

12.3 Notes

"Divide Polynomials"

Warm-Up → Divide 7,615 by 12 using long division.

$$\begin{array}{r}
 634.58\bar{3} \\
 12 \overline{) 7615} \\
 \underline{-72} \\
 41 \\
 \underline{-36} \\
 55 \\
 \underline{-48} \\
 70 \\
 \underline{-60} \\
 100 \\
 \underline{-96} \\
 40 \\
 \underline{-36} \\
 40
 \end{array}$$

Divide.....

1. $(8x^3 - 12x^2 + 16x) / 4x$

$$\begin{array}{r}
 x^2 \\
 x^1 \overline{) 8x^3 - 12x^2 + 16x} \\
 \underline{4x} \\
 2x^2 - 3x + 4
 \end{array}$$

EXAMPLE 1 Divide a polynomial by a monomial

Divide $15x^3 - 10x^2 - 20x$ by $-5x$.

Solution

METHOD 1: Write the division as a fraction.

$$\begin{aligned}
 (15x^3 - 10x^2 - 20x) \div (-5x) &= \frac{15x^3 - 10x^2 - 20x}{-5x} \\
 &= \frac{15x^3}{-5x} + \frac{-10x^2}{-5x} + \frac{-20x}{-5x} \\
 &= -3x^2 + 2x + 4
 \end{aligned}$$

Write as fraction.

Divide each term by $-5x$.

Simplify.

METHOD 2: Use long division.

Think: $15x^3 \div -5x$	Think: $-10x^2 \div -5x$	Think: $-20x \div -5x$
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$$\begin{array}{r}
 -3x^2 + 2x + 4 \\
 -5x \overline{) 15x^3 - 10x^2 - 20x} \\
 \underline{-15x^3 + 10x^2 + 20x} \\
 0
 \end{array}$$

$(15x^3 - 10x^2 - 20x) \div (-5x) = -3x^2 + 2x + 4$

EXAMPLE 2 Divide a polynomial by a binomial

Divide $6x^2 - 13x + 2$ by $2x - 5$.

Solution

$$\begin{array}{r}
 3x + 1 \\
 2x - 5 \overline{) 6x^2 - 13x + 2} \\
 \underline{6x^2 - 15x} \\
 2x + 2 \\
 \underline{2x - 5} \\
 7
 \end{array}$$

Multiply $3x$ and $2x - 5$.
Subtract $6x^2 - 15x$. Bring down 2.
Multiply 1 and $2x - 5$.
Subtract $2x - 5$.

$(6x^2 - 13x + 2) \div (2x - 5) = 3x + 1 + \frac{7}{2x - 5}$

↑ Remainder

Divide.....

2. $(-21 - 4p + 3p^2) / (3 + p)$

$$\begin{array}{r}
 -7 + p \\
 3 + p \overline{) -21 - 4p + 3p^2} \\
 \underline{-21 - 7p} \\
 3p + 3p^2 \\
 \underline{-3p - p^2} \\
 2p^2 \leftarrow \text{Remainder}
 \end{array}$$

$-7 + p + \frac{2p^2}{3 + p}$

Divide.....

3. $(5 - m^2) / (m - 3)$

$$\begin{array}{r}
 -m^2 + 5 \\
 m - 3 \overline{) -m^2 + 0m + 5} \\
 \underline{-m^2 + 3m} \\
 -3m + 5 \\
 \underline{-3m + 9} \\
 -4
 \end{array}$$

$-m - 3 - \frac{4}{m - 3}$