Worcester Polytechnic Institute
Department of Mathematical Sciences
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Fall 2020 - A Term

MA 1023
Calculus III

Conference 1 – Ideas
Covers material from Lecture 1-3 & Active Learning 1

1. Calculate the following limits with and without using l'Hôpital's rule:

   a) $\lim\limits_{x\to 1} \dfrac{x^8-1}{x-1}$ b) $\lim\limits_{y\to 0} \dfrac{\sin(y)\cos(y)}{\sin(2y)}$ c) $\lim\limits_{z\to 0} \dfrac{\tan(z)}{1-\cos(z)}$

2. Calculate the following limits of fractions

   a) $\lim\limits_{x\to 0} \dfrac{8x^2}{\cos(x)-1}$ b) $\lim\limits_{\varphi\to \frac{\pi}{2}} \dfrac{1-\sin(\varphi)}{1+\cos(2\varphi)}$ c) $\lim\limits_{t\to 0} \dfrac{t\sin(t)}{1-\cos(t)}$

3. Calculate the following limits of products, powers and differences

   a) $\lim\limits_{x\to 0} x^2e^{-x}$ b) $\lim\limits_{y\to 1+} y^{\frac{1}{1-y}}$ c) $\lim\limits_{x\to\infty} \big(1+2x\big)^{\frac{1}{2\ln(x)}}$

   d) $\lim\limits_{z\to\infty} \Big(\dfrac{z^2+1}{z+2}\Big)^{\frac{1}{z}}$ e) $\lim\limits_{y\to 0+} \Big(\dfrac{3y+1}{y} - \dfrac{1}{1-\cos(y)}\Big)$

4. Explain what it means to say that

   $$\lim_{x\to 0+} \Big(\frac{1}{x}\Big)^x = 1.$$

   Why this makes sense even though the base is infinity zero for $x = 0$, the exponent is zero and ∞^0 is not defined? Your answer might be a mix of text, graphics and mathematical expressions.