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Math 110-004: Calculus I

Lab Test # 3, Oct. 26, 1999.

Name:

1- Find the derivative of $f(x) = \sec^2(x^3)$ and of $g(x) = \tan^2(x^3)$. You should get the same answer in both cases. Why is that?

$\frac{5}{5}$

$f(x) = \left(\frac{1}{\cos(x^3)}\right)^2 = (\cos(x^3))^{-2}$ $f'(x) = -2(\cos(x^3))^{-3}(-\sin(x^3))3x^2$

$= \frac{6x^2\sin(x^3)}{\cos^3(x^3)} = 6x^2\tan x^3 \sec^2(x^3)$ ✓

$g(x) = (\tan(x^3))^2$ $g'(x) = 2(\tan(x^3))(\sec^2(x^3))(3x^2)$

$= 6x^2\tan(x^3)\sec^2(x^3)$ ✓

$\cos^2 x + \sin^2 x = 1$

$1 + \tan^2 x = \sec^2 x$

$\sec^2 x = \tan^2 x$

$\frac{d}{dx}$ $1 + \tan^2 x = 0 + 2(\tan x^3)(\sec^2 x^3)3x^2$

$= 6x^2\tan x^3\sec^2 x^3$

$\therefore$ they are the same because $1+\tan^2 x = \sec^2 x$ and the derivative of 1 is 0. good!

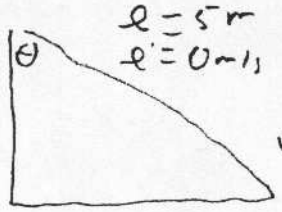
2- A ladder 5 meters long rests against a vertical wall, and the bottom of the ladder is sliding away from the wall. Let θ be the angle between the ladder and the wall, and $H(\theta)$ be the height of the top of the ladder in terms of the angle θ. Find $H'(\theta)$ and $H'(\pi/4)$.

$\frac{5}{5}$

$\cos\theta = \frac{adj}{hyp} = \cos\theta\, \ell = H$

$\ell = 5m$

$\ell' = 0m/s$



$H(\theta)$ ✓

$H(\theta) = 5\cos\theta$ ✓

$\sin \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

$\boxed{H'(\theta) = -5\sin\theta}$ ✓

$H'\left(\frac{\pi}{4}\right) = -5\sin\left(\frac{\pi}{4}\right)$ ✓

$= -\frac{5\sqrt{2}}{2}$ m/rad ✓

good!