Vocabulary: Dividing Polynomials Using Synthetic Division

Vocabulary

- Remainder Theorem – a theorem that states that, when the polynomial $P(x)$ is divided by the binomial $(x – a)$, the remainder is equal to $P(a)$.
  - For example, when $P(x) = x^2 + 2x + 1$ is divided by $(x – 1)$, the remainder is $P(1)$, or $1^2 + 2 \bullet 1 + 1 = 4$.

- Synthetic division – a shortcut to divide a polynomial by a binomial of the form $(x – a)$.
  - For example, here's how to divide $(2x^2 + x – 15)$ by $(x + 3)$, using both long division and synthetic division:

Long division

$$
\begin{array}{r}
2x \quad -5 \\
x+3 \overline{)\; 2x^2 + x - 15} \\
\underline{-(2x^2 + 6x)} \\
-5x - 15 \\
\underline{-(-5x - 15)} \\
0
\end{array}
$$

Synthetic division

$$
\begin{array}{r|rr}
-3 & 2 & 1 & -15 \\
 & & -6 & 15 \\
\hline
 & 2 & -5 & 0
\end{array}
$$