

Bsp. 4.12: Euklidischer Algorithmus in $\mathbb{Q}[X]$

$$f = X^4 + 2X^3 - X^2 - 4X - 2$$
$$g = X^4 + X^3 - X^2 - 2X - 2$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

h

s

r

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$$X^4 + 2X^3 - X^2 - 4X - 2 \quad h$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

$$X^4 + 2X^3 - X^2 - 4X - 2 \quad = \quad 1 \quad \cdot \quad X^4 + X^3 - X^2 - 2X - 2 \quad + \quad X^3 - 2X$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

$$\frac{X^4 + 2X^3 - X^2 - 4X - 2}{X^4 + X^3 - X^2 - 2X - 2} = 1 \cdot \frac{X^4 + X^3 - X^2 - 2X - 2}{X^3 - 2X} + X^3 - 2X$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

$$\begin{array}{rcl} X^4 + 2X^3 - X^2 - 4X - 2 & = & \overset{h}{1} \cdot X^4 + X^3 - X^2 - 2X - 2 \\ X^4 + X^3 - X^2 - 2X - 2 & = & X + 1 \cdot X^3 - 2X + \overset{r}{X^3 - 2X} \\ & & + \overset{s}{X^2 - 2} \end{array}$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

$$\begin{array}{rcl} h & & \\ \begin{array}{c} X^4 + 2X^3 - X^2 - 4X - 2 \\ - (X^4 + X^3 - X^2 - 2X - 2) \\ \hline X^3 - 2X \end{array} & = & 1 \cdot \begin{array}{c} s \\ X^4 + X^3 - X^2 - 2X - 2 \\ - (X^3 - 2X) \\ \hline X^2 - 2 \end{array} \\ & = & X + 1 \cdot \begin{array}{c} r \\ X^3 - 2X \\ X^2 - 2 \end{array} \end{array}$$

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$$\begin{aligned}f &= X^4 + 2X^3 - X^2 - 4X - 2 \\g &= X^4 + X^3 - X^2 - 2X - 2\end{aligned}$$

$$\begin{array}{rclclclcl} & & h & & s & & r & & \\ X^4 + 2X^3 - X^2 - 4X - 2 & = & 1 & \cdot & X^4 + X^3 - X^2 - 2X - 2 & + & X^3 - 2X & & \\ X^4 + X^3 - X^2 - 2X - 2 & = & X + 1 & \cdot & X^3 - 2X & + & X^2 - 2 & & \\ X^3 - 2X & = & X & \cdot & X^2 - 2 & + & 0 & & \end{array}$$

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$$\begin{array}{rclclclcl} & & h & & s & & r & & \\ X^4 + 2X^3 - X^2 - 4X - 2 & = & 1 & \cdot & X^4 + X^3 - X^2 - 2X - 2 & + & X^3 - 2X & & \\ X^4 + X^3 - X^2 - 2X - 2 & = & X + 1 & \cdot & X^3 - 2X & + & X^2 - 2 & & \\ X^3 - 2X & = & X & \cdot & X^2 - 2 & + & 0 & & \\ X^2 - 2 & & & & 0 & & & & \end{array}$$

$$\text{ggT}(f, g) = X^2 - 2$$