Extra Limit Problems Name ________________
Period ________________

1) $\lim_{x \to 0} \left[\frac{\sin 3x}{5x} = \frac{1}{5} \cdot \frac{\sin 3x}{3x} \cdot \frac{3}{1}\right] = \frac{1}{5}(1)(3) = \frac{3}{5}$

2) $\lim_{x \to 0} \left[\frac{x^3 - 7x}{x^3} = \frac{x(x^2-7)}{x^3} = \frac{x^2-7}{x^2}\right] = -\infty$

3) $\lim_{x \to -3} \left[\frac{x+3}{x^3+27} = \frac{\cancel{x+3}}{\cancel{(x+3)}(x^2-3x+9)}\right] = \frac{1}{9+9+9} = \frac{1}{27}$

4) $\lim_{x \to 4} \left[\frac{-1}{(3+\sqrt{x+5})}\right]$
$= \frac{+(3-\sqrt{x+5})}{}$
Duh!! $= \frac{-1}{6}$

5) $\lim_{x \to 4} \left[\frac{(3-\sqrt{x+5})(3+\sqrt{x+5})}{(x-4)(3+\sqrt{x+5})}\right]$
$= \frac{9-(x+5)}{(x-4)(3+\sqrt{x+5})}$
$= \frac{-(\cancel{4-x})}{(\cancel{x-4})(3+\sqrt{x+5})} = -\frac{1}{6}$

5) $\lim_{x \to 1} \left[\frac{x^3-1}{x^2-2x+1} = \frac{\cancel{(x-1)}(x^2+x+1)}{\cancel{(x-1)}(x-1)}\right]$
$= DNE$
$\lim_{x \to 1^-} f(x) = \frac{3}{-0} = -\infty$
$\lim_{x \to 1^+} f(x) = \frac{3}{+0} = \infty$

6) $f(x) = \begin{cases} ax+b & x>2 \\ 3 & x=2 \\ b-ax^2 & x<2 \end{cases}$ Solve for a and b so that $\lim_{x \to 2} f(x)$ exists

$2a+b=3$
$b-4a=3$

$-2a-b=-3$
$-4a+b=3$
$-6a=0$
$a=0$
$b=3$

7) $\lim_{x \to \infty} \frac{x+3}{x^2-5x+2} = 0$

8) $\lim_{x \to -\infty} \frac{2x-1}{7-5x} = -\frac{2}{5}$

9) $\lim_{x \to \infty} \left[x - \sqrt{x^2+7}\right.$ $= \infty - \infty$ Ind ... nope

$= \frac{x-\sqrt{x^2+7}}{1} \cdot \frac{x+\sqrt{x^2+7}}{x+\sqrt{x^2+7}} =$

$= \frac{x^2-(x^2+7)}{x+\sqrt{x^2+7}} = \left.\frac{-7}{x+\sqrt{x^2+7}}\right] = \frac{-7}{\infty}$
$= 0$

10) $\lim_{x \to -\infty} x - \sqrt{x^2+7}$
$-\infty - \infty = -\infty$

11) $\lim_{x \to \infty} \tan(\frac{1}{\sqrt{x}})$
$= \tan(0) = 0$

12) $f(x) = \begin{cases} \frac{x-1}{x^2-1} & x<1 \\ \frac{x-1}{\sqrt{x+8}-3} & x \geq 1 \end{cases}$

a) $\lim f(x)$ *as* $x \to 1$

b) $\lim f(x)$ *as* $x \to e-2$

(a) $\lim_{x \to 1^+} \left[\frac{(x-1)(\sqrt{x+8}+3)}{(\sqrt{x+8}-3)(\sqrt{x+8}+3)}\right.$
$\left.\frac{\cancel{(x-1)}(\sqrt{x+8}+3)}{\cancel{(x+8)-9}}\right]$
$= 3+3 = 6$

(a) $\lim_{x \to 1^-} \frac{\cancel{x-1}}{(x+1)\cancel{(x-1)}} = \frac{1}{2}$

$\therefore \lim_{x \to 1} f(x) = DNE$

(b) $e \approx 2.7$
$e-2 \approx 0.7$
$f(x)$ is continuous @ $x \neq 1$

$\therefore \lim_{x \to e-2} f(x) = \frac{(e-2)-1}{(e-2)^2-1} = \frac{e-3}{e^2-4e+4-1} = \frac{e-3}{e^2-4e+3}$
$= \frac{e-3}{(e-3)(e-1)} = \frac{1}{e-1}$