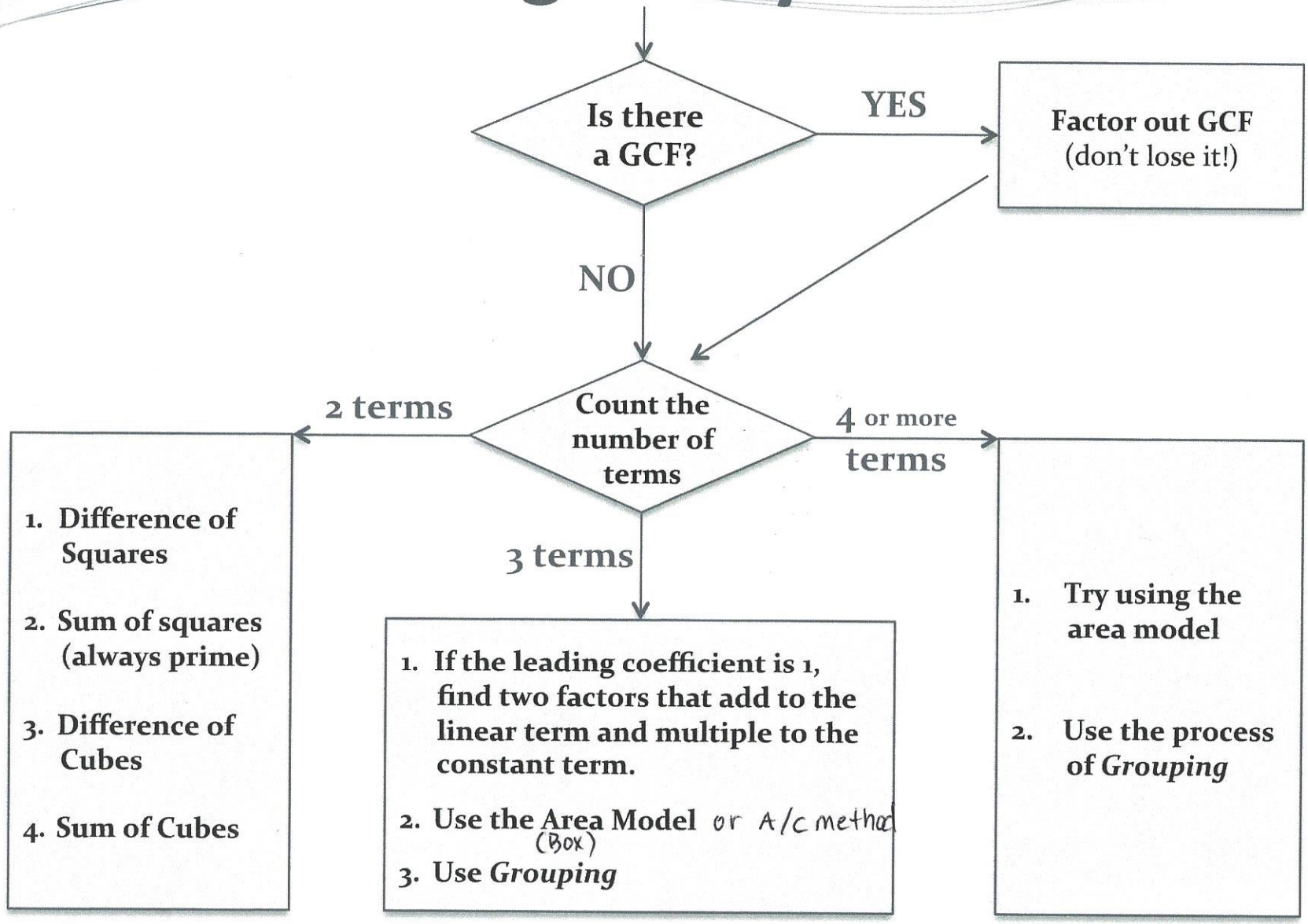
Factoring Polynomials



REMEMBER TO ALWAYS CHECK YOUR WORK!

Factoring Polynomials with 2 terms (Binomials)

Difference of Squares

$x^2 - y^2 = (x + y)(x - y)$

Example: $9x^2 - 4 = (3x + 2)(3x - 2)$

Difference of Cubes

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Example: $x^3 - 27$
So, $a = x$ and $b = 3$
$x^3 - 27 = (x - 3)(x^2 + 3x + 9)$

Sum of Squares

$x^2 + y^2$ = **always prime**

(can't be factored further)

Sum of Cubes

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Example: $8x^3 + 125$
So, $a = 2x$ and $b = 5$
$8x^3 + 125 = (2x + 5)(2x^2 - 10x + 25)$

Factoring Polynomials with 3 terms (Trinomials)

If the leading coefficient is 1, find the two values that add to the linear term and multiply to the constant.

Example: $x^2 - 6x + 8 = (x - 2)(x - 4)$

Using the Area Model

(works in all cases – if not, the polynomial is prime!)

Step 1: Fill in the upper left box with the quadratic term and the lower right box with the constant.
Step 2: Multiply the quadratic term and the constant.
Step 3: Find two terms that add to the linear term and multiply to the product from Step 2. Fill in the last two boxes (in any order) with these two terms.
Step 4: Find the GCF of each row & column. Check that your area model works correctly!

Example: $2x^2 - 9x - 5 = (2x + 1)(x - 5)$

	x	-5
2x	$2x^2$	-10x
1	1x	-5

$(2x^2)(-5) = (-10x^2)$
-10x & 1x

Grouping

(works in all cases – if not, the polynomial is prime!)

Example: $6x^2 - 19x + 10$

Step 1: Split the middle term (–19x in the example above) into the sum or difference of two terms so that the resulting 4-term polynomial can be factored by grouping.
So, $6x^2 - 4x - 15x + 10$

Step 2: Group the first two terms and the last two terms, factoring out the negative sign in the second grouping.
Now we have $(6x^2 - 4x) - (15x - 10)$

Step 3: Factor out the GCF from each group.
This leaves us with $2x(3x - 2) - 5(3x - 2)$

Step 4: Factor out the common group factor – rewrite!
Our solution is: $6x^2 - 19x + 10 = (2x - 5)(3x - 2)$