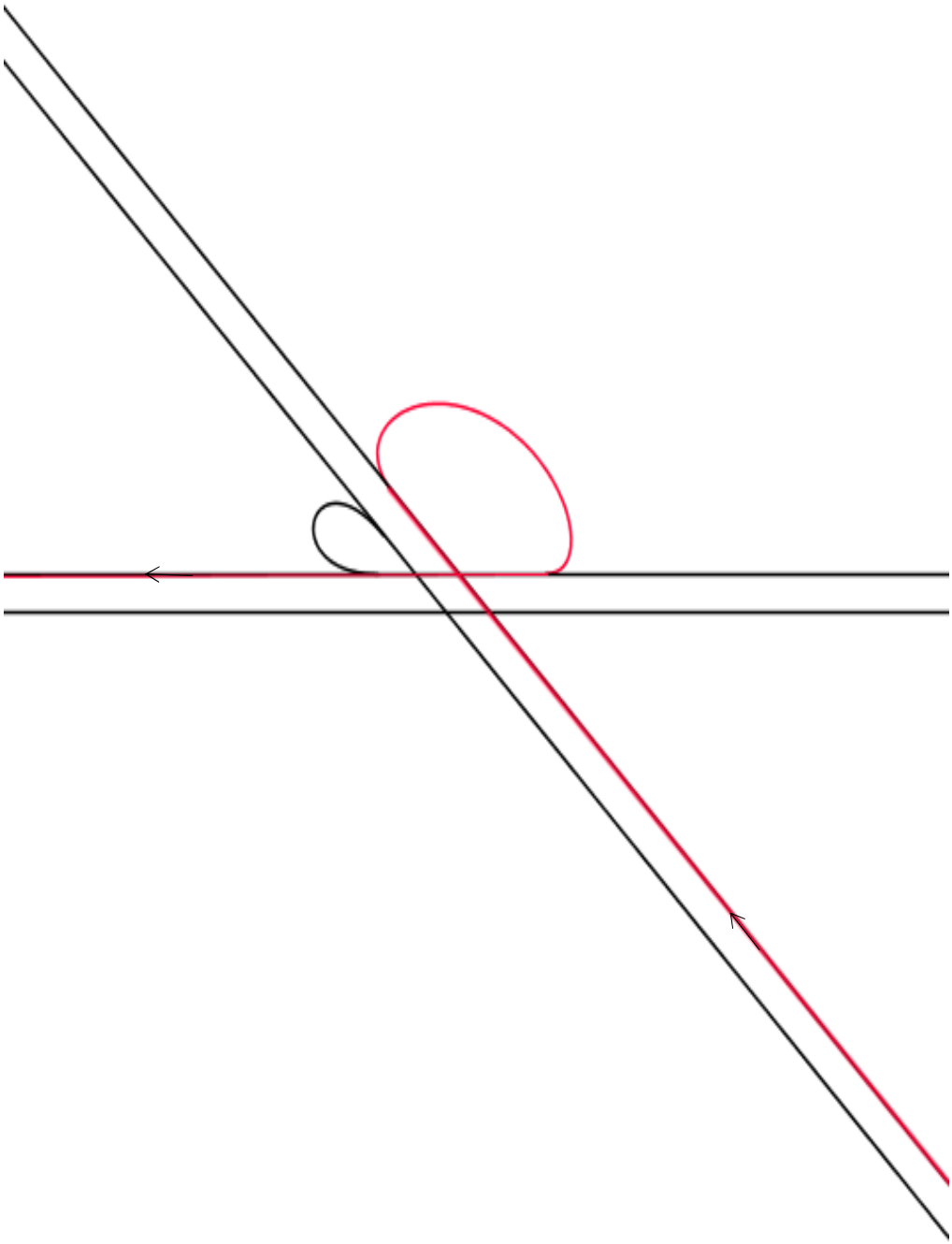
Zweite Variante

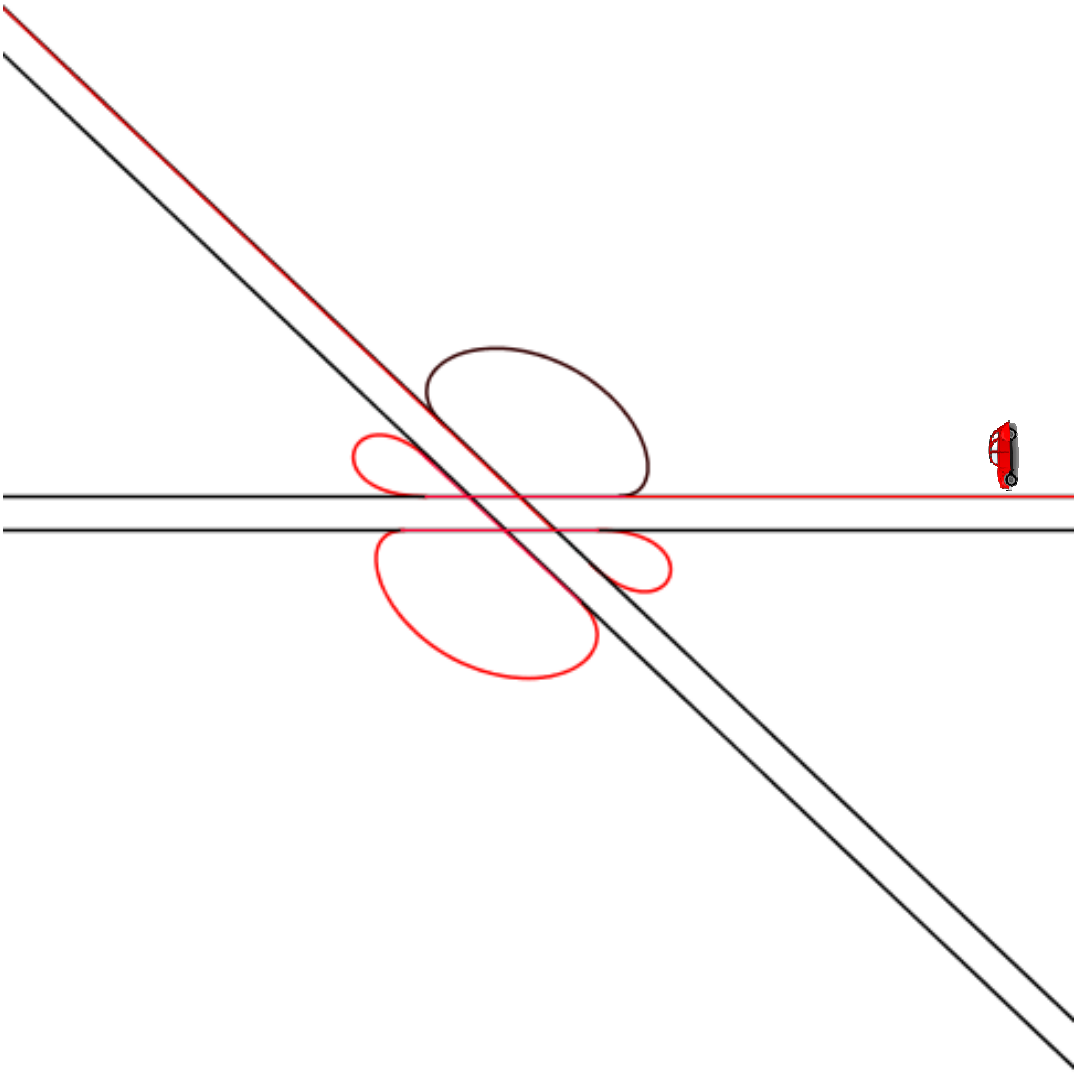


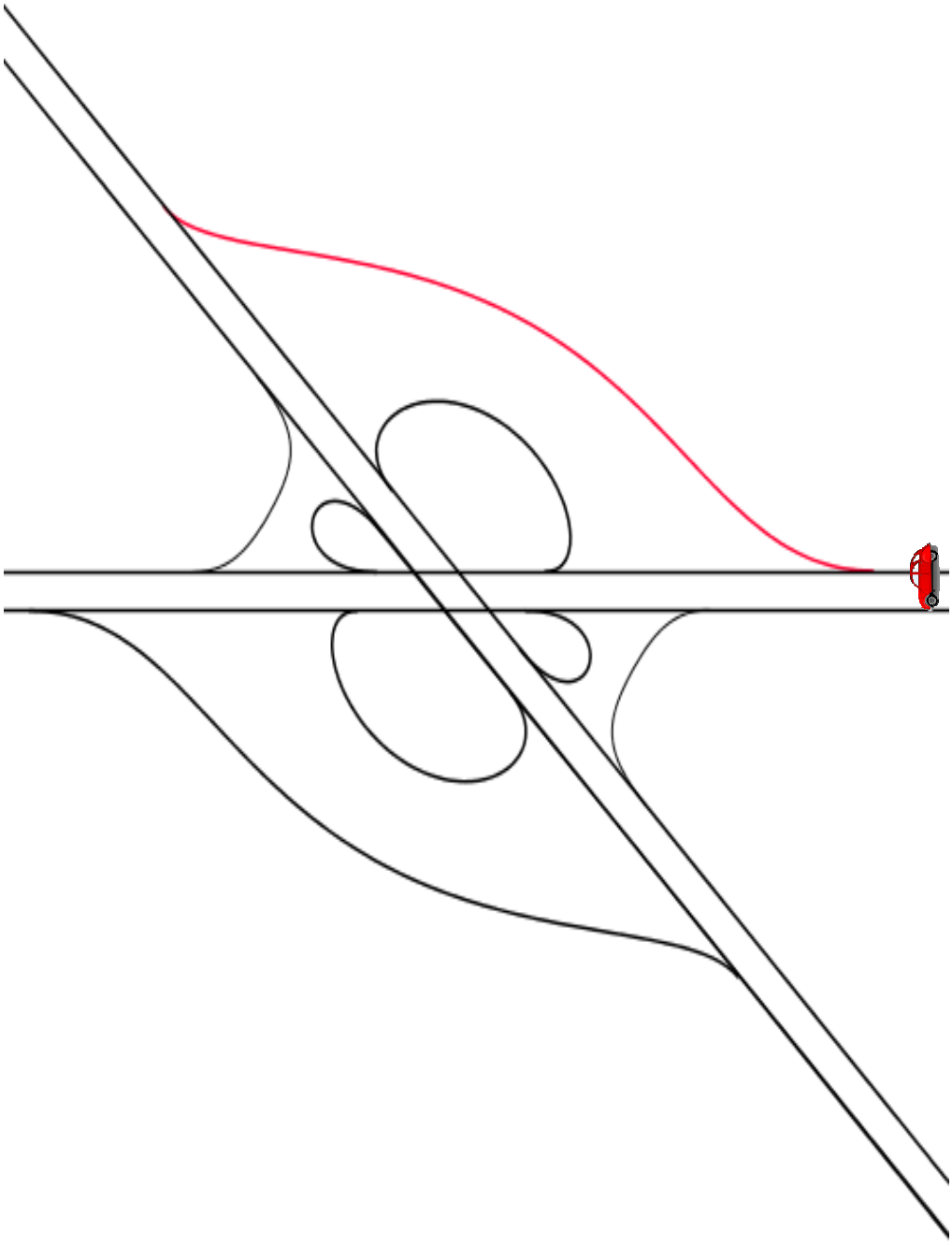
http://de.wikipedia.org/wiki/Autobahnkreuz#mediaviewer/File:Klaverblad_Hoevelaken.jpeg











$$y = -141.12\,t^2 - 38.28\,t + 66.18$$

$$g'_1:\quad \begin{cases} x = 0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \frac{201}{100}\right) - 0.71\left(-\frac{294}{25}t^4 - \frac{319}{50}t^3 + \frac{3309}{100}t^2 - 10\,t - \frac{56}{25} - 1.41\right) \\ y = -0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \frac{201}{100}\right) - 0.71\left(-\frac{294}{25}t^4 - \frac{319}{50}t^3 + \frac{3309}{100}t^2 - 10\,t - \frac{56}{25} - 1.41\right) + 1.41 \end{cases} \quad 0 \le t \le 1$$

$$g_1:\quad x = 0.71\left(-0.71\left(\frac{328}{25}t^4 - \frac{656}{25}t^3 + \frac{453}{25}t^2 + 0.83\right) + 0.71\left(\frac{586}{25}t^4 - \frac{2137}{50}t^3 + \frac{2723}{100}t^2 - 10\,t + \frac{907}{100}\right) + 1.17\right) - 0.71\left(0.71\left(\frac{328}{25}t^4 - \frac{656}{25}t^3 + \frac{453}{25}t^2 + 0\right.\right.$$

$$y = -0.71\left(-0.71\left(\frac{328}{25}t^4 - \frac{656}{25}t^3 + \frac{453}{25}t^2 + \right.\right.$$

$$h:\quad x = -9\,t^3 + 10\,t^2 + 2$$

$$y = 3.4\,t^3 - 13.6\,t^2 + 10\,t +$$

$$h':\quad x = -\left(-9\,t^3 + 10\,t^2 + 0.5\right)$$

$$y = 0\left(-9\,t^3 + 10\,t^2 + 0.5\right.$$

$$h'':\quad x = -\left(-9\,t^3 + 10\,t^2 + 0\right.$$

$$y = -\left(0\left(-9\,t^3 + 10\,t^2 -\right.\right.$$

$$h_1:\quad x = -0.71\left(0.71\left(\frac{224}{5}\right.\right.$$

$$y = 0.71\left(0.71\left(\frac{224}{5}t^4\right.\right.$$

$$i_1:\quad x = 0.71\left(-0.71\left(\frac{232}{25}t^4\right.\right.$$

$$y = -0.71\left(-0.71\left(\frac{232}{25}\right.\right.$$

$$x = -0.71\left(0.71\left(\frac{674}{25}t^4\right.\right.$$

$$x = -0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}\right.$$

$$y = 0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}t^2\right.$$

$$x = 0.71\left(\frac{224}{5}t^4 - \frac{2459}{25}t^3 + \frac{3147}{50}\right.$$

$$y = -0.71\left(\frac{224}{5}t^4 - \frac{2459}{25}t^3 + \frac{314}{50}\right.$$

$$x = 0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \right.$$

$$y = -0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \right.$$

$$= 0.71\left(-0.71\left(\frac{328}{25}t^4 - \frac{656}{25}t^3 + \frac{453}{25}\right.\right.$$

$$= -0.71\left(-0.71\left(\frac{328}{25}t^4 - \frac{656}{25}t^3 + \frac{45}{25}\right.\right.$$

$$- 10\,t^2 + 2$$

$$- 13.6\,t^2 + 10\,t + 3.2\Big\} \quad 0 \le t \le 1$$

$$t^3 + 10\,t^2 + 0.5) + 0\ (3.4\,t^3 - 13$$

$$^4 - \frac{656}{25}t^3 + \frac{453}{25}t^2 + 0.83\Big) + 0.71\ ($$

$$t^4 - \frac{656}{25}t^3 + \frac{453}{25}t^2 + 0.83\Big) + 0.71$$

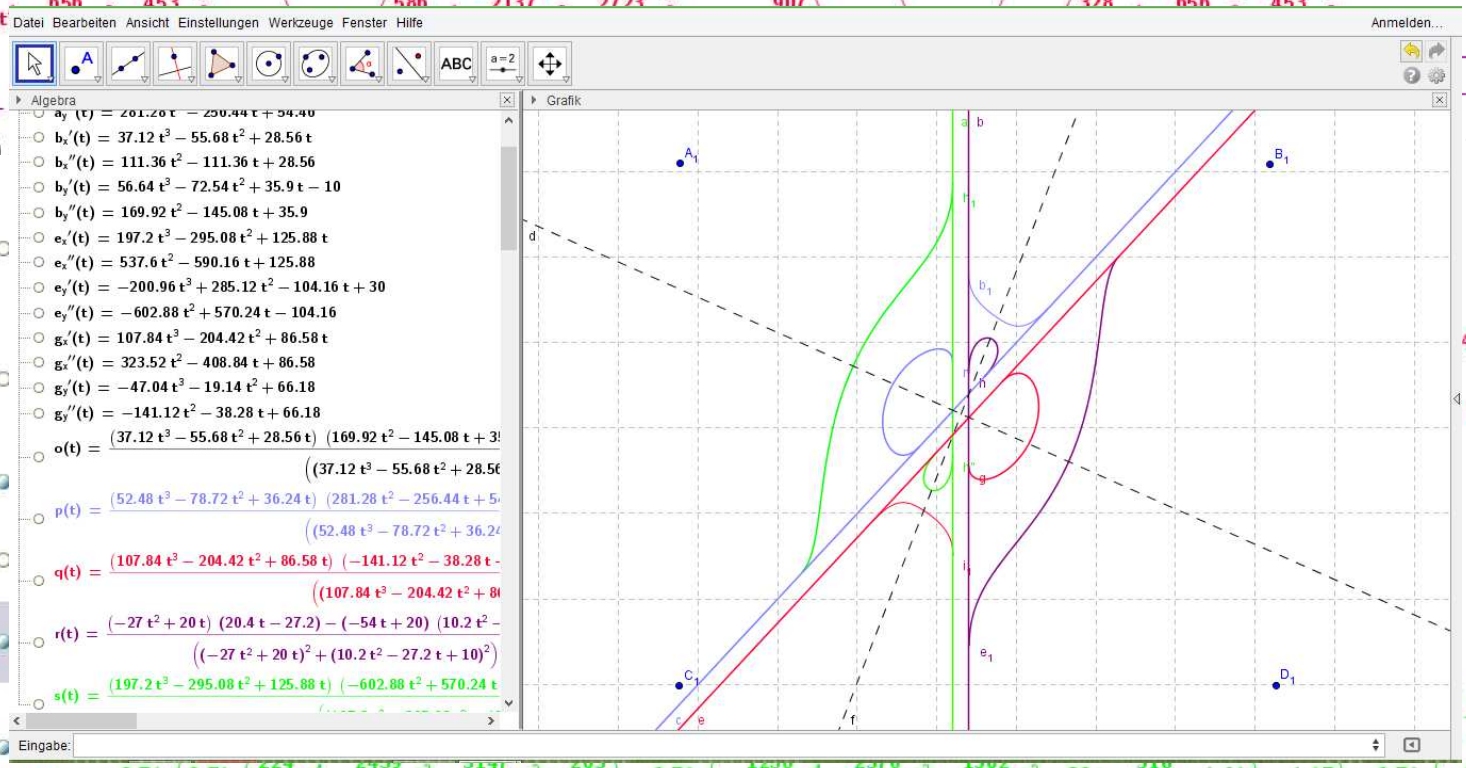
$$-0.71\left(\frac{224}{5}t^4 - \frac{2459}{25}t^3 + \frac{3147}{50}t^2\right.$$

$$y = 0.71\left(0.71\left(\frac{224}{5}t^4 - \frac{2459}{25}t^3 + \frac{3147}{50}t^2 + \frac{201}{100}\right) - 0.71\left(-\frac{1256}{25}t^4 + \frac{2376}{25}t^3 - \frac{1502}{25}t^2 + 30\,t - \frac{516}{25} - 1.41\right) - 1.17\right) + 0.71\left(-0.71\left(\frac{224}{5}t^4 - \frac{2459}{25}t^3 + \frac{3147}{50}t^2 +\right.\right.$$

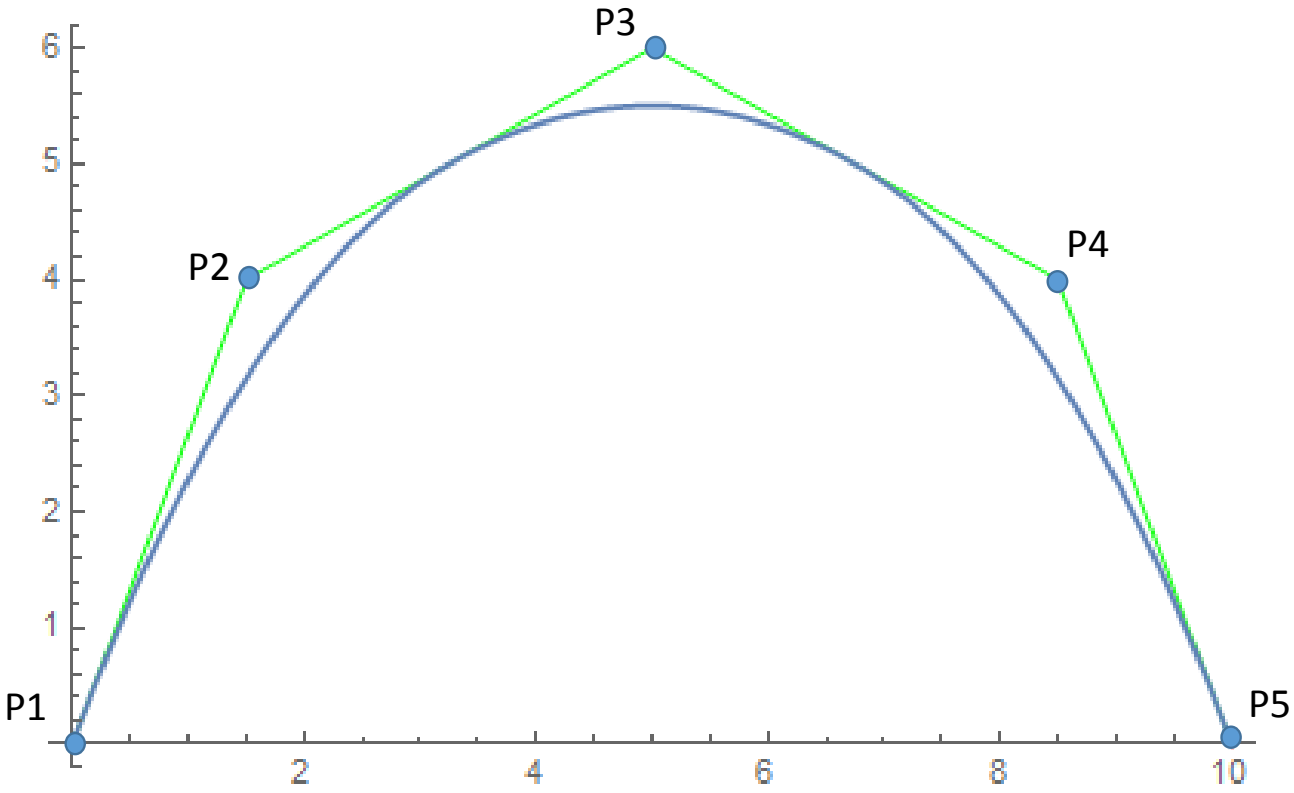
$$i_1:\quad x = 0.71\left(-0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}t^2 + 0.83\right) + 0.71\left(\frac{354}{25}t^4 - \frac{1209}{50}t^3 + \frac{359}{20}t^2 - 10\,t + \frac{907}{100}\right) + 1.17\right) - 0.71\left(0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}t^2 + 0.83\right) + 0.71\left(\frac{3}{2}\right.\right.$$

$$y = -0.71\left(-0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}t^2 + 0.83\right) + 0.71\left(\frac{354}{25}t^4 - \frac{1209}{50}t^3 + \frac{359}{20}t^2 - 10\,t + \frac{907}{100}\right) + 1.17\right) - 0.71\left(0.71\left(\frac{232}{25}t^4 - \frac{464}{25}t^3 + \frac{357}{25}t^2 + 0.83\right) + 0.71\left(\right.\right.$$

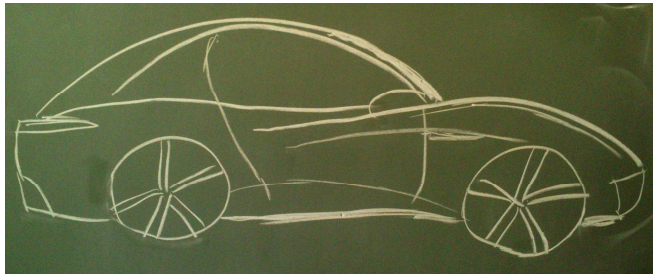
$$x = -0.71\left(0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \frac{201}{100}\right) - 0.71\left(-\frac{294}{25}t^4 - \frac{319}{50}t^3 + \frac{3309}{100}t^2 - 10\,t - \frac{56}{25} - 1.41\right) - 1.17\right) + 0.71\left(-0.71\left(\frac{674}{25}t^4 - \frac{3407}{50}t^3 + \frac{4329}{100}t^2 + \frac{20}{10}\right.\right.$$

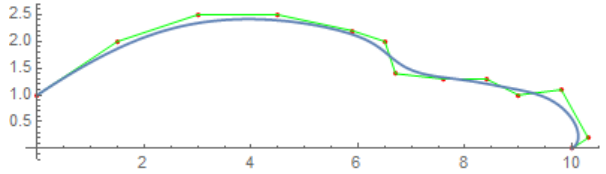


B-Spline-Kurven



Die französischen Autohersteller Renault und Citroën legen den Grundstein für die B-Spline-Kurven.

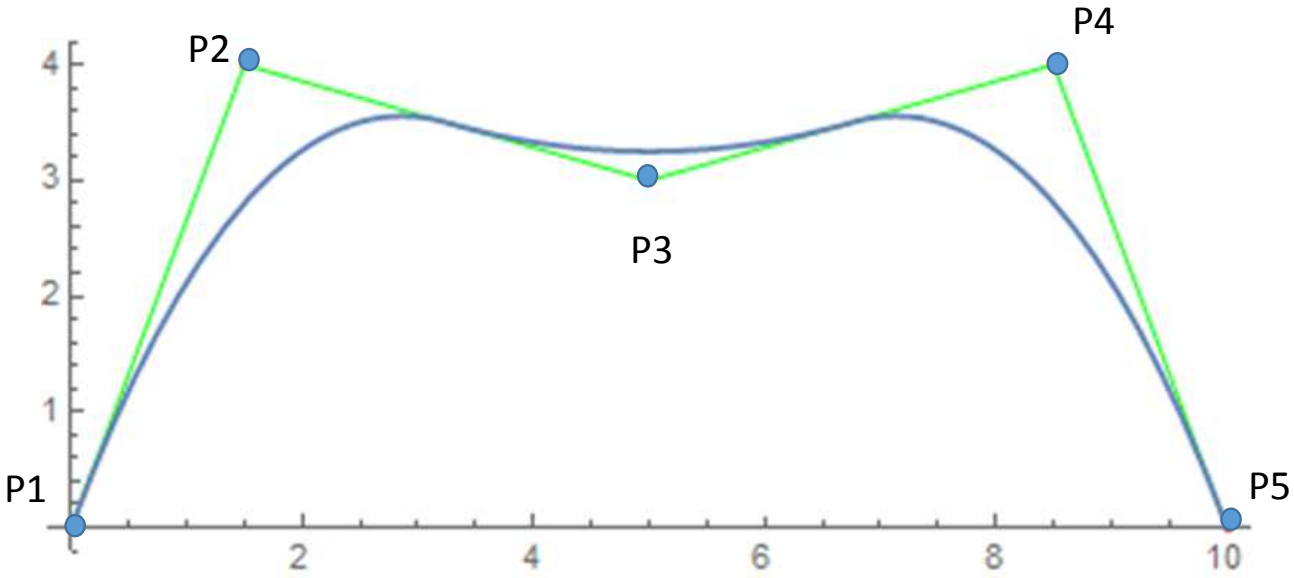


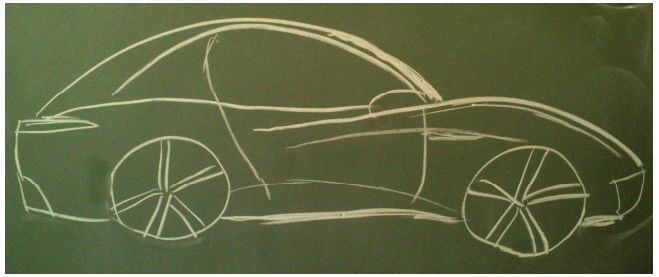


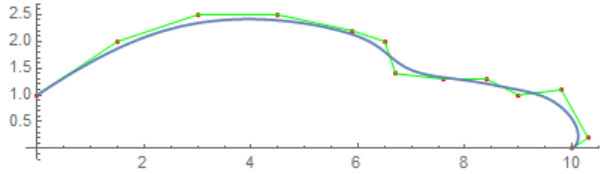
Kann Produktplatzierungen enthalten.

B-Spline-Kurven

Die französischen Autohersteller Renault und Citroën legen den Grundstein für die B-Spline-Kurven.



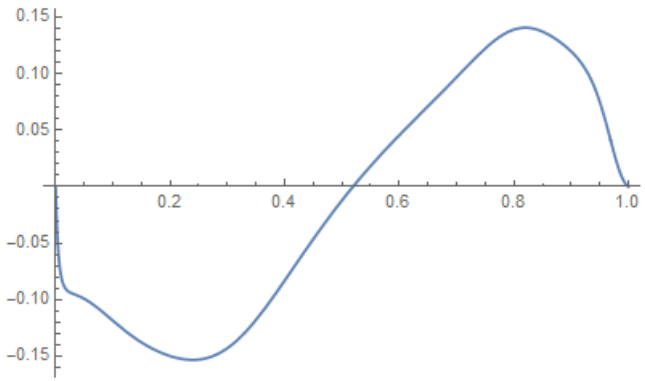
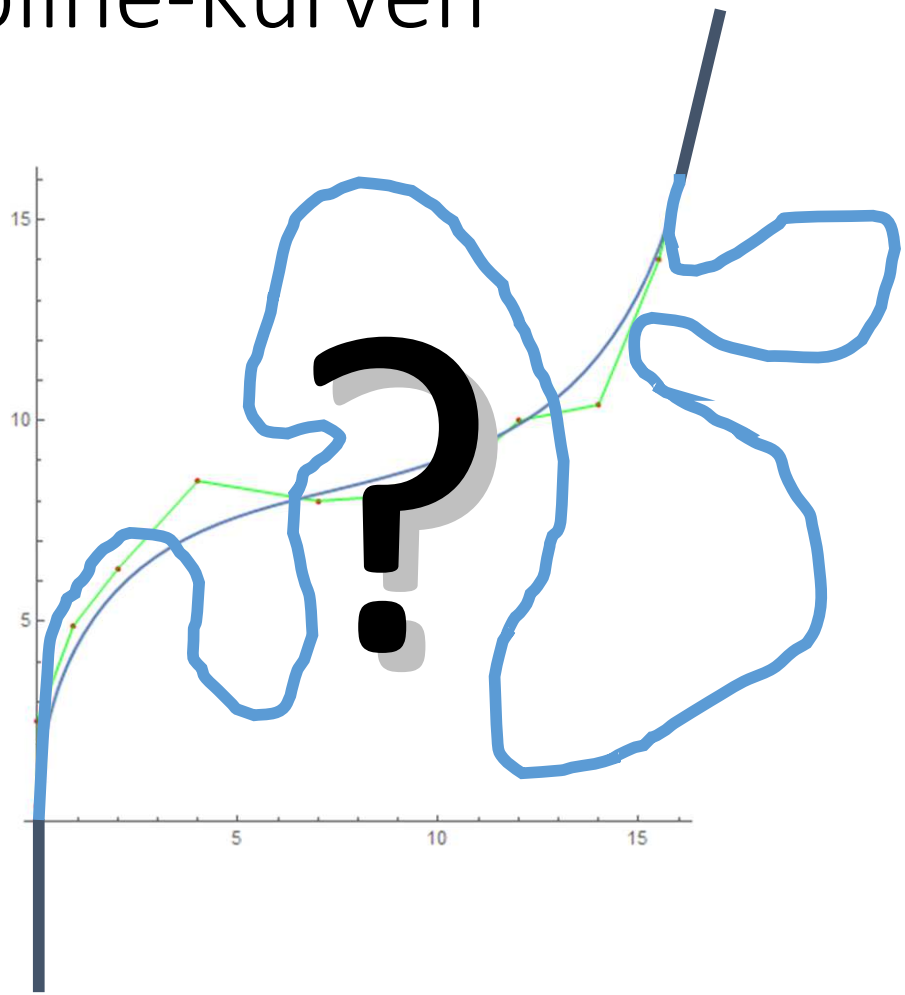




Kann Produktplatzierungen enthalten.

Anwendungen von B-Spline-Kurven

- Autoindustrie
- Straßenbau
- Industrielles Design



Krümmungsplot