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** **Homework 10 posted** **Last day to drop with a W**	28 #3	29 **EMCF28 due at 9am** Quiz in lab/workshop **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. $\lim_{x\to\infty} \frac{100x^2}{e^x} =$

2. $\lim_{x\to\infty} \frac{100\ln(x)}{x^2} =$

* 3. $\lim_{x\to\infty} x \sin\left(\frac{1}{x}\right) =$

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

5. $\lim_{x\to 0} \frac{1-\sec(x)}{x^2} =$

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* 3. $\lim_{x\to\infty} x \sin\left(\frac{1}{x}\right) =$ $\lim_{x\to\infty} \frac{\sin\left(\frac{1}{x}\right)}{\frac{1}{x}}$ $\frac{1}{x} = u$ $u \to 0$

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

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

$= 1$

$\lim_{x\to\infty} 17x \cdot \frac{1}{x}$ $= 17$

$17x \to \infty$, $\frac{1}{x} \to 0$

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

"$\frac{0}{0}$" ind. form

Try L-H:

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

"$\frac{0}{0}$" ind form

Think or Use L-H rule 2 more times.

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

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

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

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

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

Recall:

L'Hospital's Rule: (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* $\pm\infty$.

$$\text{If } \frac{f'(x)}{g'(x)} \to L \text{ then } \frac{f(x)}{g(x)} \to L$$

and...

L'Hospital's Rule: (∞/∞) 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 $\pm\infty$.

$$\text{If } \frac{f'(x)}{g'(x)} \to L \text{ then } \frac{f(x)}{g(x)} \to L$$

Recall: $\lim\limits_{x\to 0^+}\left(e^x+2x\right)^{1/x} = e^3$

($e^x + 2x \to 1$, $1/x \to \infty$)

There is no way we would have ever guessed this.

"1^∞" ind. form.

Example: $\lim\limits_{x\to\infty}\left(e^x+2x\right)^{1/x} = e$

($e^x + 2x \to \infty$, $1/x \to 0$) "∞^0" ind. form

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

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

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

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

$= \lim\limits_{x\to\infty} \dfrac{e^x}{e^x}\,\dfrac{\left(1+\frac{2}{e^x}\right)}{\left(1+\frac{2x}{e^x}\right)} = 1$ ($\frac{2}{e^x} \to 0$, $\frac{2x}{e^x} \to 0$)

Example: $\lim_{x\to\infty}\left(x^2+2x\right)^{1/x}$ $= 1$

$1/x \to 0$; $x^2+2x \to \infty$

"∞^0" ind form

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

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

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

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

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