# FLOWCHART #3: FINDING $\lim\limits_{x\to\infty} \dfrac{g(x)}{h(x)}$ (AT INFINITY)

For limits where $x \to \infty$ or $x \to -\infty$, we start with the

STRATEGY FOR LIMITS AT INFINITY:

1. Find the leading term of both $g(x)$ and $h(x)$.
   (the leading term is the term with the highest power of $x$)
2. Discard all other terms. (Set them equal to zero)
3. Cancel any common factors and simplify.

**Are there any variables left?**

- YES → **Where are they?**
  - IN THE NUMERATOR → THE LIMIT DOES NOT EXIST (it may be $\infty$ or $-\infty$)
  - IN THE DENOMINATOR → THE FUNCTION TENDS TO ZERO $\lim\limits_{x\to\infty} \dfrac{g(x)}{h(x)} = 0$
- NO → YOU HAVE A REAL NUMBER $L$ $\lim\limits_{x\to\infty} \dfrac{g(x)}{h(x)} = L$

★ This means the function has a horizontal asymptote at $x = L$

ex/ $$\lim_{x\to\infty} \frac{x+\boxed{3x^2}}{\boxed{6x}} = \lim_{x\to\infty} \frac{3x^{\cancel{2}}}{6\cancel{x}} = \lim_{x\to\infty} \frac{x}{2} = \infty$$

ex/ $$\lim_{x\to-\infty} \frac{\boxed{2x}-4}{\boxed{x^2}+1} = \lim_{x\to-\infty} \frac{2\cancel{x}}{x^{\cancel{2}}} = \lim_{x\to-\infty} \frac{2}{x} = 0$$

ex/ $$\lim_{x\to\infty} \frac{\boxed{2x^2}+x-1}{3\boxed{-x^2}} = \lim_{x\to\infty} \frac{2\cancel{x^2}}{-\cancel{x^2}} = \lim_{x\to\infty} -2 = -2$$