# 3.5 Dividing Polynomials

Review $\frac{37}{3}$.

$$\begin{array}{r} 12 \text{ r } 1 \\ 3\overline{)37} \\ -3\downarrow \\ \hline 07 \\ -6 \\ \hline 1 \end{array}$$

Ans: $\frac{37}{3} = 12 + \frac{1}{3}$

*Now we do the same for polynomials

**EX** $\frac{2x^2-9x-5}{x-5}$

$$\begin{array}{r} 2x+1 \quad \text{r. } 0 \\ x-5\overline{)2x^2-9x-5} \\ -(2x^2-10x)\downarrow \\ \hline x-5 \\ -(x-5) \\ \hline 0 \end{array}$$

Ans:

$$\frac{2x^2-9x-5}{x-5} = 2x+1$$

BTW: $2x^2-9x-5 = (2x+1)(x-5)$

we have factored this poly since $r=0$

**EX** long divide to evaluate the quotient

$$\frac{x^3-126}{x-5}$$

$$x-5 \;\overline{)\; x^3+0x^2+0x-126}$$

$$x^2+5x+25 \quad \text{r.} -1$$

$$-(x^3-5x^2)$$

$$5x^2+0x$$

$$-(5x^2-25x)$$

$$25x-126$$

$$-(25x-125)$$

$$-1$$

Ans:
$$\frac{x^3-126}{x-5} = x^2+5x+25+\frac{-1}{x-5}$$

**EX** $\dfrac{x^4-3x^2+5x-11}{x^2-1}$

$$x^2+0x-1 \;\overline{)\; x^4+0x^3-3x^2+5x-11}$$

$$x^2-2 \quad \text{r.} \; 5x-13$$

$$-(x^4+0x^3-x^2)$$

$$-2x^2+5x-11$$

$$-(-2x^2+0x+2)$$

$$5x-13$$

Ans:
$$\frac{x^4-3x^2+5x-11}{x^2-1} = x^2-2+\frac{5x-13}{x^2-1}$$

* when the denominator is a linear binomial, we can use a short cut method call synthetic division

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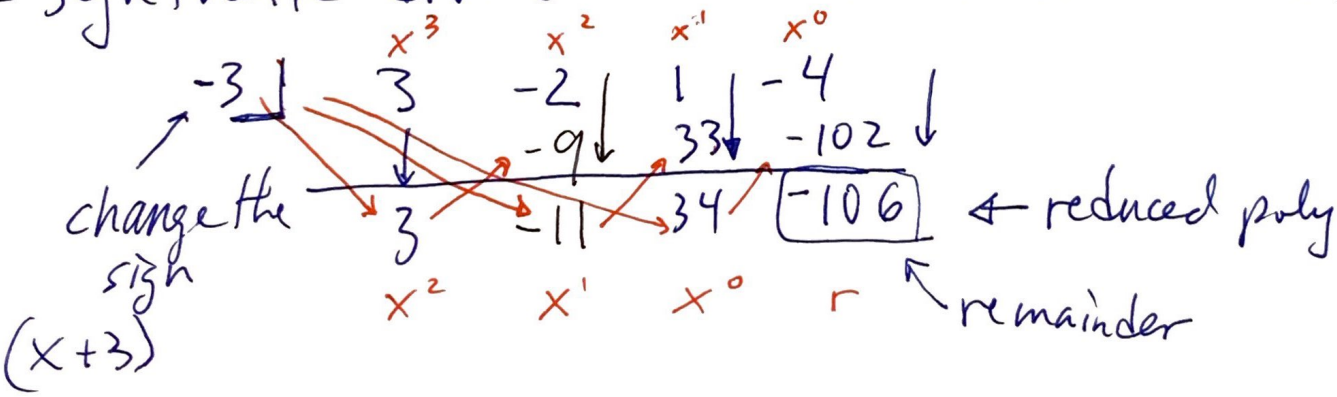
**Ex** $\dfrac{3x^3-2x^2+x-4}{x+3}$

$$
\begin{array}{r}
3x^2-11x+34 \\
x+3\,\overline{)\,3x^3-2x^2+x-4} \\
\underline{-(3x^3+9x^2)\ \downarrow} \\
-11x^2+x \\
\underline{-(-11x^2-33x)\ \searrow} \\
34x-4 \\
\underline{-(34x+102)} \\
-106
\end{array}
$$

$$\frac{3x^3-2x^2+x-4}{x+3} = 3x^2-11x+34-\frac{106}{x+3}$$

or $$3x^3-2x^2+x-4 = (3x^2-11x+34)(x+3)-106$$

* synthetic div. (denominator must be linear)




$$\frac{3x^3-2x^2+x-4}{x+3} = 3x^2-11x+34-\frac{106}{x+3}$$

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

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

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

$x+3=0$

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

$-3(-9-2)$

$-3(-11)+1$

$-3(34) - 4$

not finished with 3.5 (but almost)