$-3\pi/2$

$-\pi$ ⊕ O

$-\pi/2$

Math 180, Quiz 7 Retest: Tuesday, March 19, 2013

Take fifteen minutes to complete this quiz. Please show all your work, and write your name on the front *and* back of the paper before turning it in. Make sure to show all relevant work.

1. **(4 pts)** Find the absolute extrema of $f(x) = \dfrac{1}{\cos x - 1}$ on the interval $\left[\dfrac{-3\pi}{2}, \dfrac{-\pi}{2}\right]$.

$f'(x) = \dfrac{-(-\sin(x))}{(\cos x - 1)^2}$

$\sin(x) = 0 \Rightarrow x = \ldots, -\pi, 0, \pi, \ldots$

$\cos(x) = 1 \Rightarrow x = \ldots, -2\pi, 0, 2\pi, \ldots$

$\Rightarrow$ Critical point: $x = -\pi$

$f\left(\dfrac{-3\pi}{2}\right) = \dfrac{1}{\cos\left(\dfrac{-3\pi}{2}\right) - 1} \cdot = \dfrac{1}{0-1} = -1$ max

$f(-\pi) = \dfrac{1}{\cos(-\pi) - 1} = \dfrac{1}{-1-1} = \dfrac{-1}{2}$ min

$f\left(\dfrac{-\pi}{2}\right) = \dfrac{1}{\cos\left(\dfrac{-\pi}{2}\right) - 1} = \dfrac{1}{0-1} = -1$ max

2. **(5 pts)** One person begins walking west from a building at 4 mph. At the same time, another person begins walking south towards the same building at 3 mph. After some time passes, both people are one mile from the building. At this point, how quickly is the distance between the two people changing?

3 mph

1 mi $\{$ ↓ $z = \sqrt{2}$ mi

□ → 4 mph

1 mi

x
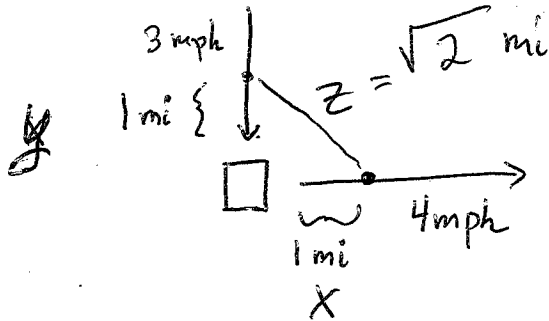
$x^2 + y^2 = z^2$ (Pythagorean theorem)

$2xx' + 2yy' = 2zz'$

$z' = \dfrac{xx' + yy'}{z} = \dfrac{(1\text{ mi})(4\text{ mph}) + (1\text{ mi})(-3\text{ mph})}{\sqrt{2}\text{ mi}}$

$= \boxed{\dfrac{1}{\sqrt{2}}\text{ mph}}$

3. **(1 pt)** Suppose f and f^{-1} are differentiable functions, and that you are given the values

x	$f(x)$	$f'(x)$
0	3/2	1/2
1	2	1/2
3/2	19/8	1
2	3	3/2
5/2	31/8	2
3	5	5/2

What is $(f^{-1})'(2)$? (Show at least enough work that I can tell you didn't just make a lucky guess!)

Recall:

$f(f^{-1}(x)) = x$

$f'(f^{-1}(x))(f^{-1})'(x) = 1$

$(f^{-1})'(x) = \dfrac{1}{f'(f^{-1}(x))}$

$f^{-1}(2) = 1 \qquad f'(1) = \dfrac{1}{2}$

$(f^{-1})'(3) = \dfrac{1}{1/2} = \boxed{2}$