Section 6.3 Synthetic Division

Synthetic Division → short cut

↳ only used if/when

1) divisor is linear
2) leading coeff = 1

ex: $(3x^3-2x^2+4x-1) \div (x-4)$

↳ linear w/ LC of 1

$x-4=0$, $x=4$

4 |	3	−2	4	−1 ← coeff of the dividend
	↓	12	40	176
	3	10	44	|175
	x^2	x	c	

zero of the divisor

* must put in 0 placeholders!

$$3x^2+10x+44+\frac{175}{x-4}$$

ex: $(x^4-1) \div (x-2)$ $\quad x-2=0$, $x=2$

2 |	1	0	0	0	−1
	↓	2	4	8	16
	1	2	4	8	|15
	x^3	x^2	x	c	

$$x^3+2x^2+4x+8+\frac{15}{x-2}$$

Remainder Theorem

If the polynomial function $P(x)$ is divided by $x-a$, then the remainder r is $P(a)$.

ex: Evaluate the polynomial:

a) $P(x) = x^3 - 4x^2 + 3x - 5$ for $x = 4$

$$\begin{array}{r|cccc} 4 & 1 & -4 & 3 & -5 \\ & \downarrow & 4 & 0 & 12 \\ \hline & 1 & 0 & 3 & \boxed{7} \end{array} \qquad P(4) = 7$$

$$\begin{aligned} P(4) &= 4^3 - 4(4)^2 + 3(4) - 5 \\ &= 64 - 64 + 12 - 5 \\ &= 7 \end{aligned}$$

ex: $P(x) = 6x^4 - 25x^3 - 3x + 5$ for $x = -1/3$

$$\begin{array}{r|ccccc} -1/3 & 6 & -25 & 0 & -3 & 5 \\ & \downarrow & -2 & 9 & -3 & 2 \\ \hline & 6 & -27 & 9 & -6 & \boxed{7} \end{array} \qquad P(-1/3) = 7$$