Factoring Summary

(1) factor out the Greatest Common Factor (GCF) *Form for GCF:* $ax^2 + ax + ab = a(x^2 + x + b)$

(2) factor by grouping *(see example below)*

(3) form: $x^2 + bx + c$. Find factors of c that add to get b and multiply to get c.

(4) form: $ax^2 + bx + c$. Use trial and error to find the factored form.

(5) form: $P^2 \pm 2PQ + Q^2$ Then this factors into: $(P \pm Q)^2$ *(called "perfect square")*

(6) form: $\boxed{x^2 - y^2 = (x+y)(x-y)}$

(7) form: $\boxed{x^2 + y^2}$ *(cannot be factored with integers!)*

(8) form: $\boxed{x^3 + y^3 = (x+y)(x^2 - xy + y^2)}$

(9) form: $\boxed{x^3 - y^3 = (x-y)(x^2 + xy + y^2)}$

Examples:

Directions - factor all of the following completely.

(1) $3x^2 + 9x + 15$ has a GCF of 3. (NOTE: ALWAYS FACTOR OUT GCF FIRST!!)

Thus, factoring out 3 yields: $3(x^2 + 3x + 5)$

(Since the expression inside the parintheses cannot be factored, this is the final answer.)

(2) $3x^3 + 2x^2 - 6x - 4$ is a candidate for factoring by grouping. Grouping terms:

$$(3x^3 + 2x^2) + (-6x - 4) = x^2(3x + 2) - 2(3x+2) = (3x + 2)(x^2 - 2)$$

(3) $x^2 + 4x - 12$ Since $a=1$ in the trinomial, need to find factors of -12 that add to get 4.
All the possible pairs of factors for -12 are: 1,-12 ; -1,12 ; 2,-6 ; **-2,6** ; 3,-4 ; -3,4 Since the only pair that adds to 4 is {-2,6} the answer is: **(x - 2)(x + 6)**

(4) $3x^2 + 2x - 8$ Since $a \neq 1$ in the trinomial, use trial and error to find the answer.
The factor pairs of 3 are: {3,1}. The factor pairs for -8 are: {1,-8}, {-1,8}, {2,-4}, {-2,4} By trial and error it is found that the answer is **(3x - 4)(x + 2)**

Sign Hints:

If trinomial has the form:	$ax^2 + bx + c$	then factored form is	$(px + m)(qx + n)$
If trinomial has the form:	$ax^2 - bx + c$	then factored form is	$(px - m)(qx - n)$
If trinomial has the form:	$ax^2 \pm bx - c$	then factored form is	$(px + m)(qx - n)$ **OR** $(px - m)(qx + n)$

(5) $4x^2 - 12x + 9$ is in the form $P^2 \pm 2PQ + Q^2$. Thus, $4x^2 - 12x + 9 = (2x - 3)^2$ ***(perfect square)***

(6) $9x^2 - 36y^2$ is in the form of $x^2 - y^2 = (x + y)(x - y)$. Thus, $9x^2 - 36y^2 =$ **(3x + 6y)(3x - 6y)**

(7) $9x^2 + 36y^2$ is in the form of $x^2 + y^2$. Thus, $9x^2 + 36y^2$ is **non-factorable** using integers.

(8) $8x^3 + 27y^3$ is in the form of $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$. Thus, $8x^3 + 27y^3 = (2x + 3y)(4x^2 - 6xy + 9y^2)$

(9) $8x^3 - 27y^3$ is in the form of $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$ Thus, $8x^3 - 27y^3 = (2x - 3y)(4x^2 + 6xy + 9y^2)$