Synthetic Division

- Shortcut for dividing polynomials when the divisor is Linear (binomial)

Ex: ① Divide $-x^3+4x^2+0x+9$ by $x-3$

* must check whether dividend and/or divisor are incomplete *

$$\frac{x^3}{x^1} = x^2$$

if $x-3$ goes in evenly, it is a factor of $-x^3+4x^2+9$, and $x=3$ would be a root/zero

③ Divide $x^3+4x^2-9x+10$ by $x-2$

$$\begin{array}{c|cccc} 2 & 1 & 4 & -9 & 10 \\ & \downarrow & 2 & 12 & 6 \\ \hline & 1 & 6 & 3 & 16 \end{array}$$

$$x^2+6x+3+\frac{16}{x-2}$$

HW

(8) $x^2+0x+1 \overline{)\,7x^3+x^2+1x+0}$

$7x+1$

$-(7x^3+0x^2+7x)$ ↓

x^2-6x+0

$-(x^2+0x+1)$

$-6x-1$

$$7x+1+\frac{-6x-1}{x^2+1}$$

(18) Divide $x^4+4x^3+16x-35$ by $x+5$.

$+0x^2$

$$x+5 \;\overline{)\; x^4+4x^3+0x^2+16x-35 \;}\;\; x^3-x^2+5x-9$$

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

$$-x^3+0x^2$$

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

$$5x^2+16x$$

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

$$-9x-35$$

$$-(-9x-45)$$

$$10$$

$x^3-x^2+5x-9+\frac{10}{x+5}$

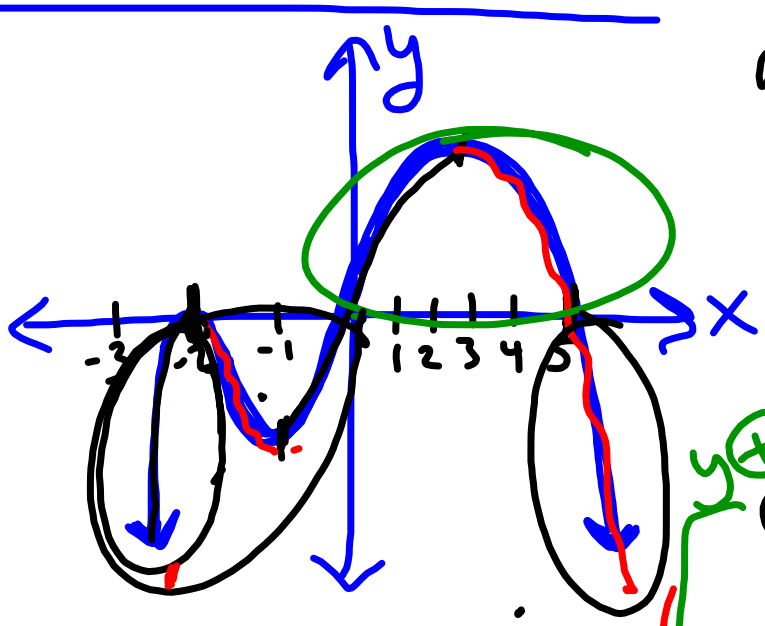
(18)

$$-5 \;\big|\; 1 \;\; 4 \;\; 0 \;\; 16 \;\; -35$$
$$\qquad\quad \downarrow \;\; -5 \;\; 5 \;\; -25 \;\; 45$$
$$\qquad\quad 1 \;\; -1 \;\; 5 \;\; -9 \;\; \big|\; 10$$

$$x^3 - x^2 + 5x - 9 + \frac{10}{x+5}$$

$x = -5$ is not a root b/c there's a remainder of 10 & therefore doesn't go in evenly.

Practice for Test:

① 

x-intervals

a) inc: $(-\infty, -2)$ $(-1, 3)$

b) dec: $(-2, -1)$ $(3, \infty)$

c) $f(x) > 0$: $(0, 5)$ (y +)

d) $f(x) < 0$: $(-\infty, -2)$ $(-2, 0)$ $(5, \infty)$ (y −)

EB:

As $x \to -\infty$, $f(x) \to -\infty$

As $x \to \infty$, $f(x) \to -\infty$

deg: even

LC: Negative

② $f(x) = 3x^5 - 4x^4 + 9x^2 + 12$

deg: 5/odd

LC: 3/pos.

EB: ↗

As $x \xrightarrow{\text{right}} \infty$, $f(x) \to \infty$

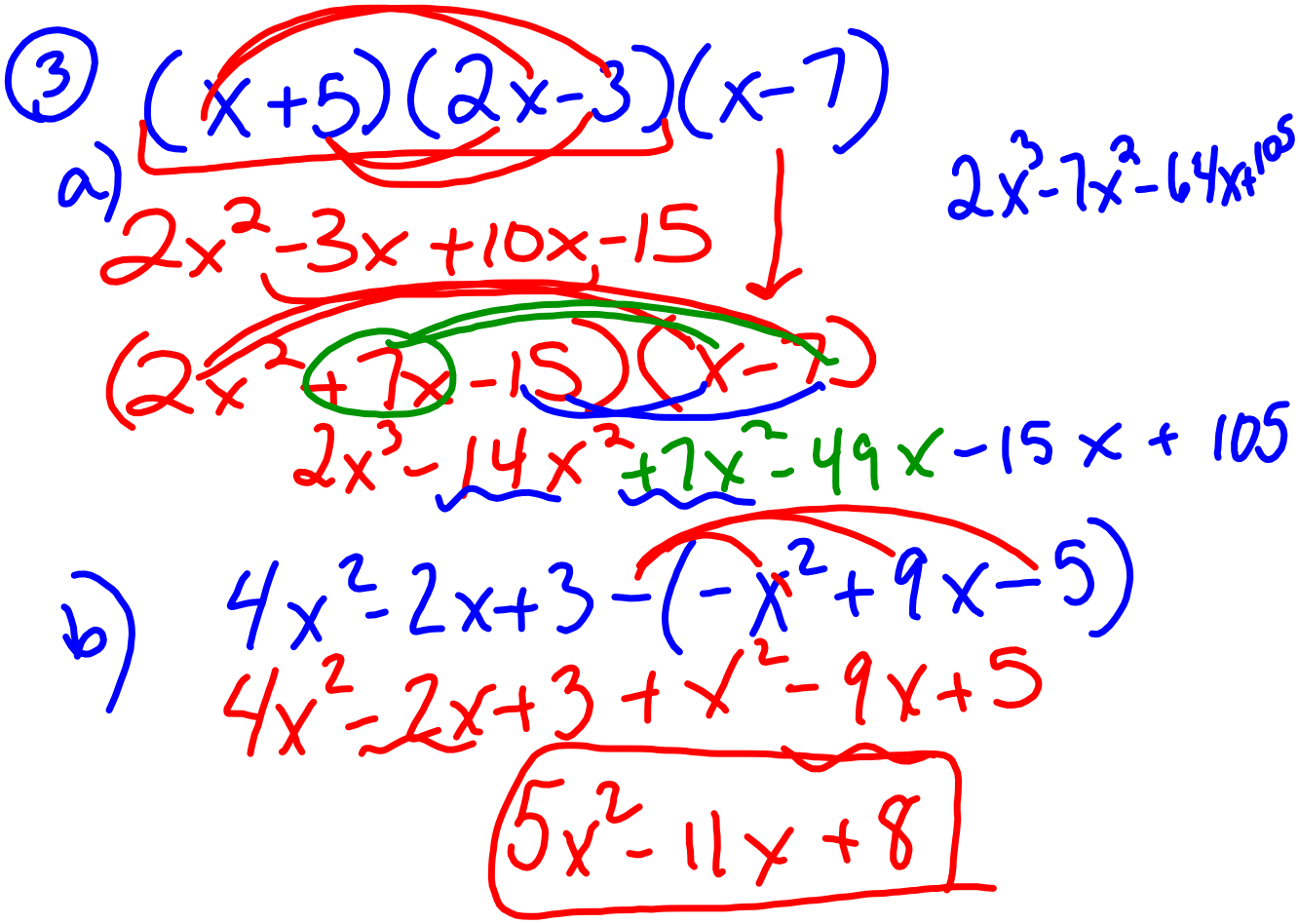
As $x \xrightarrow[\text{left}]{} -\infty$, $f(x) \to -\infty$

AROC from $x=2$ to $x=5$

"slope" $m = \frac{\Delta y}{\Delta x} = \frac{80 - 7112}{2 - 5}$

$= 2,344$

On average, between $x=2$ & $x=5$, the function increases by 2,344 for every $y=1$.


3
(x+5)(2x-3)(x-7)
a)
2x²-3x+10x-15
(2x²+7x-15)(x-7)
2x³-14x²+7x²-49x-15x+105
2x³-7x²-64x+105
b)
4x²-2x+3-(-x²+9x-5)
4x²-2x+3+x²-9x+5
5x²-11x+8

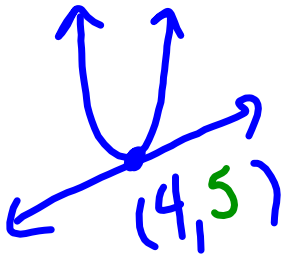
④ System: $x^2 - 6x + 13 = y$

$-y = -2x + 3$

-1

$y = 2x - 3$

Sub. or Elim.



$x^2 - 6x + 13 = 2x - 3$

$-2x + 3 \quad -2x + 3$

$1x^2 - 8x + 16 = 0$

Factor

$(x - 4)(x - 4) = 0$

$x = 4 \quad x = 4$

Sol. (4,5)

$-y = -2(4) + 3$

$-y = -8 + 3$

$-y = -5 \quad y = 5$