

Dividing Polynomials (Long Division)

Divide using Long Division:

$$\begin{array}{r}
 1046 \\
 9 \overline{) 9421} \\
 \underline{-9} \\
 4 \\
 \underline{-0} \\
 42 \\
 \underline{-36} \\
 6
 \end{array}$$

1046 R. 7

quotient $\rightarrow 5$
 divisor $\rightarrow 3 \overline{) 16}$
 dividend $\nearrow 15$
 remainder $\rightarrow 1$

Now let's do the same thing, but with polynomials.

Step 1: Rewrite the dividend in standard form, filling in any gaps in the exponent order with a coefficient of 0 followed by the missing variable (if needed).

Step 2: Rewrite the divisor in standard form, filling in any gaps in the exponent order with a coefficient of 0 followed by the missing variable (if needed).

Step 3: Divide the first term of the dividend by the first term of the divisor. This creates your quotient. Multiply through.

Step 4: Drop down the next term in the dividend. SUBTRACT like terms. Signs will always change!

Step 5: Repeat Steps 3 and 4 until you cannot divide any further.

Step 6: Whatever is left over is called your remainder. You write the answer as the quotient from the top plus remainder over divisor.

Step 7: If your remainder is 0, then the quotient at the top is your final answer.

Divide by using long division.

1. $x-2 \overline{) 6x^3 - 19x^2 + 16x - 4}$

$$\begin{array}{r}
 6x^2 - 7x + 2 \\
 x-2 \overline{) 6x^3 - 19x^2 + 16x - 4} \\
 \underline{-6x^3 + 12x^2} \\
 -7x^2 + 16x \\
 \underline{+7x^2 + 14x} \\
 2x - 4 \\
 \underline{-2x + 4} \\
 0
 \end{array}$$

$6x^2 - 7x + 2$

3. $(x^2 + 5x - 28) \div (x - 3)$

$$\begin{aligned}
 \frac{6x^3}{x} &= 6x^2 \\
 \frac{-7x^2}{x} &= -7x \\
 \frac{2x}{x} &= 2
 \end{aligned}$$

2. $(15x^2 + 8x - 12) \div (3x + 1)$

$$\begin{array}{r}
 5x + 1 \\
 3x + 1 \overline{) 15x^2 + 8x - 12} \\
 \underline{-15x^2 + 5x} \\
 3x - 12 \\
 \underline{-3x + 1} \\
 -13
 \end{array}$$

$5x + 1 - \frac{13}{3x + 1}$

4. $(-y^2 + 2y^3 + 25) \div (y - 3)$

$$(2y^3 - y^2 + 0y + 25) \div (y - 3)$$

$$\begin{array}{r}
 2y^2 + 5y + 15 \\
 y-3 \overline{) 2y^3 - y^2 + 0y + 25} \\
 \underline{-2y^3 + 6y^2} \\
 5y^2 + 0y \\
 \underline{-5y^2 + 15y} \\
 15y + 25 \\
 \underline{-15y + 45} \\
 70
 \end{array}$$

$2y^2 + 5y + 15 + \frac{70}{y-3}$