Calculus I Quiz 8

Name:

Pledge:

SHOW ALL WORK. Any answers without work will not receive full credit.

1. Approximate $\cos(\pi/4 + .03)$, where $f(x) = \cos x$, $a = \pi/4$, $\Delta x = 0.03$.

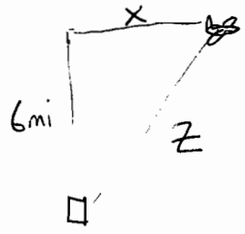
$f(x+\Delta x) \approx f'(x)\Delta x + f(x)$ $\qquad f'(x) = -\sin x$

$\cos(\pi/4 + .03) \approx -\sin(\pi/4)(.03) + \cos(\pi/4)$

$\approx \boxed{-\frac{\sqrt{2}}{2}(.03) + \frac{\sqrt{2}}{2}}$

2. At a given moment, a plane passes directly above a radar station at an altitude of 6 miles.
a) If the plane's speed is 500 mph, how fast is the distance between the plane and the station changing half an hour later?

D



E $x^2+6^2=z^2$

D $2x\frac{dx}{dt}+0=2z\frac{dz}{dt}$

S $2(250)(500)=2(\sqrt{250^2+6^2})\frac{dz}{dt}$

$$\frac{2(250)(500)}{2(\sqrt{250^2+6^2})}\frac{mi}{hr}=\frac{dz}{dt}$$

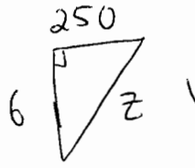
R known: 6 mi above

$\frac{dx}{dt}=500\,mi/hr$

unknown: $\frac{dz}{dt}=?$

$\frac{1}{2}$ hr later $\Rightarrow x=500\frac{mi}{hr}\cdot\frac{1}{2}hr=$

$x=250\,mi$



$\sqrt{250^2+6^2}=z$

b) How fast is the distance between the plane and the station changing when the plane passes directly above the station?

Here, $x=0$. So

$2x\frac{dx}{dt}=2z\frac{dz}{dt}$

$\frac{2(0)(500)}{2z}=\frac{2z\frac{dz}{dt}}{2z}$

$$0\frac{mi}{hr}=\frac{dz}{dt}$$