

Exercise 26

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

$$(x^3 - 15x^2 + 75x - 125) \div (x - 5)$$

Solution

Solving $x - 5 = 0$ gives $x = 5$; this is the number that goes on the top left. Write out all the coefficients of the dividend to the right.

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & & & & \end{array}$$

Bring down the leading coefficient.

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & 1 & & & \end{array}$$

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

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & 1 & 5 & & \end{array}$$

Add the numbers in the second column.

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & & 5 & & \\ \hline & 1 & -10 & & \end{array}$$

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

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & & 5 & -50 & \\ \hline & 1 & -10 & & \end{array}$$

Add the numbers in the third column.

$$\begin{array}{r|rrrr} 5 & 1 & -15 & 75 & -125 \\ \hline & & 5 & -50 & \\ \hline & 1 & -10 & 25 & \end{array}$$

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

$$\begin{array}{r|rrrr}
 5 & 1 & -15 & 75 & -125 \\
 & & 5 & -50 & 125 \\
 \hline
 & 1 & -10 & 25 &
 \end{array}$$

Add the numbers in the fourth column.

$$\begin{array}{r|rrrr|r}
 5 & 1 & -15 & 75 & -125 \\
 & & 5 & -50 & 125 \\
 \hline
 & 1 & -10 & 25 & 0
 \end{array}$$

This final result is the remainder, and the numbers to the left are the coefficients of the quotient, which is $x^2 - 10x + 25$.

$$(x^3 - 15x^2 + 75x - 125) \div (x - 5) = x^2 - 10x + 25$$