

**Exercise 13**

For the following exercises, use long division to divide. Specify the quotient and the remainder.

$$(2x^3 + 3x^2 - 4x + 15) \div (x + 3)$$

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**Solution**

Set up the division problem, writing out every term in the dividend.

$$x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15}$$

Divide the leading term of the dividend by the leading term of the divisor and place the result above the term with the same power of  $x$ .

$$x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15} \quad \begin{array}{r} 2x^2 \\ \hline \end{array}$$

Multiply this result by the divisor and subtract it from the dividend.

$$\begin{array}{r} 2x^2 \\ x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\ \underline{-(2x^3 + 6x^2)} \\ -3x^2 \end{array}$$

Bring the next term in the dividend down.

$$\begin{array}{r} 2x^2 \\ x+3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\ \underline{-(2x^3 + 6x^2)} \quad \downarrow \\ -3x^2 - 4x \end{array}$$

Divide the leading term of this modified dividend by the leading term of the divisor and place the result above the term with the same power of  $x$ .

$$\begin{array}{r} 2x^2 - 3x \\ x+3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\ \underline{-(2x^3 + 6x^2)} \\ -3x^2 - 4x \end{array}$$

Multiply this result by the divisor and subtract it from the modified dividend.

$$\begin{array}{r} 2x^2 - 3x \\ x+3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\ \underline{-(2x^3 + 6x^2)} \\ -3x^2 - 4x \\ \underline{-(-3x^2 - 9x)} \\ 5x \end{array}$$

Bring the next term in the dividend down.

$$\begin{array}{r}
 2x^2 - 3x \\
 x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\
 \underline{-(2x^3 + 6x^2)} \quad \downarrow \\
 -3x^2 - 4x \\
 \underline{-(-3x^2 - 9x)} \quad \downarrow \\
 5x + 15
 \end{array}$$

Divide the leading term of this modified dividend by the leading term of the divisor and place the result above the term with the same power of  $x$ .

$$\begin{array}{r}
 2x^2 - 3x + 5 \\
 x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\
 \underline{-(2x^3 + 6x^2)} \\
 -3x^2 - 4x \\
 \underline{-(-3x^2 - 9x)} \\
 5x + 15
 \end{array}$$

Multiply this result by the divisor and subtract it from the modified dividend.

$$\begin{array}{r}
 2x^2 - 3x + 5 \\
 x + 3 \overline{) 2x^3 + 3x^2 - 4x + 15} \\
 \underline{-(2x^3 + 6x^2)} \\
 -3x^2 - 4x \\
 \underline{-(-3x^2 - 9x)} \\
 5x + 15 \\
 \underline{-(5x + 15)} \\
 0
 \end{array}$$

There are no further terms in the dividend to drop down, so the division is complete. The quotient is  $2x^2 - 3x + 5$ , and the remainder is 0.

$$(2x^3 + 3x^2 - 4x + 15) \div (x + 3) = 2x^2 - 3x + 5$$