Section 1 – Topic 3
Using Division to Rewrite Rational Expressions

We know that $\frac{294}{7} = 42$. What is another way of writing the equation?

$7 \cdot 42 = 294$ $\quad \frac{294}{42} = 7$

Consider the following equation.

$$2x^2 - x - 10 = (2x - 5)(x + 2)$$

How can the equation be rewritten as a rational equation?

$\frac{2x^2-x-10}{2x-5} = x+2$ or $\frac{2x^2-x-10}{x+2} = 2x-5$

Oct 2-7:14 AM

We can use long division to divide polynomial functions and rewrite rational expressions.

Use long division to evaluate $294 \div 7$.

$$\begin{array}{r} 42 \\ 7\overline{)294} \\ -28 \\ \hline 14 \\ 14 \\ \hline 0 \end{array}$$

Similarly, we can divide polynomial functions.

Find the quotient, $q(x)$, of $a(x)$ and $b(x)$.

$a(x) = 2x^2 - x - 10$
$b(x) = x + 2$

$$\begin{array}{r} 2x - 5 \\ x+2\overline{)2x^2 - x - 10} \\ (-)\,2x^2 + 4x \\ \hline -5x - 18 \\ (-)\,-5x - 10 \\ \hline 0 \end{array}$$

$q(x) = \frac{2x^2 - x - 10}{x+2} = 2x - 5$

Oct 2-7:19 AM

What happens in long division when we have a remainder?

$\frac{295}{7}$

$$\begin{array}{r} 42 \\ 7\overline{)295} \\ 28 \\ \hline 15 \\ 14 \\ \hline 1 \end{array}$$

$42\frac{1}{7}$

We follow this same method when dividing polynomial functions.

Find $f(x) \div g(x)$. $= 7x^2 - 12x + 50 - \frac{201}{x+4}$

$f(x) = 7x^3 + 16x^2 + 2x - 1$

$g(x) = x + 4$

$$\begin{array}{r} 7x^2 - 12x + 50 \\ x+4\overline{)7x^3 + 16x^2 + 2x - 1} \\ (-)\,\cancel{7x^3} + 28x^2 \\ \hline -\cancel{12x^2} + 2x \\ (-)\,-\cancel{12x^2} - 48x \\ \hline 50x - 1 \\ (-)\,50x + 200 \\ \hline -201 \end{array}$$

Oct 2-7:20 AM

Let's Practice!

1. Find the quotient of the functions below.

$$i(x) = 2x^3 - x^2 - 13x + 1$$

$$j(x) = x^2 + 3x - 5$$

$i(x) \div j(x) =$ $\boxed{2x - 7 + \frac{18x-34}{x^2+3x-5}}$

$$\begin{array}{r} x^2+3x-5\overline{)\cancel{2x^3} - x^2 - 13x + 1} \\ (-)\,\cancel{2x^3} + 6x^2 - 10x \\ \hline -\cancel{7x^2} - 3x + 1 \\ (-)\,-\cancel{7x^2} - 21x + 35 \\ \hline 18x - 34 \end{array}$$

Oct 2-7:32 AM

Try It!

2. Two polynomial functions are given.

$$m(x) = 6x^5 - 5x^4 + x^3 - 2x^2 - 4x + 3$$

$$n(x) = x^2 - 1$$

Find $m(x) \div n(x)$.

$744 \div 7$

$$\begin{array}{r} 1 \\ 7\overline{)744} \\ -7 \\ \hline 04 \end{array}$$

$6x^3 - 5x^2 + 7x - 7 + \frac{3x-4}{x^2-1}$

$$\begin{array}{r} x^2+0x-1\overline{)\cancel{6x^5} - 5x^4 + x^3 - 2x^2 - 4x + 3} \\ (-)\,\cancel{6x^5} + 0x^4 - 6x^3 \\ \hline -\cancel{5x^4} + 7x^3 - 2x^2 \\ (-)\,-\cancel{5x^4} + 0x^3 + 5x^2 \\ \hline \cancel{7x^3} - 7x^2 - 4x \\ (-)\,\cancel{7x^3} + 0x^2 - 7x \\ \hline -\cancel{7x^2} + 3x + 3 \\ (-)\,-\cancel{7x^2} + 0x + 7 \\ \hline 3x - 4 \end{array}$$

Oct 2-7:39 AM

BEAT THE TEST!

1. An equation is shown.

$$\frac{2x^3 + 3x}{x + 1} = Ax^2 + Bx + C + \frac{G(x)}{H(x)}$$

$2x^2 - 2x + 5 \qquad -5 \qquad x+1$

What are the values of B, $G(x)$, and $H(x)$ that make the equation true?

$B =$ $\boxed{-2}$

$G(x) =$ $\boxed{-5}$

$H(x) =$ $\boxed{x+1}$

$$\begin{array}{r} 2x^2 - 2x + 5 \\ x+1\overline{)2x^3 + 0x^2 + 3x + 0} \\ (-)\,\cancel{2x^3} + 2x^2 \\ \hline -\cancel{2x^2} + 3x \\ (-)\,-\cancel{2x^2} - 2x \\ \hline \cancel{5x} + 0 \\ (-)\,\cancel{5x} + 5 \\ \hline -5 \end{array}$$

Oct 2-7:41 AM

Oct 3-6:21 AM