

Bsp. 4.5: Divisionsalgorithmus in $\mathbb{Q}[X]$

$$r = \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad q$$

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$$r = \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad \overset{q}{3X^2}$$

Bsp. 4.5: Divisionsalgorithmus in $\mathbb{Q}[X]$

$$r = \overset{f}{3X^3 + 2X^2 + 3X} - \overset{g}{3X^2}(X + 1) \quad \overset{q}{X + 1}$$

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$$r = \begin{array}{r} \overset{f}{3X^3 + 2X^2 + 3X} \\ - 3X^2(X + 1) \\ \hline \end{array} \quad \begin{array}{r} \overset{g}{X + 1} \\ 3X^2 \\ \hline \end{array} \quad \overset{q}{3X^2}$$

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$$\begin{array}{r} \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad \overset{q}{3X^2} \\ \underline{-3X^2(X + 1)} \\ r = -X^2 + 3X \end{array}$$

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$$\begin{array}{r} \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad \overset{q}{3X^2} \\ - 3X^2(X + 1) \\ \hline r = -X^2 + 3X \end{array}$$

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$$\begin{array}{r} \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad \overset{q}{3X^2} \\ - 3X^2(X + 1) \\ \hline r = -X^2 + 3X \end{array}$$

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$$r = \frac{\overset{f}{3X^3 + 2X^2 + 3X} - \overset{g}{X+1} \cdot \overset{q}{3X^2 - X}}{-X^2 + 3X}$$

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$$r = \frac{\begin{array}{r} 3X^3 + 2X^2 + 3X \\ - 3X^2(X + 1) \\ \hline -X^2 + 3X \\ - (-X)(X + 1) \end{array}}{\begin{array}{r} X + 1 \\ 3X^2 - X \end{array}}$$

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$$\begin{array}{rcl} & f & g \\ & 3X^3 + 2X^2 + 3X & X + 1 \\ & \underline{-3X^2(X + 1)} & \\ r = & -X^2 + 3X & 3X^2 - X \\ & \underline{-(-X)(X + 1)} & \end{array}$$

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$$\begin{array}{r} \overset{f}{3X^3 + 2X^2 + 3X} \quad \overset{g}{X + 1} \quad \overset{q}{3X^2 - X} \\ \underline{-3X^2(X + 1)} \\ -X^2 + 3X \\ \underline{-(-X)(X + 1)} \\ 4X \end{array} \quad r =$$

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$$\begin{array}{r} f \\ g \\ q \\ 3X^3 + 2X^2 + 3X \\ \underline{-3X^2(X+1)} \\ -X^2 + 3X \\ \underline{-(-X)(X+1)} \\ 4X \end{array} \quad r =$$

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$$r = \frac{3X^3 + 2X^2 + 3X - 3X^2(X+1)}{-X^2 + 3X} = \frac{-(-X)(X+1)}{4X} = \frac{X+1}{4}$$

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$$\begin{array}{r} f \\ 3X^3 + 2X^2 + 3X \\ \underline{-3X^2(X + 1)} \\ -X^2 + 3X \\ \underline{-(-X)(X + 1)} \\ -4X \\ r = \end{array}$$

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$$\begin{array}{r} f \\ 3X^3 + 2X^2 + 3X \\ \underline{-3X^2(X + 1)} \\ -X^2 + 3X \\ \underline{-(-X)(X + 1)} \\ -4X \\ \underline{-4(X + 1)} \\ r = 4X + 4 \end{array}$$

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$$\begin{array}{r} \begin{array}{r} f \\ 3X^3 + 2X^2 + 3X \\ - 3X^2(X + 1) \\ \hline -X^2 + 3X \\ - (-X)(X + 1) \\ \hline 4X \\ - 4(X + 1) \\ \hline r \end{array} \end{array} \quad \begin{array}{r} g \\ X + 1 \end{array} \quad \begin{array}{r} q \\ 3X^2 - X + 4 \end{array}$$

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$$\begin{array}{r} f \\ X + 1 g \\ 3X^2 - X + 4 q \\ \underline{-3X^2(X + 1)} \\ -X^2 + 3X \\ \underline{-(-X)(X + 1)} \\ 4X \\ \underline{-4(X + 1)} \\ r = -4 \end{array}$$

Bsp. 4.5: Divisionsalgorithmus in $\mathbb{Q}[X]$

$$\begin{array}{r} f \\ 3X^3 + 2X^2 + 3X \\ \underline{-3X^2(X+1)} \\ -X^2 + 3X \\ \underline{-(-X)(X+1)} \\ 4X \\ \underline{-4(X+1)} \\ -4 \end{array} \quad \begin{array}{r} g \\ \textcolor{red}{X} + 1 \end{array} \quad \begin{array}{r} q \\ 3X^2 - X + 4 \end{array}$$

$r =$

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$$\begin{array}{r} f \\ X + 1 g \\ 3X^2 - X + 4 q \\ \underline{-3X^2(X + 1)} \\ -X^2 + 3X \\ \underline{-(-X)(X + 1)} \\ 4X \\ \underline{-4(X + 1)} \\ r = -4 \end{array}$$

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$$\begin{array}{r} \begin{array}{r} f \\ 3X^3 + 2X^2 + 3X \\ \underline{-3X^2(X+1)} \\ -X^2 + 3X \\ \underline{-(-X)(X+1)} \\ 4X \\ \underline{-4(X+1)} \\ -4 \end{array} \quad \begin{array}{r} g \\ X + 1 \end{array} \quad \begin{array}{r} q \\ 3X^2 - X + 4 \end{array} \\ r = \end{array}$$

$$3X^3 + 2X^2 + 3X = (3X^2 - X + 4)(X + 1) - 4$$