**REVIEW OF ALL FACTORING METHODS**

**#1. Greatest Common Factor**

1. Find the biggest number that divides into each term.
2. Find the variable with the largest exponent that divides into each term.

The biggest number and the biggest variable make up the Greatest Common Factor (GCF).

1. Write the GCF out in front of a bracket.
2. **Divide** each term in the expression by the GCF to create the terms for the bracket.

**Examples:**

Factor the following:

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3t + 6= 3(t + 2) | b) 2y + 8= 2(y + 4) | c) 2z² + z= z(2z + 1) | d) 8x³ + 12= 4(2x³ + 3) |
| e) 2x² + 4x + 6= 2(x² + 2x + 3) | f) 6x³ + 12x² + 3x= 3x(2x² + 4x + 1) | g) 16t³ + 12t² + 16t5= 4t2(4t + 3 + 4t3) | h) 10x³y + 12x²y² + 16y= 2y(5x³ + 6x²y + 8) |

**#2. Perfect Square Trinomials** (3 terms)

1. Check to see that the first and last terms are perfect squares (you can square root them without resulting in a decimal value).
2. To factor, square root the first term and enter this first in a bracket.
3. Then square root the last term and enter this second in the bracket.
4. Finally, **the sign of the middle term** goes in between the two terms in the bracket and the bracket is squared.

|  |  |  |
| --- | --- | --- |
| Factoring of Perfect Squares: | (a² + 2ab + b²) | = (a + b)(a + b) |
|   | (a² + 2ab + b²) | = (a+b)² |

**Example**

Factor the following:

|  |  |  |
| --- | --- | --- |
| a) x² + 2x + 1= (x + 1)² | b) x² – 2x + 1= (x – 1)² | c) 4x² – 12x + 9= (2x – 3)² |
| d) 16y2 + 40y + 25= (4y + 5)2 | e) a2 – 12a + 36= (a – 6)2 | f) 49x2 + 140x + 100= (7x + 10)2 |

**#3. Simple Trinomials** (3 terms and NO number in front of the x2)

1. Find two values that add up to the middle terms coefficient and multiply to give the last value (the sum of the middle value and product of the last).
2. Enter these two values into two separate brackets with an x before them.

**Example**

Factor the following:

|  |  |  |
| --- | --- | --- |
| a) x² + 4x + 3= (x + 1)(x + 3) | b) x² – 6x – 16= (x + 2)(x – 8) | c) x² + 9xy + 8y²= (x + 1y)(x + 8y) |
| d) y2 – 5y + 6= (y – 3)(y – 2) | e) a2 + 3a – 10 = (a + 5)(a – 2) | f) x2 – 6x – 7 = (x – 7)(x + 1) |

**#4. Difference of Squares** (2 terms separated by a minus sign)

1. Check to see that the two terms are perfect squares (you can square root them without resulting in a decimal value).
2. Take the square root of the first term and put this in each bracket first.
3. Next take the square root of the second term and put this in each bracket second.
4. Give one bracket a (+) and give the other bracket a (–).

a² – b² = (a + b)(a – b)

**Example**

Factor the following:

|  |  |  |
| --- | --- | --- |
| a) x² – 9= (x + 3)(x – 3) | b) 4x² – 25y²= (2x + 5y)(2x – 5y) | c) y2 – 25= (y + 5)(y – 5) |
| d) 16 – a2= (4 + a)(4 – a) | e) 9x2 – 144= (3x + 12)(3x – 12) | f) x2 + 4= cannot be factored *(not a minus sign)* |

**#5. Complex Trinomials** (3 terms and does have a number in front of the x2)

For each of the example expressions below observe the following steps required to factor complex trinomials.

1. Multiply the coefficients of the first and the third term.
2. Break the middle term down into 2 smaller terms. The 2 smaller terms that you pick must multiply to the product from #1 and add to the coefficient of the middle term.
3. Take a GCF from the first 2 terms and a different GCF from the last 2 terms.
4. The terms in the brackets should be identical, so move that bracket to the front and put the leftover terms in a second bracket.

**Example**

Factor the following:

|  |  |  |
| --- | --- | --- |
| a) 2x² + 7x + 3 2 × 3 = 6Middle coefficient = 7What 2 numbers multiply to 6 and add to 7? 1 × 6 = 6 and 1 + 6 = 7 | b) 3x² – 2x – 5 3 × (–5) = –15Middle coefficient = –2What 2 numbers multiply to –15 and add to –2?(–5)(3) = –15 and –5 + 3 = –2 | c) 10x2 + 3x – 1  10 × (–1) = –10Middle coefficient = 3What 2 numbers multiply to –10 and add to 3? –2 × 5 = –10 and –2 + 5 = 3 |
|  2x² + 7x + 3= 2x² + 6x + 1x + 3= 2x(x + 3) + 1(x + 3)= (x + 3)(2x + 1) |  3x² – 2x – 5= 3x² + 3x – 5x – 5= 3x(x + 1) – 5(x + 1)= (x + 1)(3x – 5) | 10x² + 3x – 1= 10x² + 5x – 2x – 1= 5x(2x + 1) – 1(2x + 1)= (2x + 1)(5x – 1) |

**Example**

Factor the following:

|  |  |  |
| --- | --- | --- |
| a) 3x² + 8x + 4= (3x + 2)(x + 2) | b) 2x² – x – 15= (2x + 5)(x – 3) | c) 4x² – 5x – 6= (x – 2)(4x + 3) |
| d) 4y2 + 4y – 3 = (2y – 1)(2y + 3) | e) 2a2 + 3a – 5 = (2a + 5)(a – 1) | f) 2p2 – 3pq + q2 = (2p – q)(p – q) |