Long Division of Polynomials

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$x^2 - 2\overline{\big)\quad 2x^3 - 3x^2 + 5x + 1}$$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$x^2 - 2\overline{\big)\quad 2x^3 - 3x^2 + 5x + 1}$$

First we divide the lead terms:

$\frac{2x^3}{x^2} = 2x$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{r|l} & 2x \\ \cline{2-2} x^2 - 2) & 2x^3 - 3x^2 + 5x + 1 \end{array}$$

First we divide the lead terms:
$\frac{2x^3}{x^2} = 2x$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3-3x^2+5x+1}{x^2-2}$

$$\begin{array}{r} 2x\phantom{{}+5x+1} \\ x^2-2\overline{)\;2x^3-3x^2+5x+1} \end{array}$$

First we divide the lead terms: $\frac{2x^3}{x^2}=2x$

Next we multiply $2x\cdot(x^2-2)$ and subtract

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials
We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3-3x^2+5x+1}{x^2-2}$

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

First we divide the lead terms:
$\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2-2)$ and subtract

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{r l}
 & \qquad\qquad\qquad\quad 2x \\ \cline{2-2}
x^2 - 2 \,\big) & 2x^3 - 3x^2 + 5x + 1 \\
 & \underline{-2x^3 \qquad\quad + 4x} \\
 & \qquad\; -3x^2 + 9x + 1
\end{array}$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{r r}
 & 2x \\ \cline{2-2}
x^2 - 2 \big) & 2x^3 - 3x^2 + 5x + 1 \\
 & \underline{-\,2x^3 \qquad\quad + 4x\phantom{{}+1}} \\
 & -\,3x^2 + 9x + 1
\end{array}$$

First we divide the lead terms:

$\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{rl} & \phantom{2x^3 - 3x^2 + {}} 2x \\ x^2 - 2 \, \big) & \overline{\; 2x^3 - 3x^2 + 5x + 1} \\ & \underline{-\, 2x^3 \qquad\quad + 4x} \\ & \qquad -\, 3x^2 + 9x + 1 \end{array}$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$
\begin{array}{rr}
 & 2x \phantom{{} + 1} \\ \cline{2-2}
x^2 - 2 \big) & 2x^3 - 3x^2 + 5x + 1 \\
 & \underline{-2x^3 \qquad\qquad + 4x} \phantom{{} + 1} \\
 & -3x^2 + 9x + 1
\end{array}
$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms: $\frac{-3x^2}{x^2} = -3$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{rl} & \phantom{2x^3 - 3x^2 + {}}2x - 3 \\ x^2 - 2 \,\big) & \overline{\;2x^3 - 3x^2 + 5x + 1} \\ & \underline{-2x^3 \qquad\quad + 4x\phantom{{}+1}} \\ & -3x^2 + 9x + 1 \end{array}$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms: $\frac{-3x^2}{x^2} = -3$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials
We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$
\begin{array}{rr}
 & 2x - 3 \\
x^2 - 2 \big) & \overline{2x^3 - 3x^2 + 5x + 1} \\
 & \underline{-2x^3 \qquad\quad + 4x \quad\;\;} \\
 & -3x^2 + 9x + 1 \\
 & \underline{3x^2 \qquad\quad - 6}
\end{array}
$$

First we divide the lead terms:
$\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms:
$\frac{-3x^2}{x^2} = -3$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$\begin{array}{rr}
 & 2x - 3 \\ \cline{2-2}
x^2 - 2\,\big) & 2x^3 - 3x^2 + 5x + 1 \\
 & \underline{-\,2x^3 \qquad\quad + 4x} \\
 & -\,3x^2 + 9x + 1 \\
 & \underline{3x^2 \qquad\quad - 6} \\
 & 9x - 5
\end{array}$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms: $\frac{-3x^2}{x^2} = -3$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3 - 3x^2 + 5x + 1}{x^2 - 2}$

$$
\begin{array}{rrrrr}
 & & & 2x & -\,3\\ \cline{2-5}
x^2-2) & 2x^3 & -\,3x^2 & +\,5x & +\,1\\
 & -\,2x^3 & & +\,4x & \\ \cline{2-4}
 & & -\,3x^2 & +\,9x & +\,1\\
 & & 3x^2 & & -\,6\\ \cline{3-5}
 & & & 9x & -\,5
\end{array}
$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2 - 2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms: $\frac{-3x^2}{x^2} = -3$

Once the degree of what is being divided is smaller than the degree we are dividing by, the process is complete:

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3-3x^2+5x+1}{x^2-2}$

$$
\begin{array}{rrrrr}
 & & & 2x & -\,3 \\ \cline{2-5}
x^2-2\big) & 2x^3 & -\,3x^2 & +\,5x & +\,1 \\
 & -\,2x^3 & & +\,4x & \\ \cline{2-4}
 & & -\,3x^2 & +\,9x & +\,1 \\
 & & 3x^2 & & -\,6 \\ \cline{3-5}
 & & & 9x & -\,5
\end{array}
$$

First we divide the lead terms:
$\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2-2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms:
$\frac{-3x^2}{x^2} = -3$

Once the degree of what is being divided is smaller than the degree we are dividing by, the process is complete:

Conclusion: $\dfrac{2x^3-3x^2+5x+1}{x^2-2} = 2x-3+\dfrac{9x-5}{x^2-2}$

Long Division of Polynomials

Now that we have seen how to ▸ Add and Subtract and ▸ Multiply Polynomials, we will look at an example of Dividing Polynomials

We will follow a similar algorithm as Long Division of numbers

Example 1: Simplify $\dfrac{2x^3-3x^2+5x+1}{x^2-2}$

$$
\begin{array}{rrrrr}
 & & & 2x & -\,3 \\ \cline{2-5}
x^2-2\big) & 2x^3 & -\,3x^2 & +\,5x & +\,1 \\
 & -\,2x^3 & & +\,4x & \\ \cline{2-4}
 & & -\,3x^2 & +\,9x & +\,1 \\
 & & 3x^2 & & -\,6 \\ \cline{3-5}
 & & & 9x & -\,5
\end{array}
$$

First we divide the lead terms: $\frac{2x^3}{x^2} = 2x$

Next we multiply $2x \cdot (x^2-2)$ and subtract

Now we have a lower degree

Now we repeat this process.

Dividing the new lead terms: $\frac{-3x^2}{x^2} = -3$

Once the degree of what is being divided is smaller than the degree we are dividing by, the process is complete:

Conclusion: $\dfrac{2x^3-3x^2+5x+1}{x^2-2} = 2x-3+\dfrac{9x-5}{x^2-2}$

Note: $2x-3$ is called the Quotient and $9x-5$ the Remainder