Exercise 11

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

$$(3x^2 - 5x + 4) \div (3x + 1)$$

Solution

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

$$3\,x + 1 \,\overline{\smash{)}\,3\,x^2 - 5\,x + 4}$$

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.

$$\begin{array}{r} x \\ 3\,x + 1 \,\overline{\smash{)}\,3\,x^2 - 5\,x + 4} \end{array}$$

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

$$\begin{array}{r} x \\ 3\,x + 1 \,\overline{\smash{)}\,3\,x^2 - 5\,x + 4} \\ -\left(3\,x^2 + x\right) \\ \hline -6\,x \end{array}$$

Bring the next term in the dividend down.

$$
\begin{array}{r}
x \\
3\,x+1\,\overline{)\,3\,x^2-5\,x+4} \\
-\left(3\,x^2+x\right)\Big\downarrow \\
\hline
-6\,x+4
\end{array}
$$

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.

$$
\begin{array}{r}
x-2 \\
3\,x+1\,\overline{)\,3\,x^2-5\,x+4} \\
-\left(3\,x^2+x\right) \\
\hline
-6\,x+4
\end{array}
$$

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

$$
\begin{array}{r}
x-2 \\
3\,x+1\,\overline{)\,3\,x^2-5\,x+4} \\
-\left(3\,x^2+x\right) \\
\hline
-6\,x+4 \\
-(-6\,x-2) \\
\hline
6
\end{array}
$$

There are no further terms in the dividend to drop down, so the division is complete. The quotient is $x-2$, and the remainder is 6.

$$
(3x^2-5x+4)\div(3x+1)=x-2+\frac{6}{3x+1}
$$