College Algebra
Lesson 4F
Dividing Polynomials
Using Long Division

Textbook Section 2.3

Divide using long division and get a remainder

\[
\begin{align*}
52 \div 28 &= 1 \text{ R } 2 \quad 32 \div 3 &= 10 \\
-28 &-28 \\
\hline
\end{align*}
\]

\[
\begin{align*}
28 &\quad 14598 \\
-148 &\quad 32439 \\
-59 &\quad 72439 \\
-56 &\quad -28 \\
\hline
38 &\quad 38 \\
-38 &\quad -38 \\
\hline
10 &\quad 10
\end{align*}
\]

Simplify: \( \frac{6r^2s^2 + 3rs^2 - 9r^2s}{3rs} \)

\[
\begin{align*}
2rs &+ 1s - 3r \\
3rs &\quad 6r^2s^2 + 3rs^2 - 9r^2s \\
\hline
- \frac{3r^2}{3rs} &\quad -3r^2 \\
\hline
\end{align*}
\]

Simplify: \( \frac{x^2 - x - 30}{x - 6} \)

\[
\begin{align*}
x - 6 &\quad x^2 - x - 30 \\
\hline
x^2 + 6x &\quad -5x - 30 \\
\hline
-5x &\quad -5x - 30 \\
\hline
3 &\quad 3
\end{align*}
\]

Simplify: \( \frac{4x^3 - 7x^2 - 11x + 5}{4x + 5} \)

\[
\begin{align*}
4x &+ 5 \\
- \frac{4x^3 - 7x^2 - 11x + 5}{4x^3 + 5x^2} \\
\hline
-1ax - 11x &\quad + \frac{12x^2 + 5x}{-4x^2} \\
\hline
\end{align*}
\]

Simplify: \( \frac{x^3 - 1}{x - 1} \)

\[
\begin{align*}
x - 1 &\quad x^3 - 1 \\
\hline
x &\quad 1x^2 + x + 1 \\
\hline
- x^2 &\quad -1x^2 \\
\hline
+ 0x &\quad +0x \\
\hline
- 1x &\quad -1x \\
\hline
1 &\quad 1
\end{align*}
\]
Simplify: \((x^2 + 4x - 16)(-x + 6)^{-1}\)
\[
\begin{aligned}
-x &-10 \\
4 &+ \\
-x+6 &
\end{aligned}
\]
\[
\begin{aligned}
-x^2+6x &
\end{aligned}
\]
\[
\begin{aligned}
10x-15 & \\
-10x+60 &
\end{aligned}
\]
\[
\begin{aligned}
49 &
\end{aligned}
\]

Simplify: \((x^3 - 13x^2 + 40x + 18)(x - 7)^{-1}\)
\[
\begin{aligned}
2x-6x-2 &+ \\
x &-7
\end{aligned}
\]
\[
\begin{aligned}
2x^2-13x^2 &+ \\
x &-7
\end{aligned}
\]
\[
\begin{aligned}
-16x^2+40x &
\end{aligned}
\]
\[
\begin{aligned}
+16x^2+43x &
\end{aligned}
\]
\[
\begin{aligned}
-2x+18 &
\end{aligned}
\]
\[
\begin{aligned}
+2x+14 &
\end{aligned}
\]
\[
\begin{aligned}
4 &
\end{aligned}
\]

The fence problem
Perimeter: \[y = \frac{347 - x}{2}\]
Area: \[A(x) = x \cdot \left( \frac{347 - x}{2} \right)\]
Area: \[A(x) = \frac{-x^3 + 173.5x}{2}\]
\[x = \frac{b}{3a} = \frac{-173.5}{9(\frac{3}{2})} = 173.5\]
\[A(x)_{(173.5)} = \] -180

The fence problem
Perimeter: \[x + 2y = 1000\]
Area: \[y = \frac{(1000-x)}{a}\]
\[x = \frac{b}{3a} = \frac{-500}{9\left(\frac{5}{3}\right)} = -500\]
\[\frac{500}{9} = \frac{x^2 + 1000x}{a}\]
\[\frac{500}{9} = \frac{x^2 + 500x}{a}\]
\[ P = 20 \text{ yards} \]
\[ \begin{align*}
  P &= x + 2y = 20 \\
  y &= \frac{20 - x}{2} \\
  A &= x \cdot y = x \left( \frac{20 - x}{2} \right) = \frac{20x - x^2}{2} \\
  \text{Area} &= 50 \text{ yd}^2 \\
  \text{when } x &= 10 \text{ yd}, y &= 5 \text{ yd} \]