L'HÔPITAL'S THEOREM
FINDING LIMITS:
TO USE L'HÔPITAL'S RULE OR NOT,
THAT IS THE QUESTION.

Let the $U = \mathbb{R}$ and the codomain of each function on this worksheet be $\mathbb{R}$

Find the following limits and use L'Hôpital's rule (where appropriate) . Justify the methodology used for finding the limit (bulldozer, algebraic manipulation, plug-in method, L'Hôpital's rule, or our limit theorems (handout 1.5):

Exercise 4 – 1: Let $U = \mathbb{R}$. Define c as $c(\mathrm{x}) = \frac{\mathrm{x}^2}{\mathrm{e}^{\mathrm{x}}}\ \forall\ \mathrm{x} \in \mathbb{R}$. Find $\lim\limits_{\mathrm{x}\longrightarrow 0}(c(\mathrm{x})) = \lim\limits_{\mathrm{x}\longrightarrow 0}\left(\frac{\mathrm{x}^2}{\mathrm{e}^{\mathrm{x}}}\right)$

Exercise 4 – 2: Let $U = \mathbb{R}$. Define c as $c(\mathrm{x}) = \frac{\mathrm{x}^2}{\mathrm{e}^{\mathrm{x}}}\ \forall\ \mathrm{x} \in \mathbb{R}$ Find $\lim\limits_{\mathrm{x}\longrightarrow \infty}(c(\mathrm{x}))$

Exercise 4 – 3: Let $U = \mathbb{R}$. Define g as $g(\mathrm{x}) = \frac{\mathrm{x}^2}{\sin(\mathrm{x})}\ \forall\ \mathrm{x} \in \mathbb{R} \setminus \{\mathrm{x}:\mathrm{x}\neq k\pi,\ k\in\mathbb{Z}\}$.

Find $\lim\limits_{\mathrm{x}\longrightarrow 0}(g(\mathrm{x}))$

Exercise 4 – 4: Let $U = \mathbb{R}$. Define g as $g(\mathrm{x}) = \frac{\mathrm{x}^2}{\sin(\mathrm{x})}\ \forall\ \mathrm{x} \in \mathbb{R} \setminus \{\mathrm{x}:\mathrm{x}\neq k\pi,\ k\in\mathbb{Z}\}$.

Find $\lim\limits_{\mathrm{x}\longrightarrow \infty}(g(\mathrm{x}))$

Exercise 4 – 5: Let $U = \mathbb{R}$. Define f as $f(\mathrm{x}) = \mathrm{x}\cdot\ln(\mathrm{x})\ \forall\ \mathrm{x} \in (0,\infty)$ Find $\lim\limits_{\mathrm{x}\longrightarrow 0}(f(\mathrm{x}))$

Exercise 4 – 6: Let $U = \mathbb{R}$. Define f as $f(\mathrm{x}) = \mathrm{x}\cdot\ln(\mathrm{x})\ \forall\ \mathrm{x} \in (0,\infty)$ Find $\lim\limits_{\mathrm{x}\longrightarrow \infty}(f(\mathrm{x}))$

Exercise 4 – 7: Let $U = \mathbb{R}$. Let f: D $\longrightarrow \mathbb{R}$ be defined by $f(\mathrm{x}) = \frac{\mathrm{x}^2+2\mathrm{x}-8}{\mathrm{x}^2+\mathrm{x}-6}$ where

D = $(-\infty, -3)\cup(-3,2)\cup(2,\infty)$ Find $\lim\limits_{\mathrm{x}\longrightarrow -3}(f(\mathrm{x}))$

Exercise 4 – 8: Let $U = \mathbb{R}$. Let f: D $\longrightarrow \mathbb{R}$ be defined by $f(\mathrm{x}) = \frac{\mathrm{x}^2+2\mathrm{x}-8}{\mathrm{x}^2+\mathrm{x}-6}$ where

D = $(-\infty, -3)\cup(-3,2)\cup(2,\infty)$ Find $\lim\limits_{\mathrm{x}\longrightarrow 2}(f(\mathrm{x}))$

Exercise 4 – 9: Let $U = \mathbb{R}$. Let f: D $\longrightarrow \mathbb{R}$ be defined by $f(\mathrm{x}) = \frac{\mathrm{x}^2+2\mathrm{x}-8}{\mathrm{x}^2+\mathrm{x}-6}$ where

D = $(-\infty, -3)\cup(-3,2)\cup(2,\infty)$ Find $\lim\limits_{\mathrm{x}\longrightarrow 1}(f(\mathrm{x}))$

Exercise 4 – 10: Let $U = \mathbb{R}$. Let l: $(-\infty, -3) \cup (-3, \infty) \longrightarrow \mathbb{R}$ be defined by $l(x) = \dfrac{4x^2 + x - 7}{3x^3 + x}$

Find $\lim\limits_{x \longrightarrow \infty} l(x)$

Exercise 4 – 11: Let $U = \mathbb{R}$. Let l: $(-\infty, -3) \cup (-3, \infty) \longrightarrow \mathbb{R}$ be defined by $l(x) = \dfrac{4x^2 + x - 7}{3x^3 + x}$

Find $\lim\limits_{x \longrightarrow 3} l(x)$

Exercise 4 – 12: Let $U = \mathbb{R}$. Let l: $(-\infty, -3) \cup (-3, \infty) \longrightarrow \mathbb{R}$ be defined by $l(x) = \dfrac{4x^2 + x - 7}{3x^3 + x}$

Find $\lim\limits_{x \longrightarrow -3} l(x)$

Exercise 4 – 13: Let $U = \mathbb{R}$. Define $k : D \longrightarrow \mathbb{R}$ by $k(x) = x \cdot \tan(x)$ where $D = (-\frac{\pi}{2}, \frac{\pi}{2})$

Find $\lim\limits_{x \longrightarrow 0} \left(f(x) \right)$

Exercise 4 – 14: Let $U = \mathbb{R}$. Define $k : D \longrightarrow \mathbb{R}$ by $k(x) = x \cdot \tan(x)$ where $D = (-\frac{\pi}{2}, \frac{\pi}{2})$

Find $\lim\limits_{x \longrightarrow \frac{\pi}{2}} \left(f(x) \right)$