Chapter 2.4: Dividing Polynomials; Remainder/Factor Theorem.

Dividing polynomials is just like dividing large numbers

$$\frac{3}{12}$$

$$12\overline{)12345}$$

12

−12

0 3 4

− 24

1 0 5

−

5

Divide: $x^2 + 10x + 21$ by $x + 3$

$x + 7$

$x + 3 \overline{)\, x^2 + 10x + 21}$

$- \left(\cancel{x^2} + 3x\right)$

$7x + 21$

$- (7x + 21)$

0

Divide: $4-5x-x^2+6x^3$ by $3x-2$

$$\boxed{2x^2 + x - 1 + \frac{2}{3x-2}}$$

$$
\begin{array}{r|l}
3x-2 & 6x^3 - x^2 - 5x + 4 \\
\ominus & \underline{6x^3 - 4x^2} \\
 & \quad 3x^2 - 5x \\
\ominus & \quad \underline{3x^2 - 2x} \\
 & \qquad -3x + 4 \\
\ominus & \qquad \underline{-3x + 2} \\
 & \qquad\qquad 2
\end{array}
$$

Synthetic Division:

fast way to do long division

$4x^4 + 5x^3 + 7x - 1 \div x - 3$

Coefficients

divisor

$$
\begin{array}{r|rrrrr}
3 & 4 & 5 & 0 & 7 & -1 \\
 & \downarrow & 12 & 51 & 153 & 480 \\
\hline
 & 4x^3 & 17x^2 & 51x & 160 & \boxed{479}
\end{array}
$$

remainder

$4x^3 + 17x^2 + 51x + 160 + \frac{479}{x-3}$

use synthetic division to divide

$5x^3 + 6x + 8$ $\qquad x + 2$

Remainder Theorem:

If the polynomial f(x) is divided by x-c
then the remainder is f(c)

f(3)

Factor Theorem:

x-c is a factor iff f(c)=0

use the remainder theorem to find f(2) in the polynomial

$x-2$

$$f(x)=x^3-4x^2+5x+3$$

$$\begin{array}{r|rrrr}
2 & 1 & -4 & 5 & 3 \\
 & & 2 & -4 & 2 \\
\hline
 & 1 & -2 & 1 & \boxed{5}
\end{array}$$

$f(2)=5$

Solve the equation $2x^3-3x^2-11x+6=0$ given that 3 is a zero of $f(x)=2x^3-3x^2-11x+6$

$(x-3)$

$$\begin{array}{r|rrrr}
3 & 2 & -3 & -11 & 6 \\
 & & 6 & 9 & -6 \\
\hline
 & 2 & 3 & -2 & \boxed{0}
\end{array}$$

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

$(x-3)(2x-1)(x+2)=0$

$\boxed{x=3, \frac{1}{2}, -2}$

$f(\frac{1}{2})=0$ null set $\emptyset$

Suggested Homework: pg.290
#'s 3,13,17,25,31,35,39,43