# Section 6.5: Division of Polynomials

Tuesday, November 12, 2013
9:44 AM

dividing by a monomial:

$$(-9x^3 + 6x^2 - 12x) \div (-3x)$$

$$\frac{-9x^3 + 6x^2 - 12x}{-3x}$$

$$3x^2 - 2x + 4$$

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dividing by a binomial:

$$(x^2 + 5x + 7) \div (x + 3)$$

divisor

dividend

quotient

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

remainder

two ways to write your answer:

- give quotient and remainder: quotient: $x+2$, remainder: $1$

- write it in form:

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

$$x+2 + \frac{1}{x+3}$$

why do we ask for this?

$$(x+3)\left(\frac{x^2+5x+7}{x+3}\right) = \left(x+2 + \frac{1}{x+3}\right)x+3$$

$$x^2+5x+7 = (x+2)(x+3) + 1$$

which allows us to check!

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example: divide, writing in the form

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

$$\frac{6x^3+16x^2-9}{3x-1}$$

$$\begin{array}{r} 2x^2+6x+2 \\ 3x-1 \overline{)\ 6x^3+16x^2+0x-9} \\ \underline{6x^3-2x^2} \\ 18x^2+0x \\ \underline{18x^2-6x} \\ 6x-9 \\ \underline{6x-2} \\ -7 \end{array}$$

$-7$

answer: $2x^2 + 6x + 2 + \dfrac{-7}{3x-1}$

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divide, giving quotient and remainder

$$\frac{x^4 + x^3 - 2}{x^2 + 3}$$

$$x^2 + 3 \;\overline{)\; x^4 + x^3 + 0x^2 + 0x - 2}$$

$$x^2 + x - 3$$

$$\begin{array}{r} x^4 \quad + 3x^2 \\ \hline x^3 - 3x^2 + 0x \\ x^3 \quad + 3x \\ \hline -3x^2 - 3x - 2 \\ -3x^2 \quad - 9 \\ \hline -3x + 7 \end{array}$$

how do we know when to stop?

when the degree of the remainder is less than the degree of the divisor

$q$: $x^2 + x - 3$

$r$: $-3x + 7$

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Is $(x^2 - x + 3)$ a factor of $(2x^3 - 3x^2 + 7x - 3)$?

note: if remainder is zero, then answer is "yes"

$2x - 1$

$$
\begin{array}{r}
2x \quad -1 \\
x^2 - x + 3 \;\overline{)\; 2x^3 - 3x^2 + 7x - 3} \\
\underline{2x^3 - 2x^2 \quad +6x} \\
\quad -x \quad +x - 3 \\
\quad \underline{-x \quad +x - 3} \\
\quad\quad\quad\quad 0
\end{array}
$$

YES.