SEC 4.2 DIVIDING POLYNOMIAL

1. LONG DIVISION:

FOCUS $2x^2+5$ ← DIVISOR

$3x+1$ ← QUOTIENT

$(2x^2+5)\overline{)\,6x^3+2x^2+22x+0}$ ← DIVIDEND

$3x(2x^2+5) = 6x^3+15x$

$-6x^3 \quad -15x$

$2x^2+7x$

$1(2x^2+5) = 2x^2+5$

$-2x^2 \quad -5$

$7x-5$ ← REMAINDER

$$P(x) = D(x)\cdot Q(x) + R(x)$$

DIVIDEND = DIVISOR · QUOTIENT + REMAINDER

$$P(x) = (2x^2+5)(3x+1) + (7x-5)$$

EX. $(x+2)\overline{)\,3x^3-6x^2+4x-1}$

$3x^2(x+2) = 3x^3+6x^2$

$-3x^3 \quad -6x^2$

$-12x^2+4x$

$-12x(x+2) = -12x^2-24x$

$+12x^2 \quad +24x$

$28x-1$

$28(x+2) = 28x+56$

$-28x \quad -56$

-57

$3x^2-12x+28$

$$P(x) = (x+2)(3x^2-12x+28) + (-57)$$

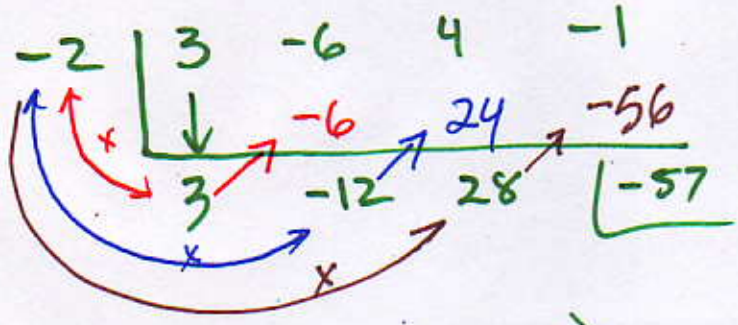
2. SYNTHETIC DIVISION: (FAST WAY TO DO LONG DIVISION

BUT DIVISOR MUST BE OF THE FORM $x - c$.

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

$$(x - (-2))$$

$x - c$



$P(x) = (x+2)(3x^2 - 12x + 28) + -57$

$D(x)$ $Q(x)$ $R(x)$

3. REMAINDER THEOREM:

IF THE POLYNOMIAL $P(x)$ IS DIVIDED BY $(x-c)$, THEN THE REMAINDER IS THE VALUE $P(c)$

$$P(x) = 3x^5 + 5x^4 - 4x^3 + 7x + 3$$

$$P(-2) = 3(-2)^5 + 5(-2)^4 - 4(-2)^3 + 7(-2) + 3$$

$$3\cdot(-32) + 5\cdot 16 - 4(-8) + 7(-2) + 3$$

$$-96 + 80 + 32 - 14 + 3$$

$$-16 + 32 - 14 + 3$$

$$16 - 14 + 3$$

$$2 + 3$$

$$5$$

-2	3	5	-4	0	7	5
		-6	2	4	-8	2
	3	-1	-2	4	-1	5

$(-2, 5)$ POINT ON THE GRAPH

4. FACTOR THEOREM: C IS A ZERO $P(c)=0$ AND $x-c$ IS A FACTOR OF THE POLYNOMIAL

↑ REMAINDER

EX. $P(x) = x^3 - 7x + 6$

DIRECT SUBSTITUTION

$1^3 - 7 \cdot 1 + 6$

$1 - 7 + 6$

$-6 + 6$

0

$\{1\}$ ZERO

$(x-1)$ FACTOR

$(1,0)$ x-INT.

$P(1)$ BY SYNTHETIC DIVISION

1	1	0	-7	6
	↓	1	1	-6
	1	1	-6	0 ← REMAINDER

$1x^2 + 1x - 6$

$x^2 + x - 6$

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

ZEROS: $\{-3, 2, 1\}$