

## SUPPLEMENTAL HW NOTE

AST110B 7 Feb 2008.

\* Also, start the HW in advance - it takes time to do properly.

READ THIS PLEASE!

H: Class -

(and I am concerned)

After grading several of the problems on HW#2, it became clear to me that there are some people who are still having significant trouble with the trigonometry stuff. Apart from posting the solutions, I thought I'd go through one of the graded problems step-by-step for you here to resolve confusion (I hope).

(not just trig.)

Let me remind you that you can (and should) come talk to me if anything is confusing. Or raise it in class and we can discuss. However, I depend on you to ~~initiate~~ initiate this since I cannot tell if you are confused unless you tell me. Consider that your obligation to me (and to yourself) so you learn the most from this class. \*

In short, don't be afraid or tentative about making sure things get set straight - you will get a lot more out of the class if you do that and you will have a much better overall experience if you do that. I depend on you to hold up that part of the bargain and I'll hold up mine.

The step-by-step trig. problem is on the next page...

- Froney.

→ Ex: trig problem for practice.

"Find a Star's Diameter", Assignment #2, Problem #6.

(See your graded HW to see how you did on this one...)

You are given: Betelgeuse has angular size 0.044 arcsec.

Betelgeuse is 427 ly away

What is diameter of Betelgeuse?

FIRST: "Convert the angular size to degrees."

Why? because when in doubt, it is safe to do so when you use the equations given.

(i.e., by default, use standard units: meters, seconds, degrees, etc.)

$$\theta = 0.044''$$

But, use conversion "factors of one"

Why? because you run the risk of multiplying instead of dividing and other such problems if you take a shortcut

$$\theta = 0.044'' \times \left(\frac{1'}{60''}\right) \times \left(\frac{1^\circ}{60'}\right) = 1.22 \cdot 10^{-5} \text{ deg}$$

Note: keep the units around in  $1.22 \cdot 10^{-5}$  deg.

and writing out the "factors of one" will help you keep straight which units go on top + bottom for canceling.

SECOND: "convert the distance to meters"

why? again, standard units are safe.

$$l = 427 \text{ ly} \times \left( \frac{9.46 \cdot 10^{15} \text{ m}}{1 \text{ ly}} \right) = 4.04 \cdot 10^{18} \text{ m.}$$

THIRD: Now that we have our variables set, we can solve for the physical size (the diameter in this case), which I call "d".

There are two ways to approach this, and they both will work. You should decide on the one that you are comfortable with and stick with it.

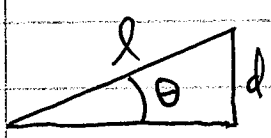
(See next page)

My Way

$$\sin \theta = \frac{d}{l}$$

↑  
degrees

← Meters   ← Meters



( I like using this since it is more graphical / visual )

Book Way

$$d = \theta \frac{2\pi l}{360^\circ}$$

↑   ↑   ← Meters

Meters   degrees

[ NOTE : Was this what Andrea Lommen gave you in lecture when I was gone? If so, good - I had assumed she gave you something else which is much more complicated. Sorry for the confusion on that ]

Let's solve for d using both methods...

My WayRe-arrange and solve for  $d$ :

$$d = l \sin \theta$$

$$d = (4.04 \cdot 10^{18} \text{ m}) \sin(1.22 \cdot 10^{-5} \text{ deg})$$

$$d = (4.04 \cdot 10^{18} \text{ m}) (2.13 \cdot 10^{-7})$$

$$\underline{d = 8.6 \cdot 10^{11} \text{ m}}$$

Book Way

$$d = \theta \frac{2\pi l}{360^\circ}$$

$$d = (1.22 \cdot 10^{-5} \text{ deg}) \frac{2\pi (4.04 \cdot 10^{18} \text{ m})}{360 \text{ deg}}$$

$$d = \frac{3.09 \cdot 10^{14} \text{ m}}{360}$$

$$\underline{d = 8.6 \cdot 10^{11} \text{ m}}$$

Both methods give the same answer (good).

Convert to km if you like:  $8.6 \cdot 10^{11} \text{ m} \times \left(\frac{1 \text{ km}}{10^3 \text{ m}}\right) = 8.6 \cdot 10^8 \text{ km}$ 

(more on next page...)

If the problem had asked ~~for~~ to solve for  $\theta$  or  $l$  instead, we could re-arrange the equations to suit.

CAVEAT : When using "My Way", and when solving for  $\theta$ , you'll need to use  $\sin^{-1}$  (called "inverse sine" or "arcsine") on your calculator. IF THIS IS TOTALLY MYSTIFYING TO YOU, then try the "book way" and see if you are more comfortable with that.

My suggestion: try a problem or two with your chosen method and make sure you got it. I can help if stuck.

Also note: this example problem took about four pages to do, though I did belabor some of the points for illustration. But ~~for~~ when you do this on the HW, it might take  $\frac{1}{2}$  ~~or~~ <sup>or</sup> 1 page. i.e., don't cram it into 2 lines - ~~just~~ <sup>just</sup> show your work + steps explicitly!