MAT – 112: Calculus I and Modeling

Logarithm and Exponent Derivatives

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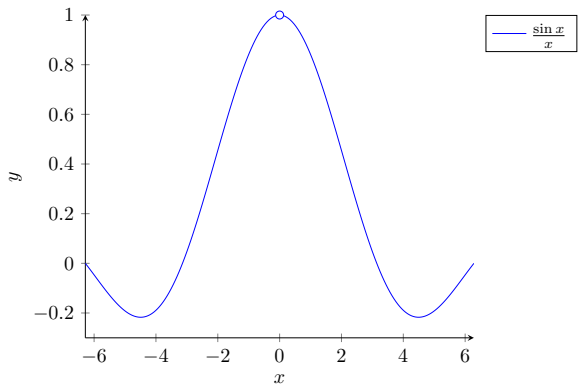
Instructions

Below is a list of trigonometric identities that you will need for today's class.

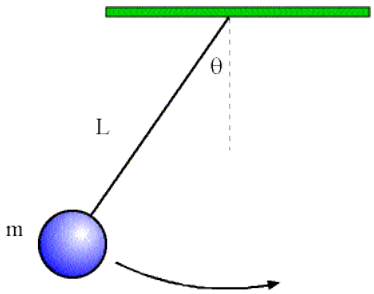
Trigonometric Identities. Let x, y be real numbers. Then

$$\sin^2 x + \cos^2 x = 1$$
$$\tan x = \frac{\sin x}{\cos x}$$
$$\sin(x + y) = \sin x \cos y + \sin y \cos x$$

An Important Lemma. Consider the graph below.



Application. A simple pendulum, see figure below, consists of a mass m



hanging from a string of length L from a fixed pivot point. When displaced to an initial angle θ_0 and released, the pendulum will swing back and forth with periodic motion described by the equation

$$\theta(t) = \theta_0 \cos(\sqrt{\frac{g}{L}}t),$$

where g is the force of gravity and t is the time elapsed since the mass was released.

1. Find an expression for $\theta^{'}(t)$.
2. Evaluate $\theta^{'}(t)$ at the points t where the displacement is maximized and zero. Interpret your results.