

Math 241

Project 1

Due Monday 10/2

1) Continuity of Cosine

a. Prove that $\lim_{\theta \rightarrow 0} \cos \theta = 1$, θ in radians

b. Prove that $\lim_{\theta \rightarrow 0} \frac{1 - \cos \theta}{\theta} = 0$, θ in radians

(Assuming you haven't proved that $\cos \theta$ is continuous.)

c. Explain why the unit circle definition of $\cos \theta$ insures that it is defined for all θ

d. Prove that $f(x) = \cos x$ is a continuous for all x

2) Hyperbolic Trigonometric Function

a. Provide a definition of $\sinh(\alpha)$ and $\cosh(\alpha)$ based off of area related to the graph of the unit hyperbola.

b. Use your definition in (a) to prove the identity $\cosh^2 \alpha - \sinh^2 \alpha = 1$.

c. Provide formulas for $\sinh(\alpha)$ and $\cosh(\alpha)$ based on the natural exponential.

d. Use your formulas in (c) to prove the identity $\cosh^2 \alpha - \sinh^2 \alpha = 1$.

e. Explain what a catenary curve is.

f. Explain how St. Louis' Gateway Arch relates to this discussion.