1.5A Factoring

$$3(x+2) \underset{\text{Factor}}{\overset{\text{Expand/Multiply}}{\rightleftharpoons}} 3x+6$$

To factor is to write an algebraic expression as a product of two or more other algebraic expressions .

Why factor? To arrive at equivalent expressions which are presented in simpler terms which allows us to:

- Solve equations
- Graph relations

In grade 10 you learned how to:

- Common Factor
- Factor by Grouping
- Factor Simple Trinomials
- Factor Complex Trinomials
- Factor a Difference of Squares
- Factor a Perfect Square Trinomial

Common Factoring

Always your first and last step.

2 or more terms

- Take out the greatest common factor.
- Divide the expression by the GCF to find the other factor.

a) $2mn-4mnt$

b) $6t^5-9t^2$

c) $3x^4-6x^3+9x$

d) $4x(a-b)-3(a-b)$

Factor by Grouping

An even # of terms: 4, 6, 8, etc...

- Group terms to form pairs.
- Factor the pairs by finding common factors.
- Factor out the shared common binomial factor.

a) $3x(m-5)+2(5-m)$

The terms *m - 5* and *5 - m* are opposites. This means that one divided by the other is *-1*.

b) $x(y-2)-4(2-y)$

c) $mx+2y+my+2x$

d) $22vx-6vy+11wx-3wy$

e) y^2+1-y^3-y

f) $16x^5+8x^4-6x^3-3x^2+4x+2$

Simple Trinomials

3 terms

$ax^2 + bx + c$ where a = 1

$(x + n_1)(x + n_2)$

M = ac

A = b

$N = n_1, n_2$

a) $x^2 - 9x + 14$

b) $5x^2 + 15x - 140$

c) $a^2 + 8ab + 15b^2$

d) $x^4 + 2x^2b - 24b^2$

Difference of Squares

2 terms

2 perfect squares separated by a subtraction: $a^2 - b^2$

$a^2 - b^2 = (a - b)(a + b)$

conjugates

a) $49x^2 - 16y^2$

b) $3x^2 - 12$

c) $a^2 - \frac{1}{9}$

d) $81 - m^{12}$

e) $(3x-2)^2 - (5x+1)^2$

Complex Trinomials

3 terms

$ax^2 + bx + c$ where $a \neq 1$

$(a_1x + f_1)(a_2x + f_2)$

M = ac

A = b

N = n_1, n_2

1. Use a, n_1 and n_2 to find the factors.

$$\frac{a}{n_1}, \frac{a}{n_2}$$

2. Reduce.

$$\frac{a_1}{f_1}, \frac{a_2}{f_2}$$

OR

Decompose the middle term using n_1, n_2 and factor by grouping.

a) $10x^2 - 11x - 6$

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b) $14x^2 + 31xy - 10y^2$

c) $18a^2b + 3ab - 6b$

d) $3x^4 - 25x^2 - 18$

e) $2x^2 - 3x - 5$

Perfect Square Trinomials

3 terms

$ax^2 + bx + c$

$\left(\sqrt{a}x \pm \sqrt{c}\right)^2$

same sign as b

where a & c are perfect squares and
b is twice the product of their square roots.

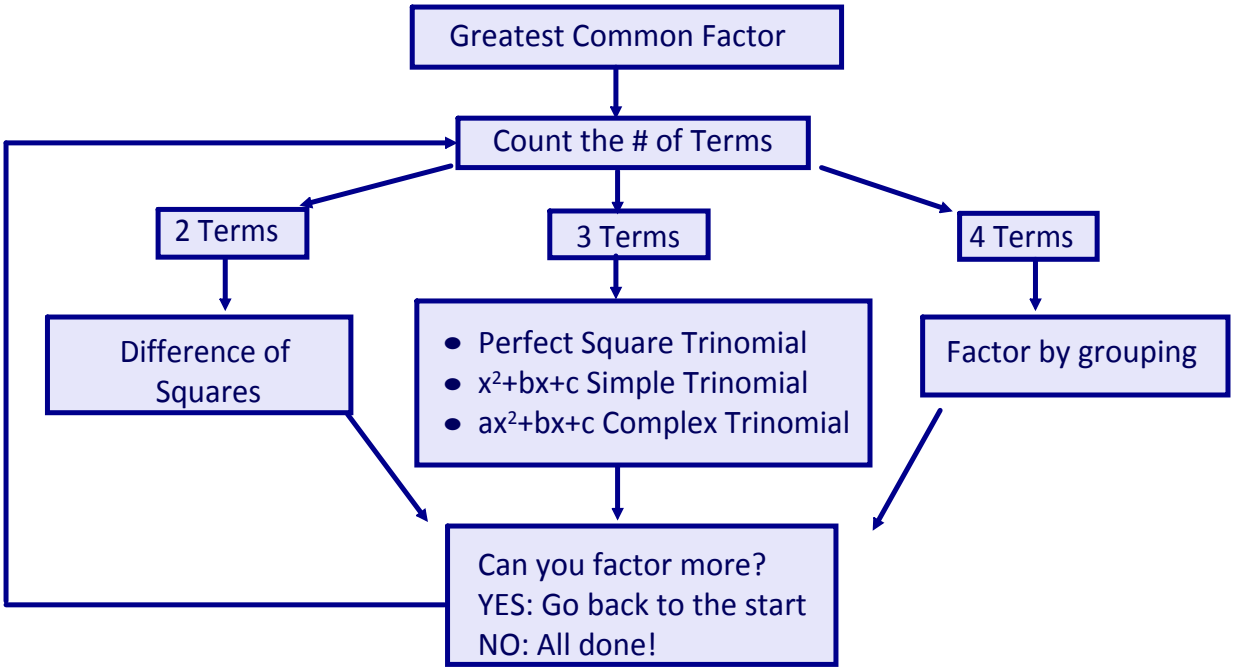
a) $m^2 + 10m + 25$

b) $2x^2 - 24x + 72$

c) $16a^2 + 24a + 9$

d) $x^4 - 8x^2 + 16$

Factoring Flowchart



Check you answer by EXPANDING