DATE: ________________

L'Hôpital (or no pital) Homework

1. Evaluate the limit, if it exists: $\lim_{x\to 0} \frac{x^2+x-6}{2-x}$ $= \frac{0^2+0-6}{2-0} = \frac{-6}{2} = \boxed{-3}$

no L'Hôpital

(A) 5
(B) 3
(C) -2
$\boxed{\text{(D)}}$ -3
(E) The limit does not exist

2. Evaluate the limit, if it exists: $\lim_{x\to 0} \frac{\sin 4x}{x^2+8x}$ $\Rightarrow \frac{\sin 4(0)}{0^2+8(0)} = \frac{\sin 0}{0} = \frac{0}{0}$ L'Hôpital rule applies

$= \lim_{x\to 0} \frac{4\cos 4x}{2x+8} = \frac{4\cos 4(0)}{2(0)+8} = \frac{4\cos 0}{8} = \frac{4(1)}{8} = \boxed{\frac{1}{2}}$

(A) 0
$\boxed{\text{(B)}}$ $\frac{1}{2}$
(C) 1
(D) $\frac{\pi}{2}$
(E) ∞

3. Evaluate the limit, if it exists: $\lim_{x\to 2} \frac{\frac{1}{x}-\frac{1}{2}}{x-2}$ $= \frac{\frac{1}{2}-\frac{1}{2}}{2-2} = \frac{0}{0}$ L'Hôpital rule applies

$= \lim_{x\to 2} \frac{x^{-1}-\frac{1}{2}}{x-2}$

$= \lim_{x\to 2} \frac{-x^{-2}}{1} = -2^{-2} = -\frac{1}{2^2} = \boxed{-\frac{1}{4}}$

(A) $\frac{1}{4}$
$\boxed{\text{(B)}}$ $-\frac{1}{4}$
(C) 1
(D) -1
(E) The limit does not exist.

4. Let $f(x)$ be a differentiable function with the properties that $\lim_{x\to 0} f(x^2+3x) = 0$ and $\lim_{x\to 0} f'(x^2+3x) = 4$. Then, $\lim_{x\to 0} \frac{f(x^2+3x)}{\sin x}$ $\Rightarrow \frac{0}{\sin 0} = \frac{0}{0}$ L'Hôpital rule applies

$= \lim_{x\to 0} \frac{(2x+3)\cdot f'(x^2+3x)}{\cos x}$

chain, chain, chain...

$= \frac{(2(0)+3)\cdot 4}{\cos 0} = \frac{3\cdot 4}{1} = \boxed{12}$

(A) 0
(B) 3
(C) 4
$\boxed{\text{(D)}}$ 12
(E) ∞

For #5 & #6, use the table below.

x	1	2	3
$f(x)$	0	-2	2
$g(x)$	$\frac{1}{2}$	0	1
$f'(x)$	3	0	-3
$g'(x)$	5	7	4

5. Find $\lim_{x\to 1} \frac{f(x)+g(x)}{f(2x)}$ $= \frac{f(1)+g(1)}{f(2\cdot 1)} = \frac{0+\frac{1}{2}}{f(2)} = \frac{\frac{1}{2}}{-2} = \frac{1}{2}\cdot -\frac{1}{2} = \boxed{-\frac{1}{4}}$

6. Find $\lim_{x\to 3} \frac{f(g(x))}{g(f(x))}$ $\Rightarrow \frac{f(g(3))}{g(f(3))} = \frac{f(1)}{g(2)} = \frac{0}{0}$ L'Hôpital rule applies

$\lim_{x\to 3} \frac{g'(x)\cdot f'(g(x))}{f'(x)\cdot g'(f(x))} = \frac{g'(3)\cdot f'(g(3))}{f'(3)\, g'(f(3))} = \frac{4\cdot f'(1)}{-3\cdot g'(2)} = \frac{4\cdot 3}{-3\cdot 7} = \boxed{-\frac{4}{7}}$