3.5 Dividing Polynomials

Polynomial Division

Math Learning Target:
"I can determine the quotient when one polynomial is divided by another polynomial."

Word wall:
divisor
quotient
dividend
remainder

Ex. 1: Divide 352 by 15 using long division.

$\frac{352}{15}$

$$15\overline{)352}\quad 23 \leftarrow \text{Quotient}$$

Divisor $-30\downarrow$ ← Dividend

52

-45

$7 \leftarrow$ Remainder

$\frac{352}{15} = 23\text{ R}7$

$= 23\frac{7}{15}$

$\frac{352}{15} = 23 + \frac{7}{15}$

$\doteq 23.4\overline{6}$

Division Statement:

dividend = divisor x quotient + remainder

$352 = 15 \times 23 + 7$

Ex. 2: Divide: $3x - 2x^4 + 5$ by $x + 3$ using long division.

$-2x^4+3x+5$

$$x+3\overline{)-2x^4+0x^3+0x^2+3x+5}\quad -2x^3+6x^2-18x+57$$

$-(-2x^4-6x^3)$ ↓

$6x^3+0x^2$

$-(6x^3+18x^2)$

$-18x^2+3x$

$-(-18x^2-54x)$

$57x+5$

$-(57x+171)$

-166 Remainder

Dividend = divisor x Quotient + Remainder

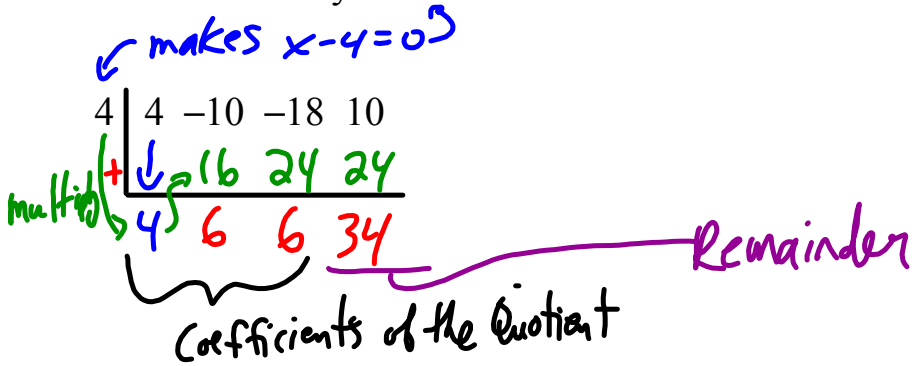
$-2x^4+3x+5 = (x+3)(-2x^3+6x^2-18x+57)+(-166)$

Also

$\frac{-2x^4+3x+5}{x+3} = -2x^3+6x^2-18x+57+\frac{-166}{x+3}$

$\frac{\text{Dividend}}{\text{Divisor}} = \text{Quotient} + \frac{\text{Remainder}}{\text{Divisor}}$

Ex. 3: When dividing by $x - k$ we can use synthetic division.
Divide $4x^3 - 10x^2 - 18x + 10$ by $x - 4$.



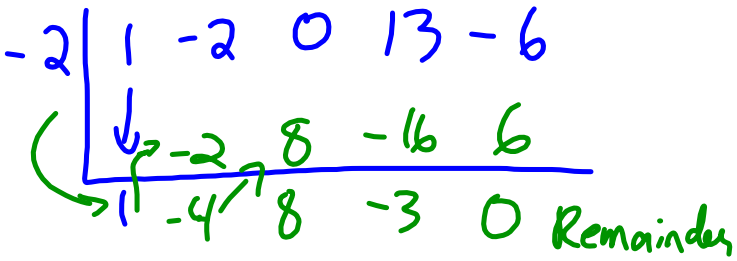
$\therefore$ Quotient $= 4x^2 + 6x + 6$

Remainder $= 34$

Division Statement: $4x^3 - 10x^2 - 18x + 10 = (x-4)(4x^2+6x+6) + 34$

Ex. 4: Using synthetic division, find the remainder when $13x - 2x^3 + x^4 - 6$ is divided by $x + 2$.

$x^4 - 2x^3 + 0x^2 + 13x - 6$ and $k = -2$



Division Statement: $x^4 - 2x^3 + 13x - 6 = (x+2)(x^3 - 4x^2 + 8x - 3) + 0$

If the remainder is zero, then

we have factors of the dividend: divisor and quotient.

Alternate using Long Division and Synthetic Division...

Complete pp.168-170 #5cd, 7ad, 8bc, 9ab, 10ae, 11, 12, 15
Challenge yourself! #17, 18, 19