Limits to Infinity

w-up: Give the equation of the horizontal asymptote(if any) for each function. If you do not remember how to find it, use the graphing calculator to help and/or verify your answer.

$A)\quad f(x)=\dfrac{3x+1}{x-1}$ $\qquad B)\quad f(x)=-\dfrac{2}{x^2+1}$ $\qquad C)\quad f(x)=\dfrac{2x^2-1}{x+4}$

Finding Horizontal Asymptotes

Degree of Numerator = Degree of Denominator

$$y=\frac{\text{leading coefficient of numerator}}{\text{leading coefficient of denominator}}$$

Degree of Numerator < Degree of Denominator the H.A.

$$y=0$$

Degree of Numerator > Degree of Denominator the H.A.

NO Horizontal Asymptote(but will have a slant/other asymptote)

Reminder: Horizontal Asymptotes are NOT values which make a function undefined and CAN contain points from the function.

Limit to infinity: The *y*-value a graph approaches as the *x*-values get infinitely large($+\infty$) or infinitely small($-\infty$).

Find the $\lim_{x\to\infty} f(x)$ for the above functions(A-C).

Find the $\lim_{x\to-\infty} f(x)$ for the above functions(A-C).

Use the graphing calculator to evaluate the following limit. $\lim_{x\to\infty}\frac{\sin x}{x}$

ZERO is the limit of any function containing a fraction where the denominator increases without bound but the numerator DOES NOT. NOTE: although zero is the limit, it is NOT a horizontal asymptote! We call this non-asymptotic behavior.

Special Case

EX1) $\lim_{x\to\infty}\sin x$

OSCILLATION

Infinite Limits when *Limits are taken to Infinity*(so, the limit DNE but can be denoted with $\pm\infty$)

EX2) $\lim_{x\to\infty} x^3-1{,}000{,}000{,}000{,}000x-1{,}000{,}000{,}000{,}000$

HIGHEST POWER WINS!

EX3) $\lim_{x\to-\infty}\frac{3x^2-2x+1}{x+4}$

Determine the sign of infinity by dividing signs of numerator and denominator!

EX4) $\lim_{x\to\infty}\frac{3x-2}{\sqrt{2x^2+1}}$

EX5) $\lim_{x\to-\infty}\frac{3x-2}{\sqrt{2x^2+1}}$