

L'Hopital's Rule:	Suppose that $f(a)=g(a)=0$, that f & g are differentiable on an open interval containing a , and that $g'(x) \neq 0$ on : then $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{g'(x)}$
Examples:	$\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2} = \frac{0}{0} \Rightarrow$ Use L'Hopital's Rule - Take derivative of numerator and denominator \Rightarrow $\lim_{x \rightarrow 2} \frac{2x}{1} = \boxed{4}$
	$\lim_{x \rightarrow 1} \frac{x-1}{\sqrt{x}-1} = \frac{0}{0} \Rightarrow$ Use L'Hopitals: $\lim_{x \rightarrow 1} \frac{1}{\frac{1}{2\sqrt{x}}} = \lim_{x \rightarrow 1} \frac{2\sqrt{x}}{1} = \boxed{2}$
	$\lim_{x \rightarrow 2} \frac{x^2 - 4}{x + 2} = \frac{0}{4} = \boxed{0} \Rightarrow$ You cannot use L'Hopital's Rule on this problem! Why??

Evaluate each Limit. Use L'Hopital's Rule where appropriate.

1	$\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$	2	$\lim_{x \rightarrow 0} \frac{\sin 5x}{x}$
3	$\lim_{x \rightarrow 2} \frac{\sqrt{2+x} - 2}{x - 2}$	4	$\lim_{x \rightarrow 1} \frac{\sqrt[3]{x} - 1}{x - 1}$
5	$\lim_{x \rightarrow 2} \frac{x^2 - 4x + 4}{x^3 - 12x + 16}$	6	$\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{1 + \cos 2x}$
7	$\lim_{x \rightarrow 1} \frac{x^3 - 1}{4x^3 - x - 3}$	8	$\lim_{x \rightarrow 3} \frac{x - 4}{x - 2}$

Find each derivative.

9	$f(x) = e^{\sqrt{x}}$	10	$y = e^{4 \ln x}$
11	$y = 3^{x+1}$	12	$y = \sqrt{4x^2 + 4x}$
13	$g(x) = \cos^3 5x$	14	$y = \ln(xe^{2x})$
15	$y = \ln \sin x $	16	$f(x) = x^{\cot 2x}$

Answers:

1) 3	2) 5	3) $\frac{1}{4}$	4) $\frac{1}{3}$
5) $\frac{1}{6}$	6) $\frac{1}{4}$	7) $\frac{3}{11}$	8) -1

9) $f'(x) = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$	10) $y' = 4x^3$	11) $\frac{dy}{dx} = 3^{x+1}(\ln 3)$	12) $y' = \frac{2x+1}{\sqrt{x^2+x}}$
13)	14)	15) $y' = \cot x$	16)