{tab 3 notes}

Synthetic Division

When Does it work? In order to divide polynomials using synthetic division, you must be dividing by a **linear expression** and the **leading coefficient** (first number) **must be a 1.** For example, you can use synthetic division to divide by $x + 3$ or $x - 6$, but you cannot use synthetic division to divide by $x^2 + 2$ or $6x + 7$.

Divisor
$-3x - 2$ L
x^2+2 L
$x - 3$ S

How Does it work?

- **Step 1:** To set up the problem, first, Make a long **"L"** and put **all** of the **coefficients** of your dividend at the top. make sure the numerator is written in descending order and if any terms are missing you must use a zero to fill in the missing term.

$\frac{x^3-4x^2-3x+6}{x-2}$ ← dividend; ← divisor

$= x^2-2x-7-\frac{8}{x-2}$

	x^3	x^2	x		
2	1	-4	-3	6	
	↓	2	-4	-14	
	$1x^2$	$-2x$	-7	-8	R
			Q		

- **Step 2: Change the sign** of your divisor, drop the x.
- **Step 3:** Once the problem is set up correctly, **bring the leading coefficient** (first number) **straight down**.
- **Step 4**: **Multiply** the number in the division box with the number you brought down and put the result in the next column.
- **Step 5**: **Add** the two numbers together and write the result in the bottom of the row. **Repeat** until done.
- **Step 6:** To write the final answer, **reduce the exponent by 1** and then use the numbers under the "L" as your coefficients. **The last number is the remainder** and the remainder must be written as a fraction.

$= x^3-2x^2-3+\frac{12}{x+2}$ $\frac{0x^3\ x^4-4x^2-3x+6}{x+2}$ ← ←

	x^4	x^3	x^2	x	
-2	1	0	-4	-3	6
	↓	-2	+4	0	6
		$1x^3$	$-2x^2$	0x	-3	12 R

$= x^2+x-1+\frac{18}{x+3}$ $\frac{x^3+4x^2-x+6}{x+3}$

	x^3	x^2	x	
-3	1	4	-1	6
	↓	-3	-3	12
	$1x^2$	$1x$	-4	18 R