

Name: Solutions

Math 105: Fall 2012

Quiz: November 30

Correct answers accompanied by incorrect or incomplete work will not receive full credit. Good Luck!

1. Use the Intermediate Value Theorem (IVT) to show that $f(x) = e^x \ln(x+1) \cos(\pi x)$ has a root between 2 and 3.

note $f(x)$ is continuous on $[2, 3]$ because each factor e^x , $\ln(x+1)$, $\cos(\pi x)$ is continuous on $[2, 3]$

$$f(2) = e^2 \ln(3) \cos(2\pi) = 8.12$$

$$f(3) = e^3 \ln(4) \cos(3\pi) = -27.84$$

note $y=0$ is between $f(2)$ and $f(3)$ so there is some c between 2 and 3 such that $f(c) = 0$.

2. What (if anything) does the Extreme Value Theorem (EVT) tell us about $f(x) = e^x \ln(x+1) \cos(\pi x)$ on the interval $(2, 3)$? Explain your answer.

The EVT tells us nothing because one of the hypotheses of the EVT is not satisfied: namely, the interval is not closed.

3. What (if anything) does the Mean Value Theorem (MVT) tell us about $f(x) = e^x \ln(x+1) \cos(\pi x)$ on the interval $[2, 3]$? Explain your answer.

Note that $f(x)$ is continuous on $[2, 3]$ because each factor e^x , $\ln(x+1)$, $\cos(\pi x)$ is continuous on $[2, 3]$.

Note that $f(x)$ is differentiable on $(2, 3)$ because each factor is.

$$\frac{f(3) - f(2)}{3 - 2} = \frac{-27.84 - 8.12}{3 - 2} = -35.96$$

The MVT tells us that there is c between 2 and 3 such that the tangent line at $x=c$ has slope equal -35.96 .