Let's do some "fake" division.

What is a synthetic material?

A material made by chemical synthesis, especially to imitate a natural substance.

Synthetic Division

Uses the zero of the divisor.
By reversing the sign of the divisor you can ADD throughout the process instead of subtracting.

Works only when the leading coefficient of the divisor is 1.

Meaning either $\div(x + a)$ or $\div(x - a)$

$$\frac{x^3 - 2x^2 - 31x + 20}{x + 5}$$

Zero of the Divisor

Coefficients of the dividend in Standard Form

$$\begin{array}{r|rrrr} -5 & 1 & -2 & -31 & 20 \\ & & -5 & 35 & -20 \\ \hline & 1 & -7 & 4 & 0 \end{array}$$

Multiply and ADD

Bring down the first #

$x^2 - 7x + 4 \quad R=0$

Find each quotient using Synthetic Division

1. $$\frac{4x^3 - 6x^2 - 7x - 33}{x - 3}$$

$$\begin{array}{r|rrrr} +3 & 4 & -6 & -7 & -33 \\ + & & 12 & 18 & 33 \\ \hline & 4 & 6 & 11 & 0 \end{array}$$

$4x^2 + 6x + 11 \quad R=0$

2. $\dfrac{2x^4 + 18x^3 + 34x^2 + 43x + 10}{x + 7}$

$$\begin{array}{r|rrrrr} -7 & 2 & 18 & 34 & 43 & 10 \\ & & -14 & -28 & -42 & -7 \\ \hline & 2 & 4 & 6 & 1 & 3 \end{array}$$

$\boxed{2x^3+4x^2+6x+1 \text{ R}3}$

Find this quotient using Synthetic Division.

$\dfrac{4x^3 - x + 9}{x - 3}$

$$\begin{array}{r|rrrr} 3 & 4 & 0 & -1 & 9 \\ & & 12 & 36 & 105 \\ \hline & 4 & 12 & 35 & 114 \end{array}$$

$\boxed{4x^2+12x-35 \text{ R}=114}$

Find this quotient using Synthetic Division.

$(x^4 - 9) \div (x + 2)$

$$\begin{array}{r|rrrrr} -2 & 1 & 0 & 0 & 0 & -9 \\ + & & -2 & 4 & -8 & 16 \\ \hline & 1 & -2 & 4 & -8 & +7 \end{array}$$

$\boxed{x^3-2x^2-4x-8 \text{ R}=7}$

Is $x + 7$ a factor of $x^3 - 2x^2 + 10x - 21$?

$x+7 \overline{) x^3-2x^2+10x-21}$

-532

$f(-7) = -532$

$$\begin{array}{r|rrrr} -7 & 1 & -2 & 10 & -21 \\ & & -7 & 63 & -511 \\ \hline & 1 & -9 & 73 & -532 \end{array}$$

NO, b/c Remainder isn't zero

Find just the remainder of this quotient.

$$\frac{2x^3 + 5x^2 - 7x + 18}{x + 3}$$

$$\begin{array}{r|rrrr} -3 & 2 & 5 & -7 & 18 \\ & & -6 & 3 & 12 \\ \hline & 2 & -1 & -4 & 30 \end{array}$$

$2x^2 - x - 4$ $\quad R = 30$

Given $f(x) = 3x^4 - 5x^3 + 8x^2 - 7x + 10$

Find f(2) $= 3(2)^4 - 5(2)^3 + 8(2)^2 - 7(2) + 10$

$= 48 - 40 + 32 - 14 + 10$

$= 36$

How could you use Synthetic Division to find f(2)?

$$\begin{array}{r|rrrrr} 2 & 3 & -5 & 8 & -7 & 10 \\ & & 6 & 2 & 20 & 26 \\ \hline & 3 & 1 & 10 & 13 & 36 \end{array}$$

$3x^3 + x^2 + 10x + 13$ $\quad R = 36$

The remainder when doing synthetic division is the same as evaluating the dividend with the zero of the divisor

Use Synthetic Division and the Remainder Theorem to find f(4).

f(4) = remainder when dividing by x−4

$f(x) = 2x^3 - 5x^2 + 10x - 1$

$$\begin{array}{r|rrrr} 4 & 2 & -5 & 10 & -1 \\ & & 8 & 12 & 88 \\ \hline & 2 & 3 & 22 & 87 \end{array}$$

$2x^2 + 3x + 22$ $\quad R = 87$

$\boxed{f(4) = 87}$

The remainder is the same as evaluating the dividend with the zero of the divisor.

Given $x - 5$ is a factor of $2x^3 - 11x^2 - 16x + 105$

Use synthetic division to help find the other two factors.

$$\begin{array}{r|rrrr} 5 & 2 & -11 & -16 & 105 \\ & & 10 & -5 & -105 \\ \hline & 2 & -1 & -21 & 0 \end{array}$$

$\to 2x^2 - x - 21$

-42

$-7 \quad 6$

-1

	$2x$	-7
x	$2x^2$	$-7x$
$+3$	$6x$	-21

The complete factored form is: $(x-5)(x+3)(2x-7)$

You can now finish Hwk #31: Sec 6-3

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Problems   14-16, 21, 24,26, 27, 46, 47