Learning Target(s): I can divide polynomials using long division and/or synthetic division.
I can use the Factor Theorem and Remainder Theorem to solve polynomial functions.

Notes: 5.5 Apply the Remainder and Factor Theorems

Divide using long division: 38,452 ÷ 256

$150 + \frac{52}{256}$

$256\overline{)38,452}$

-256

1285

-1280

52 ← Remainder

150R52

Ex. 1 Divide $4x^4 + 5x^2 - 9x + 18$ by $x^2 + 2x + 4$ using long division.

$0x^3$

$4x^2 - 8x + 5 + \frac{13x-2}{x^2+2x+4}$

$\frac{4x^4}{x^2}$

$x^2+2x+4 \;\big|\; 4x^4 + 0x^3 + 5x^2 - 9x + 18$

$-4x^4 + 8x^3 + 16x^2$

$-8x^3 - 11x^2 - 9x$

$\frac{-8x^3}{x^2}$

$+8x^3 + 16x^2 + 32x$

$\frac{5x^2}{x^2}$

$5x^2 + 23x + 18$

$-5x^2 + 10x + 20$

$13x - 2$ Remainder

① Divide
② multiply
③ Subtract
④ Repeat

Remainder Theorem
If a polynomial f(x) is divided by $x - k$, then the remainder is $f(k)$.

Ex 2: Divide $f(x) = x^3 + 4x^2 - 5x + 3$ by $(x + 2)$ using synthetic division. take the opp. sign

-2

	1	4	−5	3
	↓	−2	−4	18
	$1x^2$	+2x	−9	21 ← Remainder

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

$x^2 + 2x - 9 + \frac{21}{x+2}$

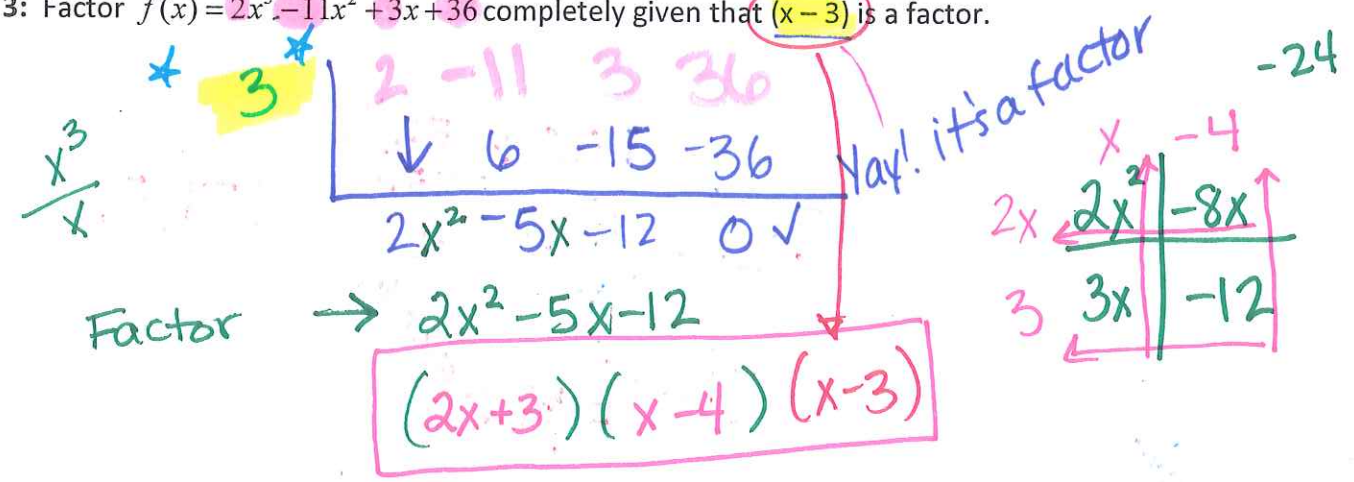
You can use the remainder theorem to check your answer:

$f(-2) = (-2)^3 + 4(-2)^2 - 5(-2) + 3$

$= 21$

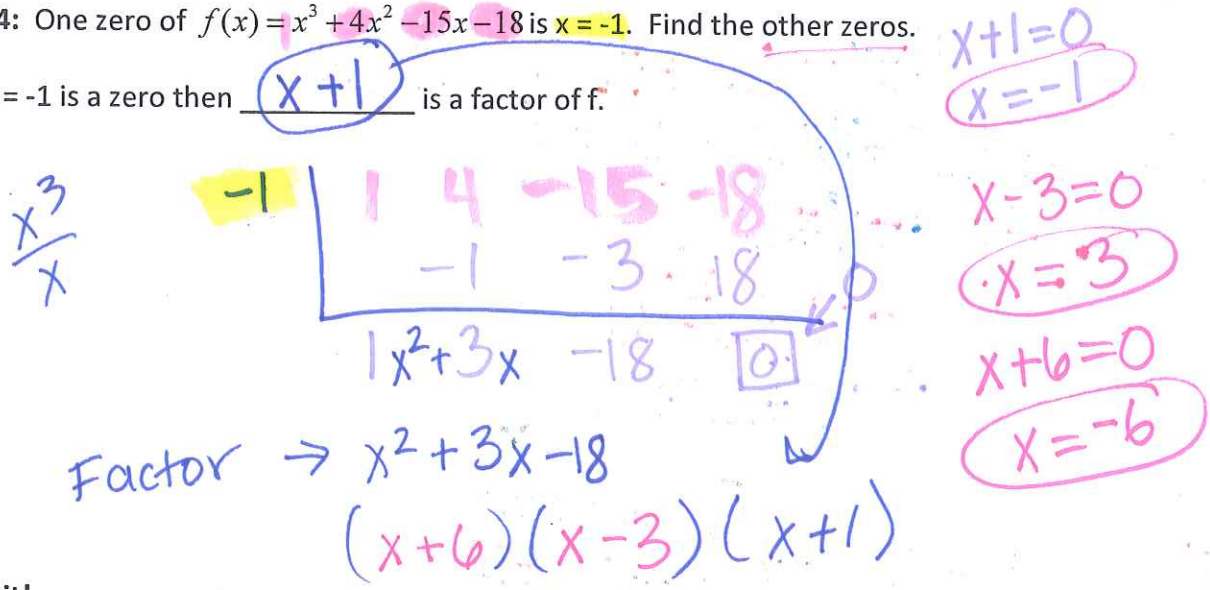
Factor Theorem – A polynomial f(x) has a factor x – k if and only if $f(k)=0$.

Ex 3: Factor $f(x)=2x^3-11x^2+3x+36$ completely given that (x – 3) is a factor.



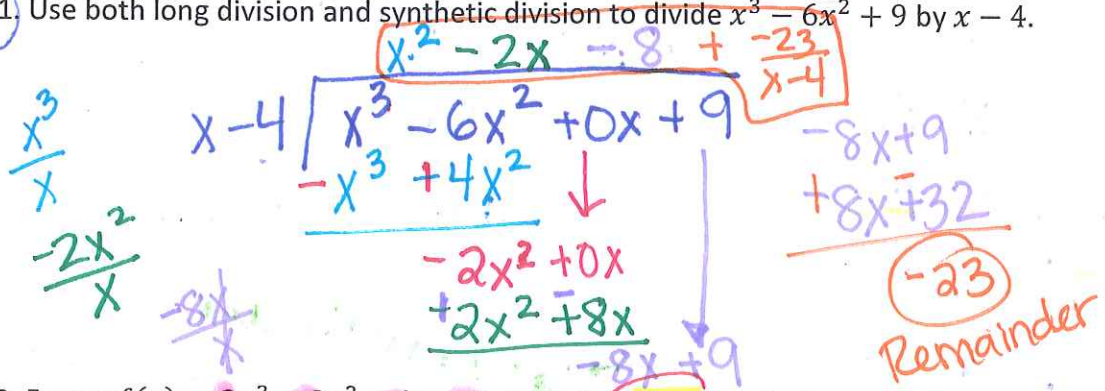
Ex 4: One zero of $f(x)=x^3+4x^2-15x-18$ is x = -1. Find the other zeros.

If x = -1 is a zero then $(x+1)$ is a factor of f.



Try it!

1. Use both long division and synthetic division to divide x^3-6x^2+9 by $x-4$.



2. Factor $f(x)=3x^3+8x^2+3x-2$ given that $x+2$ is a factor.