Ch. 1.3a Evaluating Limits Algebraically

Rules:

1) $\lim_{x\to c} b = b$ 2) Suppose $\lim_{x\to c} f(x) = L$ then $\lim_{x\to c} \boldsymbol{b}f(x) = \boldsymbol{b}L$

I. **Direct Substitution Method:** To find limits for a function, first try to evaluate the argument in the expression (plug in the value). If the resulting value is a Real Number, then the value is the limit (answer).

Example 1:

$a)\ \lim_{x\to 2} x^2 + 3x =$	$c)\ \lim_{x\to -1} 3x^5 - 2x^2 + 7x + 4 =$
$b)\ \lim_{x\to 2} 5 =$	$d)\ \lim_{x\to \pi} x\cos x\ =$

II. **Simplify/Reduction Method** (Factor/Simplify/Substitute) Steps:

1) Evaluate argument First! (plug value into expression)
2) If direct substitution produces $\frac{\mathbf{0}}{\mathbf{0}}$ (indeterminate form), we need to evaluate further

   *Note: $\frac{\mathbf{0}}{\mathbf{0}}$ does not mean the Limit is Undefined. $\frac{\mathbf{0}}{\mathbf{0}}$ just means our problem is incomplete and unfinished. (It's true that the function value is undefined because there's a hole in the graph, but the limit most times does still exist)

3) Factor/Reduce/Simplify: Try finding common factors in order to reduce expression
4) Using the Reduced expression, re-evaluate the limit
5) Confirm resulting value is now a Real Number, therefore the limit (answer)

Example 2:

$a)\ \lim_{x\to -2} \frac{x^2 + 5x + 6}{x + 2} =$	$b)\ \lim_{x\to 1} \frac{x^2 + 5x + 6}{x - 1} =$

Simplify/Reduction Method (Factor/Simplify/Substitute) Steps:

1) Evaluate argument First! (plug in value into expression)
2) If direct substitution produces $\frac{0}{0}$ (indeterminate form), we need to evaluate further
3) Factor/Reduce/Simplify: Try finding common factors in order to reduce expression
4) Using the Reduced expression, re-evaluate the limit
5) Confirm resulting value is now a Real Number, therefore the limit (answer)

Example 2 (continued):

$c)\ \lim_{x\to 2}\dfrac{x^2+5x+6}{x+2}=$

$d)\ \lim_{x\to 2}\dfrac{x^2-4}{x+2}=$

Practice Problems:

1) $\lim_{x\to 1}\dfrac{2x^2-x-3}{x-1}$

2) $\lim_{x\to 3}\dfrac{4x^2-7x-2}{x-2}$

3) $\lim_{x\to -1}\dfrac{x^2-1}{x+1}$

4) $\lim_{x\to 1}\dfrac{x^2-4}{x^2-3x+2}$

5) $\lim_{x\to -3}\dfrac{x^2+x-6}{x^2-9}$

6) $\lim_{x\to 5}\dfrac{5-x}{x^2-25}$