

# 6.5 Dividing Polynomials

## Old Long Division

negate quantity

$$\begin{array}{r} 668 \\ 2 \overline{) 1336} \\ \underline{\ominus 2} \\ 13 \\ \underline{\ominus 12} \\ 16 \\ \underline{\ominus 16} \\ 0 \end{array}$$

determine the number that when multiplied by "2" will get the closest to "13".

$$\begin{array}{r} 582. \\ 5 \overline{) 2910} \\ \underline{-25} \\ 41 \\ \underline{-40} \\ 10 \end{array}$$

## new Dividing Polynomials

**Question:** When given a factor, how can you determine the other factors?

Let's consider the function  $x^2 + 9x + 14$ . Let's say that we know one of the factors is  $(x+7)$ . Find the other factor(s).

2 ways:

1 Classic Factoring Trinomial

$$\begin{aligned} x^2 + 9x + 14 \\ = (x+7)(x+2) \end{aligned}$$

2 Divide Polynomial Technique.

$$\begin{array}{r} x+2 \\ x+7 \overline{) x^2+9x+14} \\ \underline{-x^2-7x} \\ 2x+14 \\ \underline{-2x-14} \\ 0 \end{array}$$

$$\textcircled{2} \frac{x^2+5x-14}{x+7} = \frac{x-2}{x+7} \begin{array}{r} x-2 \\ x+7 \overline{) x^2+5x-14} \\ \underline{\ominus x^2+7x} \phantom{-14} \\ -2x-14 \\ \underline{\oplus 2x+14} \\ 0 \end{array}$$

$$\textcircled{3} \frac{2x^2+10x-12}{x+6} = \frac{2x-2}{x+6} \begin{array}{r} 2x-2 \\ x+6 \overline{) 2x^2+10x-12} \\ \underline{\ominus 2x^2+12x} \phantom{-12} \\ -2x-12 \\ \underline{\oplus 2x+12} \\ 0 \end{array} \quad 2x-2 = 2(x-1)$$

$$\textcircled{4} \frac{4x^2+4x-3}{2x-1} = \frac{2x+3}{2x-1} \begin{array}{r} 2x+3 \\ 2x-1 \overline{) 4x^2+4x-3} \\ \underline{\ominus 4x^2+2x} \phantom{-3} \\ 6x-3 \\ \underline{\oplus 6x+3} \\ 0 \end{array}$$

$$\textcircled{5} \frac{x^2+5x+3}{x+6} = \frac{x-1}{x+6} \begin{array}{r} x-1 \\ x+6 \overline{) x^2+5x+3} \\ \underline{\ominus x^2+6x} \phantom{+3} \\ -1x+3 \\ \underline{\oplus 1x+6} \\ 9 \end{array} \quad x-1 + \frac{9}{x+6}$$

$$\textcircled{6} \frac{n^2+5n+4}{n+2} \begin{array}{r} n^2+5n+4 \\ n+2 \overline{) n^3+7n^2+14n+3} \\ \underline{\ominus n^3-2n^2} \phantom{+3} \\ 5n^2+14n \phantom{+3} \\ \underline{\ominus 5n^2+10n} \phantom{+3} \\ 4n+3 \\ \underline{\ominus 4n+8} \\ -5 \end{array} = n^2+5n+4 - \frac{5}{n+2}$$

Synthetic Division  $\Rightarrow$  Alternate technique to divide polynomials

$$\frac{x^2 + 9x + 14}{x + 7} =$$

$-7$	$1$	$9$	$14$
$\downarrow$	$-7$	$-14$	
	$1x + 2$	$0$	
	<i>linear</i>	<i>constant</i>	<i>Reminder</i>