HAT
Polynomial Long Division and Synthetic Division

10/4/17

Warm Up: Simplify completely

$$\frac{\left(4x^5y^{-2}\right)^3}{\left(2x^{-3}y\right)^0} = 4^3(x^5)^3(y^{-2})^3$$

$$= 1 = 64x^{15}y^{-6}$$

$$= \frac{64x^{15}}{y^6}$$

Today we are going to work on division of polynomials.

Sometime we can factor and simplify to divide.

Ex1: $\dfrac{5a^2b-15ab^3+10a^3b^4}{5ab}$

$\dfrac{5ab(a-3b^2+2a^2b^3)}{5ab}$

$a-3b^2+2a^2b^3$

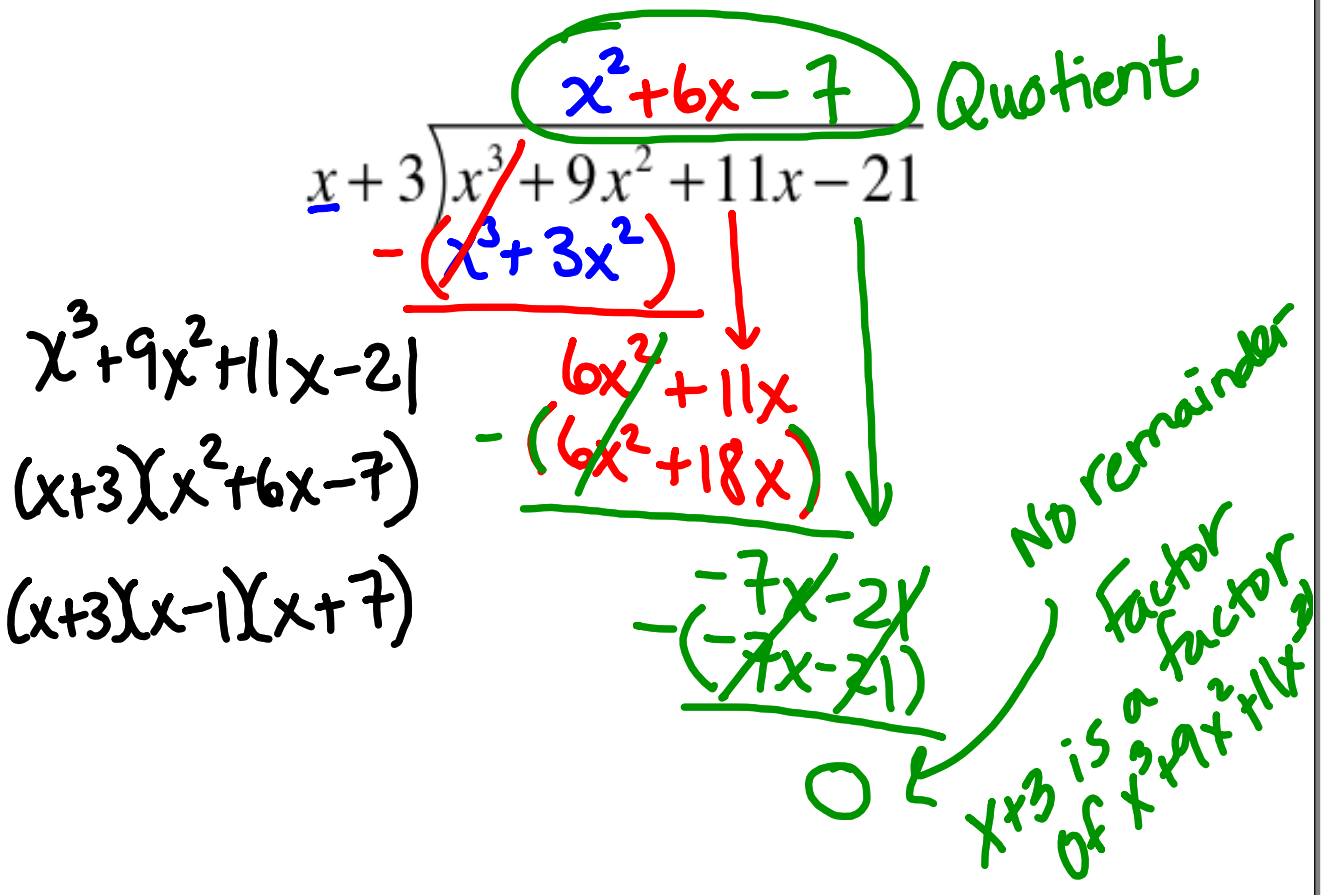
Ex2: $\dfrac{x^3-2x^2-15x}{x+3}$

$\dfrac{x(x^2-2x-15)}{x+3} \rightarrow \dfrac{x(x-5)(x+3)}{x+3} = x^2-5x$

Ex3: $\dfrac{x^3+9x^2+11x-21}{x+3}$

Sometimes we need something else.

Ex3: Polynomial Long Division



Flashback!

$$15\overline{)2035}$$

135 R10

$135\ 10/15$

$135\ 2/3$

-15

53

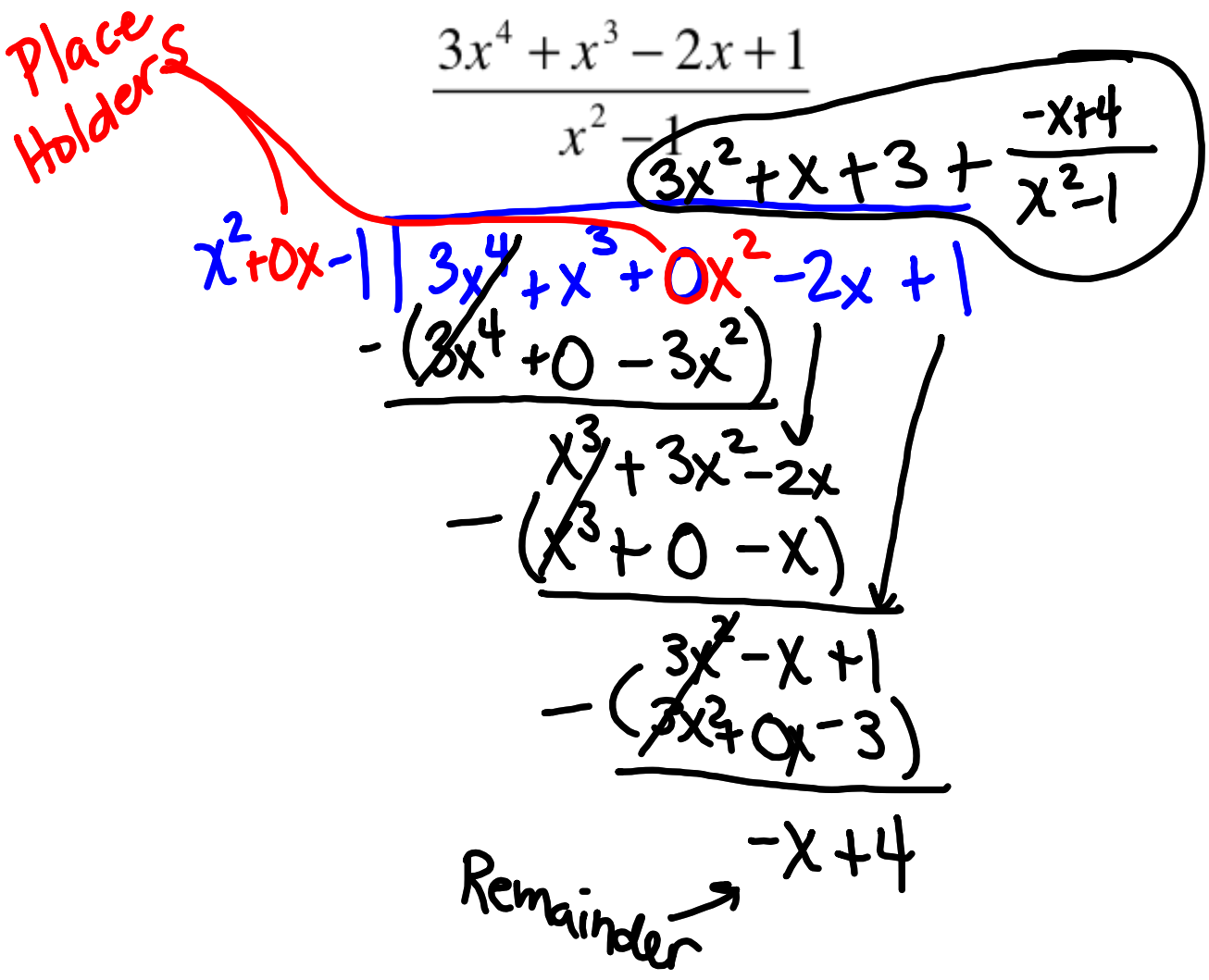
-45

85

-75

10 ← remainder

Ex4: Use long division to find the quotient and remainder



Ex5: Back to Ex3.
Complete this problem using synthetic division.

$x+3\overline{)x^3+9x^2+11x-21}$

$x+3=0$
$x=-3$

-3	1	9	11	-21
	$+$	-3	-18	21
	1	6	-7	0

Remainder

x^2+6x-7

Ex6: Is (2x-1) a factor of $f(x) = 2x^3 + 3x^2 - 8x + 3$?

YES!

leading coefficient $\neq 1$

$2x-1=0$

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

$\frac{1}{2}$	2	3	-8	3
	⊕ ↓	1	2	-3
	2	4	-6	0

$(2x-1)(2x^2+4x-6)$

$\frac{2}{2}$ $\frac{4}{2}$ $\frac{-6}{2}$

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

$(x-\frac{1}{2})\cdot 2(x^2+2x-3)$

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

Ex7: Use synthetic substitution to find f(-3) when

$$f(x) = 4x^4 - 3x^2 + 16x - 8$$

$f(-3) = 4(-3)^4 - 3(-3)^2 + 16(-3) - 8$

$-3 \mid 4 \quad 0 \quad -3 \quad +16 \quad -8$

$\oplus \quad \downarrow \quad -12 \quad 36 \quad -99 \quad 249$

$4 \quad -12 \quad 33 \quad -83 \mid 241$

$f(-3) = 241$

Assignment:

page 315 #15, 16
26, 27, 30 (Use long division)
20, 23, 24 (Use synthetic division)
36, 37, 39

October 4, 2017