

Exercise 19

For the following exercises, use synthetic division to find the quotient.

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

Solution

Solving $x + 3 = 0$ gives $x = -3$; this is the number that goes on the top left. Write out all the coefficients of the dividend to the right.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & & & & \end{array}$$

Bring down the leading coefficient.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & 3 & & & \end{array}$$

Multiply the top left number by the number brought down and put the result under the second coefficient of the dividend.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & 3 & -9 & & \end{array}$$

Add the numbers in the second column.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & & -9 & & \\ \hline & 3 & -11 & & \end{array}$$

Multiply this sum of the second column by the top left number and put it in the next column.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & & -9 & 33 & \\ \hline & 3 & -11 & & \end{array}$$

Add the numbers in the third column.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ \hline & & -9 & 33 & \\ \hline & 3 & -11 & 34 & \end{array}$$

Multiply this sum of the third column by the top left number and put it in the next column.

$$\begin{array}{r|rrrr} -3 & 3 & -2 & 1 & -4 \\ & & -9 & 33 & -102 \\ \hline & 3 & -11 & 34 & \end{array}$$

Add the numbers in the fourth column.

$$\begin{array}{r|rrrr|r} -3 & 3 & -2 & 1 & -4 & \\ & & -9 & 33 & -102 & \\ \hline & 3 & -11 & 34 & -106 & \end{array}$$

This final result is the remainder, and the numbers to the left are the coefficients of the quotient, which is $3x^2 - 11x + 34$.

$$(3x^3 - 2x^2 + x - 4) \div (x + 3) = 3x^2 - 11x + 34 + \frac{-106}{x + 3}$$