Info...

Test 3 review videos are posted!

Note the due date on Homework 10.

We will have an ONLINE review for Test 3 Friday from 4-6pm.

#4 2 Reviews Posted.

24	25 EMCF26 due at 9am Notes: page, 4-per Homework 9 due in lab/workshop	26	27 EMCF27 due at 9am Blank Slides: page, 4-per $\boxed{\text{Homework 10 posted}}$ Last day to drop with a W	28 #3	29 EMCF28 due at 9am Quiz in lab/workshop $\boxed{\text{Online Review from 4-6pm. A link will appear}}$	30 Quiz 9 closes (10.1-10.3) Test 3 starts Check the dates on CourseWare
31	April 1 EMCF29 due at 9am	2	3 Homework 10 due in lab/workshop	4	5	6 Quiz 10 closes (10.4-10.5)

Popper 20

1. $\lim\limits_{x\to\infty}\dfrac{100x^2}{e^x}=$

2. $\lim\limits_{x\to\infty}\dfrac{100\ln(x)}{x^2}=$

* 3. $\lim\limits_{x\to\infty} x\sin\left(\dfrac{1}{x}\right)=$

* 4. $\lim\limits_{x\to 0}\dfrac{x-\tan(x)}{x-\sin(x)}=$

5. $\lim\limits_{x\to 0}\dfrac{1-\sec(x)}{x^2}=$

DNE = 999

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* 3. $\lim\limits_{x\to\infty} x\sin\left(\dfrac{1}{x}\right)=\lim\limits_{x\to\infty}\dfrac{\sin\left(\overbrace{\tfrac{1}{x}}^{=u}\right)}{\underbrace{\tfrac{1}{x}}_{=u}}$ $u\to 0$

$$\boxed{\lim_{u\to 0}\frac{\sin(u)}{u}=1}$$

$$=\lim_{u\to 0}\frac{\sin(u)}{u}$$

$$=1$$

$$\lim_{x\to\infty}\underbrace{17x}_{\to\infty}\cdot\overbrace{\frac{1}{x}}^{\to 0}=17$$

* 4. $\lim_{x\to 0} \dfrac{x-\tan(x)}{x-\sin(x)} =$ "$\frac{0}{0}$" ind. form

Try L-H:

$\lim_{x\to 0} \dfrac{1-\sec^2(x)}{1-\cos(x)} =$ "$\frac{0}{0}$" ind form

Think or Use L-H rule 2 more times.

Note: $\sec^2(x) = \dfrac{1}{\cos^2(x)}$

$= \lim_{x\to 0} \dfrac{\cos^2(x)}{\cos^2(x)} \cdot \dfrac{1-\sec^2(x)}{1-\cos(x)}$

$= \lim_{x\to 0} \dfrac{\cos^2(x)-1}{\cos^2(x)(1-\cos(x))}$

$= \lim_{x\to 0} \dfrac{\cancel{(\cos(x)-1)}(\cos(x)+1)(-1)}{\cos^2(x)\cancel{(1-\cos(x))}}$

$= \dfrac{-2}{1} = -2$

Recall:

L'Hospital's Rule: $\boxed{(0/0)}$ Case.

Theorem *Suppose that f and g are differentiable functions with $g'(x) \neq 0$, and suppose*

$$f(x) \to 0 \text{ and } g(x) \to 0$$

as $x \to c^+, c^-, c, \infty, -\infty$. *Let L be a real number or $\pm\infty$.*

If $\dfrac{f'(x)}{g'(x)} \to L$ *then* $\dfrac{f(x)}{g(x)} \to L$

and...

L'Hospital's Rule: $\boxed{(\infty/\infty)}$ Case. Same deal.

Theorem *Suppose that f and g are differentiable functions with $g'(x) \neq 0$, and suppose*

$$f(x) \to \pm\infty \text{ and } g(x) \to \pm\infty$$

as $x \to c^+, c^-, c, \infty, -\infty$. *Let L be a real number or $\pm\infty$.*

If $\dfrac{f'(x)}{g'(x)} \to L$ *then* $\dfrac{f(x)}{g(x)} \to L$

Recall: $\lim_{x\to 0^+} (\underbrace{e^x + 2x}_{\to 1})^{1/x \to \infty} = e^3$

There is no way we would have ever guessed this.

"1^∞" ind. form.

Example: $\lim_{x\to\infty} (\underbrace{e^x + 2x}_{\to\infty})^{1/x \to 0} = e$ "∞^0" ind. form

Note: $e^{\ln\left((e^x+2x)^{1/x}\right)} = (e^x+2x)^{1/x}$

$\| $

$e^{\boxed{\frac{\ln(e^x+2x)}{x}}}$ ← investigate this. $\to e^1 = e$

$\lim_{x\to\infty} \dfrac{\ln(e^x+2x)}{x}$ "$\frac{\infty}{\infty}$" ind. form

$= \lim_{x\to\infty} \dfrac{\frac{e^x+2}{e^x+2x}}{1} = \lim_{x\to\infty} \dfrac{e^x+2}{e^x+2x}$

$= \lim_{x\to\infty} \dfrac{\cancel{e^x}}{\cancel{e^x}} \dfrac{\left(1+\frac{2}{e^x}\right)}{\left(1+\frac{2x}{e^x}\right)} = 1$

Example: $\displaystyle\lim_{x\to\infty}\big(\underbrace{x^2+2x}_{\to\infty}\big)^{1/x \to 0} = 1$ "∞^0" ind form

Note: $(x^2+2x)^{1/x} = e^{\ln\left((x^2+2x)^{1/x}\right)}$

$= e^{\boxed{\frac{\ln(x^2+2x)}{x}}} \to e^0 = 1$

$\displaystyle\lim_{x\to\infty} \frac{\ln(x^2+2x)}{x}$ "$\frac{\infty}{\infty}$" ind. form

Try L-H: $\displaystyle\lim_{x\to\infty} \frac{\frac{2x+2}{x^2+2x}}{1}$

$\displaystyle = \lim_{x\to\infty} \frac{2x+2}{x^2+2x} = 0$