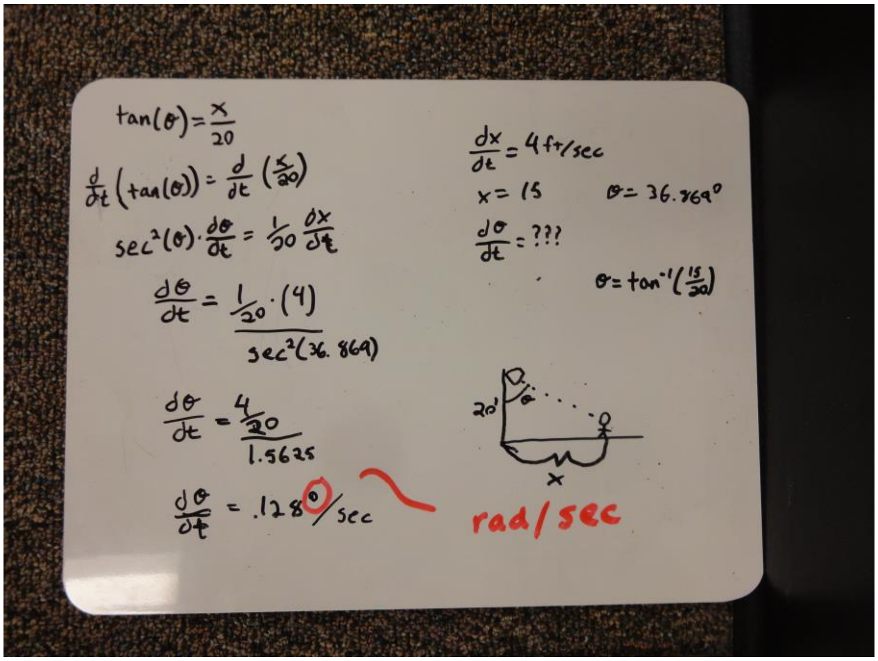
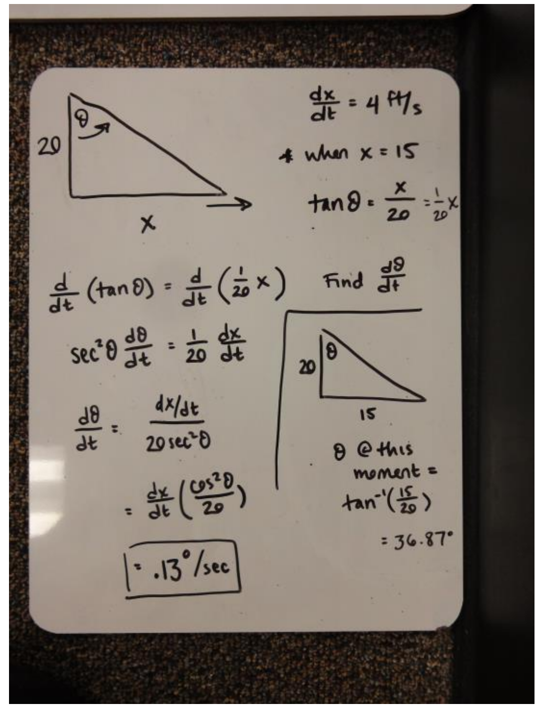
Related Rates Problem:





Some observations we made:

(1) The units should be radians/sec.

(2) We can model $\tan\theta = \dfrac{x}{20}$ as $\theta = \tan^{-1}\left(\dfrac{x}{20}\right)$ (It's tempting to do this since this problem is inquiring about the angle.) However, it's not obvious how to differentiate $\theta = \tan^{-1}\left(\dfrac{x}{20}\right)$ due to the inverse tangent function. Thus, most would prefer moving forward with $\tan\theta = \dfrac{x}{20}$; this is the case with the work seen above.

(3) Both boards above find $\theta \approx 36.87^{\circ}$. However we only need the $\cos\theta$ to solve the problem. As we saw in class, the right triangle ends up being a variation of the 3-4-5 triangle that we (might) recognize so we can find $\cos\theta = \dfrac{20}{25}$ to avoid finding theta. You don't have to do this; it's just a neat observation!

Differentials (Blue Sphere Problem):

$dV \approx 277 \text{ cm}^3$ which initially seems outrageous. <u>Translation</u>: If our radius measurement is off by just 0.05 cm, our volume calculation seems to suffer quite a bit—it could miss the target by as much as 277 cm^3! Hmmmmmm……this needs to be interpreted with caution since the volume of a "perfect" sphere (with $r = 21$ cm) is around $38{,}792 \text{ cm}^3$ (check it!). Suddenly, the 277 cm^3 value looks small in comparison. We found the relative error in computing the volume of the sphere to be quite small (<1% in fact).