2.3 Long Division of Polynomials

Use Division to solve or factor polynomials.

Use to simplify an improper Rational Expression

* Improper Rational Expression

  degree of the numerator is larger than the degree of the denominator.

Division Definition

$$\frac{f(x)}{d(x)} = q(x) + \frac{r(x)}{d(x)}$$

$$\frac{\text{function}}{\text{divisor}} = \text{quotient} + \frac{\text{remainder}}{\text{divisor}}$$

Ex 1 factor completly

$f(x) = 6x^3 - 25x^2 + 18x + 9$

and $(x-3)$ is a factor

$$
\begin{array}{r}
6x^2 - 7x - 3 \\
x-3\,\overline{)\,6x^3 - 25x^2 + 18x + 9} \\
-\,(6x^3 - 18x^2) \\
\hline
-7x^2 + 18x \\
-\,(-7x^2 + 21x) \\
\hline
-3x + 9
\end{array}
$$

goal: eliminate the first term each time

$(x-3)(6x^2 - 7x - 3)$

$(x-3)(2x-3)(3x+1)$

must have every term, including $0x^1$

Ex 2 Remainder

Divide: $9x^3 - x - 3 \div 3x + 2$

missing x^2 term

put in $0x^2$ placeholder

$$
\begin{array}{r}
3x^2 \\
3x+2\,\overline{)\,9x^3 + 0x^2 - x - 3}
\end{array}
$$

Restrict Domain

115; 1-4, 8-10, 69-72, 83