Lesson 12-5

Example 1 Divide a Binomial by a Monomial

Find $(8x^2 + 2) \div 4x$.

$(8x^2 + 2) \div 4x = \frac{8x^2+2}{4x}$ Write as a rational expression.

$= \frac{8x^2}{4x} + \frac{2}{4x}$ Divide each term by $4x$.

$= \frac{8x^2}{4x} + \frac{2}{4x}$ Simplify each term.

$= 2x + \frac{1}{2x}$ Simplify.

Example 2 Divide a Polynomial by a Monomial

Find $14a^2b - 7ab + 21a^2 \div 7ab$.

$14a^2b - 7ab + 21a^2 \div 7ab = \frac{14a^2b - 7ab + 21a^2}{7ab}$ Write as a rational expression.

$= \frac{14a^2b}{7ab} - \frac{7ab}{7ab} + \frac{21a^2}{7ab}$ Divide each term by $7ab$.

$= \frac{14a^2b}{7ab} - \frac{7ab}{7ab} + \frac{21a^2}{7ab}$ Simplify each term.

$= 2a - 1 + \frac{3a}{b}$ Simplify.

Example 3 Divide a Polynomial by a Binomial

Find $(2r^2 - 5r + 3) \div (r - 1)$.

$(2r^2 - 5r + 3) \div (r - 1) = \frac{2r^2 - 5r + 3}{(r-1)}$ Write as a rational expression.

$= \frac{(2r-3)(r-1)}{(r-1)}$ Factor the numerator.

$= \frac{(2r-3)(r-1)}{(r-1)}$ Divide by the GCF.

$= 2r - 3$ Simplify.

Example 4 Long Division

Find ($6x^2 + 5x – 3$) $\div$ ($3x + 1$).

The expression $6x^2 + 5x – 3$ cannot be factored, so use long division.

Step 1 Divide the first term of the dividend, $6x^2$, by the first term of the divisor, $3x$.

$$\begin{array}{r|l} & 2x \\ 3x+1 & 6x^2+5x-3 \\ & (-)6x^2+2x \\ & 3x \end{array}$$

$6x^2 \div 3x = 2x$

Multiply $2x$ and $3x + 1$.

Subtract.

Step 2 Divide the first term of the partial dividend, $3x – 3$, by the first term of the divisor, $3x$.

$$\begin{array}{r|l} & 2x \\ 3x+1 & 6x^2+5x-3 \\ & (-)6x^2+2x \\ & 3x-3 \\ & (-)3x+1 \\ & 4 \end{array}$$

$3x \div 3x = 1$

Subtract and bring down the -3.

Multiply 1 and $3x+1$.

Subtract.

The quotient of ($6x^2 + 5x – 3$) $\div$ ($3x + 1$) is $2x + 1$ with a remainder of –4, which can be written as $2x + 1 - \frac{4}{3x+1}$. Since there is a nonzero remainder, $3x + 1$ is not a factor of $6x^2 + 5x – 3$.

Example 5 Polynomial with Missing Terms

Find ($2x^3 - x^2 + 1$) $\div$ ($x + 1$).

Rename the x term using a coefficient of 0.

$(2x^3 - x^2 + 1) \div (x + 1) = (2x^3 - x^2 + 0x + 1) \div (x + 1)$

$$\begin{array}{r|l} & 2x^2-3x+3 \\ x+1 & 2x^3-x^2+0x+1 \\ & (-)2x^3+2x^2 \\ & -3x^2+0x \\ & (-)-3x^2-3x \\ & 3x+1 \\ & (-)3x+3 \\ & -2 \end{array}$$

Multiply $2x^2$ and $x+1$.

Subtract and bring down $0x$.

Multiply $-3x$ and $x+1$.

Subtract and bring down 1.

Multiply 3 and $x + 1$.

Subtract.

Therefore, $(2x^3 - x^2 + 1) \div (x + 1) = 2x^2 - 3x + 3 - \frac{2}{x+1}$.