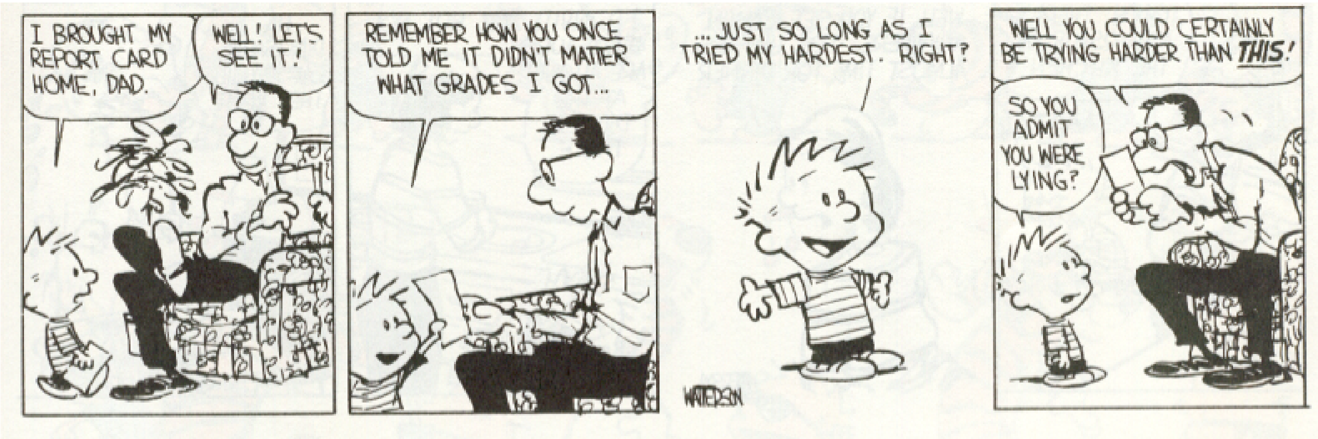

I BROUGHT MY REPORT CARD HOME, DAD.
WELL! LET'S SEE IT!
REMEMBER HOW YOU ONCE TOLD ME IT DIDN'T MATTER WHAT GRADES I GOT...
... JUST SO LONG AS I TRIED MY HARDEST. RIGHT?
WATTERSON
WELL YOU COULD CERTAINLY BE TRYING HARDER THAN THIS!
SO YOU ADMIT YOU WERE LYING?

3.3 Polynomial and Synthetic Division

$$f(x) = (6x^3 - 19x^2) + (16x - 4)$$

$$x^2(\underline{6x-19}) + 4(\underline{4x-1})$$

Divide 12 by 3

$= 4$

$12 = 3 \cdot 4$

$12 = 3 \cdot 2 \cdot 2$

Use long division to divide:

$34867 \div 23$

$$
\begin{array}{r}
1515 \text{ R}22 \\
23 \,\overline{)\,34867} \\
-23 \\
\hline
118 \\
-115 \\
\hline
36 \\
-23 \\
\hline
137 \\
115 \\
\hline
22
\end{array}
$$

$(23)\ \left(1515\frac{22}{23}\right)$

If $(x-2)$ is a factor of

$f(x) = 6x^3 - 19x^2 + 16x - 4$,

then $f(x) = (x - 2) \cdot q(x)$

$12 = 3 \cdot ?$

Division Algorithm:

$f(x) = (d(x))(q(x)) + r(x)$

$$\frac{f(x)}{d(x)} = q(x) + \frac{r(x)}{d(x)}$$

$$\frac{34867}{23} = 1515 + \frac{22}{23}$$

If (x-2) is a factor of

$f(x) = \underbrace{6x^3 - 19x^2 + 16x - 4}$,

then $f(x) = (x - 2) \cdot q(x)$

$$
\begin{array}{r}
6x^2 - 7x + 2 \\
x-2 \enclose{longdiv}{6x^3 - 19x^2 + 16x - 4} \\
-\underline{6x^3 - 12x^2} \qquad\qquad \\
-7x^2 + 16x \qquad \\
-\underline{-7x^2 + 14x} \qquad \\
2x - 4 \\
-\underline{2x - 4} \\
0
\end{array}
$$

$(x-2)(6x^2-7x+2)$

$$\boxed{(x-2)(3x-2)(2x-1)}$$

Ex 1 Use Long Division

$$
\begin{array}{r}
x^2 - 3x + 1 \\
4x + 5 \overline{)\,4x^3 - 7x^2 - 11x + 5} \\
-\;4x^3 + 5x^2 \qquad\qquad \\
\hline
-12x^2 - 11x \qquad \\
-\quad -12x^2 - 15x \qquad \\
\hline
4x + 5 \\
4x + 5 \\
\hline
0
\end{array}
$$

$$(4x+5)(x^2-3x+1)$$

$(5x^3-6x^2+8) \div (x - 4)$

$$
\begin{array}{r l}
 & 5x^2 + 14x + 56 \\
x-4 & \overline{)\,5x^3 - 6x^2 + 0x + 8} \\
 & -\underline{(5x^3 - 20x^2)} \\
 & \quad 14x^2 + 0x \\
 & -\underline{(14x^2 - 56x)} \\
 & \quad\quad 56x + 8 \\
 & -\underline{(56x - 224)} \\
 & \quad\quad\quad 232
\end{array}
$$

$$\boxed{5x^2+14x+56+\frac{232}{x-4}}$$

Shortcut to Long Division-- Synthetic Division

1) only applies when the divisor is $x - c$
2) when every descending power of x has a place in the dividend

$x+4$ yes
$x-2$ yes
$3x-2$ NO
$\frac{1}{2}x+3$ NO

<u>Ex 3</u> Do same problem using Synthetic Division

$(5x^3-6x^2+8) \div (x - 4)$

$$\begin{array}{r|rrrr} & x^3 & & & \\ 4 & 5 & -6 & 0 & 8 \\ & \downarrow & +20 & +56 & +224 \\ \hline & 5x^2 & +14x & +56 & 232 \end{array}$$

zero

remainder

Use synthetic division to divide
$-x^3 + 75x - 250$ by $x + 10$

-10	-1	0	75	-250
	$\downarrow$	10	-100	250
	-1	10	-25	$\boxed{0}$

$$(x+10)(-x^2+10x-25)$$

$$-(x+10)(x^2-10x+25)$$

$$\boxed{-(x+10)(x-5)^2}$$

Remainder Theorem: If a polynomial $f(x)$ is divided by $x - k$, the remainder is $r = f(k)$.

$$x^5 - 3x^3 + 8x - 11$$

$$f(4) = (4)^5 - 3(4)^3 + 8(4) - 11 = \underline{\underline{853}}$$

$$\begin{array}{r|rrrrrr} 4 & 1 & 0 & -3 & 0 & 8 & -11 \\ & & 4 & 16 & 52 & 208 & 864 \\ \hline & 1 & 4 & 13 & 52 & 216 & \boxed{853} \end{array}$$

Use the Remainder Theorem to find $f(2)$.

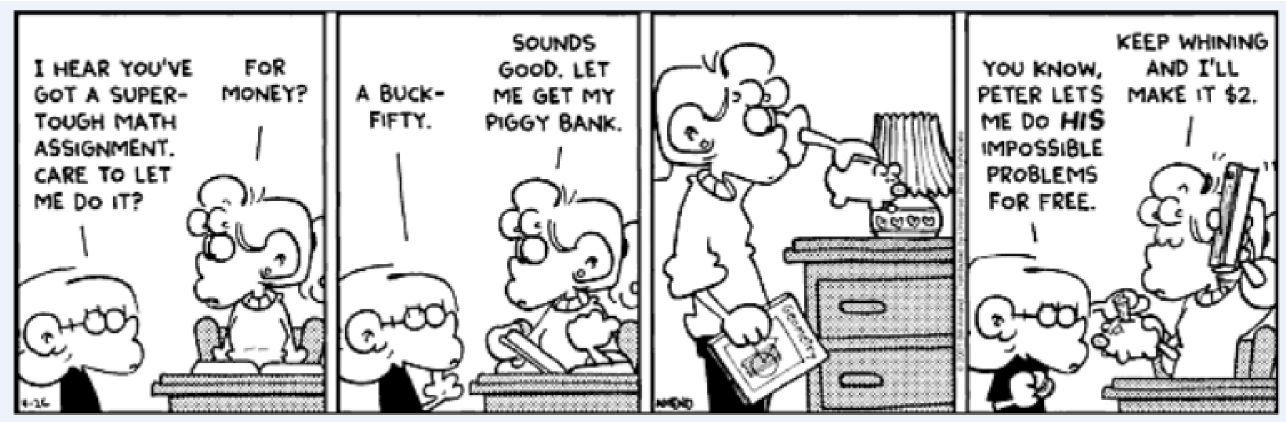
$f(x) = x^3 - 2x^2 - 4x + 1$

$f(2) = -7$

$f(-1) = 2$

$$\begin{array}{r|rrrr} 2 & 1 & -2 & -4 & 1 \\ & \downarrow & 2 & 0 & -8 \\ \hline & 1 & 0 & -4 & -7 \end{array}$$

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



HW: Pg 295 #7, 10, 14, 19,
28, 37, 45, 48,
49, 58, 70, 73