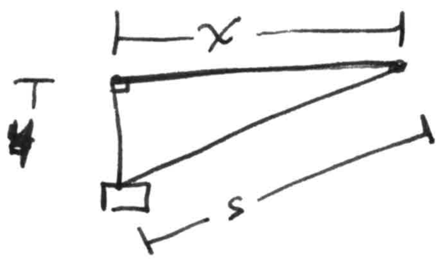
Quiz #5 Math 1131 November 18, 2013

Name: Key Section: ____________

You have 15 minutes to complete the quiz.

Please **show all work**, and then **write your answer on the line provided.**

1. An airplane flies directly over a radar station, at a constant altitude of 4 mi above the ground. A little while later, the radar station measures that (a) the distance between the plane and radar station equals 5 mi and (b) that the distance between the plane and radar station is increasing at a rate of 300 mi/hr. What is the ground speed of the airplane at the time of the second measurement?



$$4^2 + x^2 = s^2$$ 1pt

$$\Rightarrow \frac{d}{dt}(4^2 + x^2) = \frac{d}{dt}(s^2)$$ 2pt

$$2x\frac{dx}{dt} = 2s\frac{ds}{dt}$$

$$x \cdot \frac{dx}{dt} = s \cdot \frac{ds}{dt}$$ 2pt

When $s = 5$, $\frac{ds}{dt} = 300$

$$x \cdot \frac{dx}{dt} = 5 \cdot 300 = 1500$$ 2pt

what is x?

$$4^2 + x^2 = s^2 = 5^2$$

$$16 + x^2 = 25$$

$$x^2 = 9$$

$$x = \sqrt{9} = 3$$ 2pt

$$3 \cdot \frac{dx}{dt} = 5 \cdot 300$$

$$\boxed{\frac{dx}{dt} = 500}$$ 1pt

2:58

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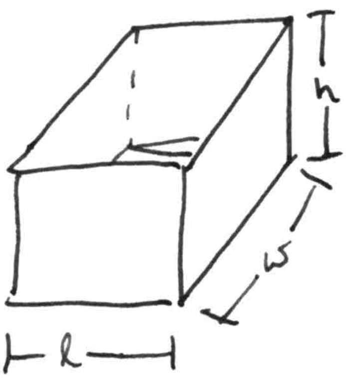
2. You are designing a rectangular display box with an open top. The box should have a volume of 1 m^3, and the length of the base should equal the width of the base. The material for the base costs \$4 per square meter, and the material for the sides costs \$2 per square meter. Find the cost of the materials for the cheapest container.

   You must show all work, but you do **NOT** need to verify that the cost is a minimum.



$V = 1 = l \cdot w \cdot h$ $\qquad l = w$

$1 = l \cdot l \cdot h$

$h = \frac{1}{l^2}$ 2pt

2pt

$\text{Cost} = 2(\text{area of sides}) + 4(\text{area of base})$

$= 2(l \cdot h + l \cdot h + w \cdot h + w \cdot h) + 4(l \cdot w)$

$= 2 \cdot (2lh + 2\overset{l}{\overset{\shortparallel}{w}}h) + 4 \cdot lw$

$= 2 \cdot 4lh + 4lw$

$= 8lh + 4l\overset{l}{\overset{\shortparallel}{w}}$

$C = 8l \cdot \frac{1}{l^2} + 4l^2 = \boxed{\frac{8}{l} + 4l^2}$ 2pt

$C' = \frac{-8}{l^2} + 8l$ 2pt

$C'(x) = 0 \iff 0 = \frac{-8}{l^2} + 8l \iff \frac{8}{l^2} = 8l$

$\iff 8 = 8l^3$

$l^3 = 1$

$\boxed{l = 1}$ 1pt

$\text{Cost} = \frac{8}{1} + 4 \cdot 1^2$

$= 8 + 4$

$\boxed{\text{Cost} = 12}$ 1 pt

4:02