Math Virtual Learning

Algebra 2A
Polynomial Synthetic Division

April 20, 2020

Lesson:
Polynomial Synthetic Division

Learning Target:
LT D2 I can perform polynomial division (long and synthetic) and apply the remainder theorem.

Objective:

Students will be able to divide polynomials using synthetic division.

Warm Up

For today's warm up, try the practice problems below:

$$f(x) = 2x^2 - 5$$

$$g(x) = x^3 + 4x^2 + 12$$

1. $(g - f)(x)$

2. $(fg)(x)$

3. $(f + g)(x)$

Warm Up Answers

1. $(g - f)(x) = x^3 + 2x^2 + 17$

2. $(fg)(x) = 2x^5 + 8x^4 - 5x^3 + 4x^2 - 60$

3. $(f + g)(x) = x^3 + 6x^2 + 7$

Lesson

If you do not remember how to use synthetic division, please review the following videos:

Intro to Synthetic Division

How To Do Synthetic Division

Lesson

For today, we will be practicing our synthetic division when our box number is a fraction. Please watch the video below:

[Dividing two polynomials using synthetic division](#)

Practice

Try these four problems listed below.

$(x^4 - 2x^3 - 3x^2 - 6x + 8) \div (x - 3)$

$(x^4 + 2x^3 - 4x^2 - 6x - 4) \div (2x - 4)$

$(4x^4 - 5x^2 - 6x + 1) \div (2x - 1)$

$(4x^4 - x^3 - 17x + 10) \div (2x + 6)$

$$(x^4 - 2x^3 - 3x^2 - 6x + 8) \div (x - 3)$$

Work

$x - 3 = 0$

$x = 3$ → 3 | 1   -2   -3   -6   8

multiply   3   3   0   -18

1   1   0   -6   (-10) remainder

↑ means 0x

Answer: $x^3 + x^2 - 6 + \dfrac{-10}{x-3}$

$$(x^4 + 2x^3 - 4x^2 - 6x - 4) \div (2x - 4)$$

$2x - 4 = 0$

$2x = 4$

$x = 2$

$$\begin{array}{r|rrrrr} 2 & 1 & 2 & -4 & -6 & -4 \\ & \downarrow & 2 & 8 & 8 & 4 \\ \hline & 1 & 4 & 4 & 2 & 0 \end{array}$$

(+)

multiply

← remainder

Answer: $x^3 + 4x^2 + 4x + 2$

$$(4x^4 - 5x^2 - 6x + 1) \div (2x - 1)$$

this needs to be a coeffient of 1.

$$\frac{(4x^4 - 5x^2 - 6x + 1) \div 2}{(2x - 1) \div 2} = \frac{2x^4 - \frac{5}{2}x^2 - 3x + \frac{1}{2}}{x - \frac{1}{2}}$$

$$\frac{1}{2} \rfloor \quad 2 \quad 0 \quad \frac{-5}{2} \quad -3 \quad \frac{1}{2}$$

$$\quad\quad\quad 1 \quad \frac{1}{2} \quad -1 \quad -2$$

$$\quad\quad 2 \quad 1 \quad -2 \quad -4 \quad \frac{-3}{2} \leftarrow \text{remaindr}$$

Answer: $2x^3 + x^2 - 2x - 4 + \dfrac{\frac{-3}{2}}{x - \frac{1}{2}}$ ← multiply by 2

← multiply by 2

$$\boxed{2x^3 + x^2 - 2x - 4 + \frac{-3}{2x - 1}}$$

$$(4x^4 - x^3 - 17x + 10) \div (2x + 6)$$

$$\frac{(4x^4 - x^3 - 17x + 10) \div 2}{(2x + 6) \div 2} \Rightarrow \frac{2x^4 - \frac{1}{2}x^3 - \frac{17}{2}x + 5}{x + 3}$$

$$
\begin{array}{r|rrrrr}
-3] & 2 & -\frac{1}{2} & 0 & \frac{-17}{2} & 5 \\
   &   & -6 & \frac{39}{2} & -\frac{117}{2} & 201 \\
\hline
   & 2 & \frac{-13}{2} & \frac{39}{2} & -67 & 206 \\
\end{array}
$$

$$2x^3 - \frac{13}{2}x^2 + \frac{39}{2}x - 67 + \frac{206}{x-3} \quad \text{✦ multpy by 2}$$

$$\boxed{\text{Answer: } 2x^3 - \frac{13}{2}x^2 + \frac{39}{2}x - 67 + \frac{412}{2x+6}}$$

Answers to Practice Problems

$x^3 + x^2 - 6 - 10/(x-3)$

$x^3 + 4x^2 + 4x + 2$

$2x^3 + x^2 - 2x - 4 - 3/(2x-1)$

$2x^3 - \dfrac{13}{2}x^2 + \dfrac{39}{2}x - 67 + \dfrac{412}{2x+6}$

Additional Resources

[College Algebra Tutorial 37: Synthetic Division and the Remainder and Factor Theorems](#)

Additional Practice

[EXAMPLES - Dividing Polynomials using LONG or SYNTHETIC DIVISION](#)