Synthetic Division

Ex 1 $4x^3 + 3x^2 - x + 8 \div x - 3$

3	4	3	-1	8
	↓	12	45	132
	4	15	44	140

$4x^2 + 15x + 44 + \frac{140}{x-3}$

Ex 2 $6x^4 + 11x^3 - 15x^2 - 12x + 7 \div x + 1$

opposite of +1 → −1

−1	6	11	−15	−12	7
	↓	−6	−5	20	−8
	6	5	−20	8	−1

$6x^3 + 5x^2 - 20x + 8 - \frac{1}{x+1}$

Remainder Theorem

$f(x) = (x-c) \cdot q(x) + r$

divisor, quotient, remainder

Evaluate $f(c) = \underbrace{(c-c) \cdot q(c)}_{\text{zero}} + r$

$f(c) = r$

* c is the number outside the box in synth. div.

Synthetic Substitution

if $x = c$, then $f(c) = r$

Use synthetic Division w/ "c" on the outside of the box, and the remainder will be the value of f(x) at c

Remainder Theorem

$f(x) = (x-c) \cdot q(x) + r$

$f(c) = \underbrace{(c-c)}_{0} \cdot q(c) + r$

$f(c) = r$

$x - c = 0$

$x = c$

outside of synthetic Div

* Synthetic Division can be used to substitute "c" into f(x), the remainder is the answer.

This is called Synthetic Substitution

* Quiz Question: Use Synthetic substitution to evaluate $f(x) = -x^3 + 5x^2 + 33x - 162$ at $x = 6$.

$f(6) = 0$ ← remainder

Is $(x-6)$ a factor? yes

Factor Theorem: if the remainder is 0, then "c" is a zero, $(x-c)$ is a factor.

HW: 115: 7, 19-22, 30-32, 38-39, 58, 59