Section 5.3 notes

Objective: Factoring with leading coefficient of 1
(no number in front of the first term)

Review Examples: Multiply the following.

a) $(x+3)(x+5)$

	$\times$	$+3$
$\times$	x^2	$3x$
$+5$	$5x$	15

$x^2+8x+15$

b) $(n-7)(n-4)$

	n	-7
n	n^2	$-7n$
-4	$-4n$	$+28$

$n^2-11n+28$

c) $(t-2)(t+9)$

	t	-2
t	t^2	$-2t$
$+9$	$9t$	-18

$t^2+7t-18$

d) Look at your answers. How do the numbers in your answer relate to the numbers in the factors?

Factoring a Trinomial of the Form x^2+bx+c **(the leading coefficient is 1):**
1. **Always check for a GCF first!** If there is a GCF, factor it out.
2. Multiply a and c. Find the factors of ac.
3. Find the factors of ac that add to **b**.
4. Rewrite the middle term bx as **1st # · x + 2nd # · x.**
5. Factor the resulting polynomial by grouping.
6. If there are no numbers that multiply to c and add to b, the polynomial is prime.

Shortcut (This only works if there is no number in front of the first term.) The leading coefficient must be 1.
1. Find two numbers that multiply to c and add to b.
2. The factored form of x^2+bx+c is $(x+\text{1st \#})(x+\text{2nd \#})$.
3. The factored form of x^2-bx+c is $(x-\text{1st \#})(x-\text{2nd \#})$.
4. The factored form of x^2+bx-c or x^2-bx-c is $(x-\text{1st \#})(x+\text{2nd \#})$.
   The larger number will have the sign of the middle term.

Examples: Factor the following polynomials.

a) $x^2+11x+30$

x + 5

	x	$+5$
x	x^2	$5x$
$+6$	$6x$	30

must Add

30	11x
1 30	1+30
2 15	2+15
3 10	3+10
5 6	5+6

$(x+5)(x+6)$

b) $m^2+8m+12$

m + 2

	m	2
m	m^2	$2m$
$+6$	$6m$	12

must Add

12	8
2 6	2+6

$(m+2)(m+6)$

c) $2b^2+40b+144$

$2(b^2+20b+72)$ MULT ADD

72	20
1·72	1+72=73
2·36	2+36=38
3·24	3+24=27
4·18	4+18=22
6·12	6+12=18
8·9	8+9=17

b^2	
	72

can only factor out
the GCF of 2.

d) $q^2-15q+56$

　　　q　　−7

q^2	$-7q$
$-8q$	56

q ←
−8

$(q-7)(q-8)$

e) $w^2-18w+45$

　　Add　　MULT

$(w\quad -3)$　MULT ADD

45	−18
−3·−15	

w^2	$-3w$
$-15w$	45

w ←
−15

−3·−15

$(w-3)(w-15)$

f) $-5g^2+25g-30$

$-5(g^2-5g+6)$

$(g\quad -2)$

MULT add

6	+5g
−1·6	−1+−6
−2·3	−2+−3

g^2	$-2g$
$-3g$	6

g
−3

$-5(g-2)(g-3)$

g) u^2+6u-9

　　add

−9	6
−1·9	−1·9=8
−3·3	−3+3=0

u^2	
	−9

prime

h) $t^2+6t-40$

　　t　　10　　　−40 add 6

t^2	$10t$
$-4t$	−40

t
−4

10·−4 | 10+−4

$(t+10)(t-4)$

i) h^3+h^2-12h GCF ish

$h^1(h^2+h^1-12)$

　MULT Add

−12	1
−1·12	
−3·4	−3+4

　　h　　−3

h^2	$-3h$
$4h$	−12

h
+4

$h(h-3)(h+4)$

j) n^2-5n-6

　　n　−6

−6	−5
+1·6	5
−2·3	

n^2	$-6n$
$5n$	−6

n
5

$(n-6)(n+5)$

2

k) $x^2 - 3x - 10$

	x	2
x	x^2	2x
-5	-5x	-10

$-10 | -3$
$1 \cdot 70$
$2 \cdot 5 \quad 2 + -5$

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

l) $3x^2 - 6x + 15$

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

x^2		
	5	

$5 | -2$
$1 \cdot 5$
$-1 \cdot 5 \quad -6$

m) $x^2 - 4$

missing term

	x	2
x	x^2	2x
-2	-2x	-4

mult | Add
$-4 | 0x$
$2 \cdot 2$

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

o) $3x^2 - 27$

$3(x^2 - 9)$

	x	-3
x	x^2	-3x
3	3x	-9

Add
$-9 | 0x$
$-3 \cdot 3$

$3(x-3)(x+3)$

p) $x^2 + 144$

x^2		
	144	

$144 | 0x$
$12 \cdot 12 | 24x$
$-12 \cdot 12 | -24x$

prime

1.) $1d^2 + 20d + 96$

$ac = \underline{96} \quad b = \underline{20}$

factors
1·96
2·48
3·32
4·24
6·16
8·12

Which factors add 8,12

$(d+8)(d+12)$

③ $1w^2 + 7w - 18$

$ac = \underline{-18} \quad b = \underline{7}$

Factors
-1·18
-2·9
-3·6

Add to b -2,9

$(w-2)(w+9)$

⑤ $1u^2 - 8u - 8$

Factors of ac
-1·8   1·-8
-2·4   2·-4
Add to -8 none
factor the expression

prime

⑦ $v^2 - 8v + 12$

	v	-2
v	v^2	-2v
-6	-6v	12

$12 | -8v$
$-2 \cdot 6 \quad -2 -6$

$(v-2)(v-6)$