

EXAMPLE OF SYNTHETIC DIVISION, STEP BY STEP

The problem $(4x^3 - 7x^2 - 3x + 5) \div (x - 3)$ is set up at the right for long division. $x - 3$ is the divisor, and $4x^3 - 7x^2 - 3x + 5$ is the dividend.

Synthetic division setup. Note positive 3 in box.

Repeat 4, the leading coefficient of the dividend, two lines down.

Multiply the leading coefficient of the dividend by the number in the box, 3, placing the product, 12, under -7, the next coefficient of the dividend.

Add the product to the coefficient above, using rules for adding signed numbers. Place the sum, 5, on the third line.

Repeat, multiplying the new number on row three by the number in the box, and placing the product, 15, in row two, in the next spot available.

Add the new product to the coefficient above.

Multiply the new number in row three by the number in the box, placing the product, 36, in row two.

Add. This is the last column, so the sum, 41, is the remainder. The other numbers in row three are the coefficients of the polynomial part of the quotient.

$$\begin{array}{r|rrrr}
 x - 3 & 4x^3 & -7x^2 & -3x & +5 \\
 \\
 \hline
 3 & 4 & -7 & -3 & 5 \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & \downarrow & & \\
 & & 4 & & \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & 12 & & \\
 & & 4 & & \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & 12 & & \\
 & & 4 & 5 & \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & 12 & 15 & \\
 & & 4 & 5 & 12 \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & 12 & 15 & 36 \\
 & & 4 & 5 & 12 \\
 \\
 3 & 4 & -7 & -3 & 5 \\
 & & 12 & 15 & 36 \\
 \hline
 & 4 & 5 & 12 & 41
 \end{array}$$

The quotient is $4x^2 + 5x + 12 + \frac{41}{x-3}$

Check: $(x - 3)(4x^2 + 5x + 12) + 41 = \dots = 4x^3 - 7x^2 - 3x + 5$

A quick, but incomplete, check, is to substitute 3 into the dividend. The result must equal the

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remainder. Let $x = 3$. Then $4x^3 - 7x^2 - 3x + 5 = 4(3)^3 - 7(3)^2 - 3(3) + 5 = 41$