Exercise 5

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

$$(3x^2 + 23x + 14) \div (x + 7)$$

Solution

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

$$x + 7 \overline{)3\,x^2 + 23\,x + 14}$$

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.

$$\begin{array}{r} 3\,x \\ x + 7 \overline{)3\,x^2 + 23\,x + 14} \end{array}$$

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

$$\begin{array}{r} 3\,x \\ x + 7 \overline{)3\,x^2 + 23\,x + 14} \\ -\left(3\,x^2 + 21\,x\right) \\ \hline 2\,x \end{array}$$

Bring the next term in the dividend down.

$$
\begin{array}{r}
3\,x \\
x+7\,\overline{)\,3\,x^2+23\,x+14} \\
-\left(3\,x^2+21\,x\right) \downarrow \\
\hline
2\,x+14
\end{array}
$$

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.

$$
\begin{array}{r}
3\,x+2 \\
x+7\,\overline{)\,3\,x^2+23\,x+14} \\
-\left(3\,x^2+21\,x\right) \\
\hline
2\,x+14
\end{array}
$$

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

$$
\begin{array}{r}
3\,x+2 \\
x+7\,\overline{)\,3\,x^2+23\,x+14} \\
-\left(3\,x^2+21\,x\right) \\
\hline
2\,x+14 \\
-(2\,x+14) \\
\hline
0
\end{array}
$$

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

$$
(3x^2+23x+14) \div (x+7) = 3x+2
$$