Math Help Sheet: Factoring

1st: Rearrange the terms if necessary.
Example: $8x^2 + 18 = 30x$ becomes $8x^2 - 30x + 18 = 0$

2nd: Factor out a monomial, if possible.
Example: $8x^2 - 30x + 18 = 0$ becomes $2(4x^2 - 15x + 9) = 0$

3rd: Consider known patterns:	**Examples:**
$a^2 - b^2 \rightarrow (a + b)(a - b)$	$49x^2 - 25 = (7x + 5)(7x - 5)$
$a^2 + 2ab + b^2 \rightarrow (a + b)^2$	$9x^2 + 12x + 4$ → Try $(3x)^2 + 2(3x)(2) + (2)^2 = (3x + 2)^2$
$a^2 - 2ab + b^2 \rightarrow (a - b)^2$	$4x^2 - 15x + 9$ → Try $(2x)^2 - 2(2x)(3) + 3^2$ This is prime.
$a^3 + b^3 \rightarrow (a + b)(a^2 - ab + b^2)$	$27x^3 + 8 = (3x + 2)(9x^2 - 6x + 4)$
$a^3 - b^3 \rightarrow (a - b)(a^2 + ab + b^2)$	$x^3 - 125 = (x - 5)(x^2 + 5x + 25)$

4th: For $x^2 + bx + c$, when the coefficient of x^2 is 1, we set up as follows:

With $b > 0$ and $c > 0$	$\rightarrow (x + \square)(x + \square)$	Example:	$x^2 + 5x + 6 = (x + 2)(x + 3)$
With $b < 0$ and $c > 0$	$\rightarrow (x - \square)(x - \square)$	Example:	$x^2 + 5x + 6 = (x - 2)(x - 3)$
With $c < 0$	$\rightarrow (x + \square)(x - \square)$	Example:	$x^2 + 5x + 6 = (x + 2)(x - 3)$

5th: For $ax^2 + bx + c$, consider the factors of a and c. Use trial and error.
Example: $4x^2 - 15x + 9 =$ what? Try $(4x - \square)(x - \square)$ and $(2x - \square)(2x - \square)$
Try using 3 and 3, or 9 and 1 for the values of $\square$.
$(4x - 9)(x - 1)$ **No** $(2x - 9)(2x - 1)$ **No** $(4x - 1)(x - 9)$ **No** $(2x - 1)(2x - 9)$ **No**
$\boxed{(4x - 3)(x - 3)}$ **Yes** $(2x - 3)(2x - 3)$ **No**

6th: Use the zero-property to find solutions. Examples:

$8x^2 - 30x + 18 = 0$	$9x^2 - 18 = 27x$
$2(4x - 3)(x - 3) = 0$	$3(3x^2 - 7x - 6) = 0$
$4x - 3 = 0$ **or** $x - 3 = 0$	$3(3x + 2)(x - 3) = 0$
$x = 3/4$ **or** $x = 3$	$x = -2/4$ **or** $x = 3$

Now you try it!

1. Factor $x^2 - 9$

2. Factor $4x^2 + 6x + 9$

3. Factor $3x^2 - 12x + 27$

4. Solve $x^2 - x - 6 = 0$

5. Solve $4x^2 - 3x = 1$

6. Solve $24x^2 - 4 = 4x$

1. $(x + 3)(x - 3)$ 2. $(2x + 3)^2$ 3. $3(x - 3)^2$
4. $x = -2$ or $x = -3$ 5. $x = -1/4$ or $x = 1$ 6. $x = ⅔$ or $x = -1/3$