

The Last Set of Word Problems

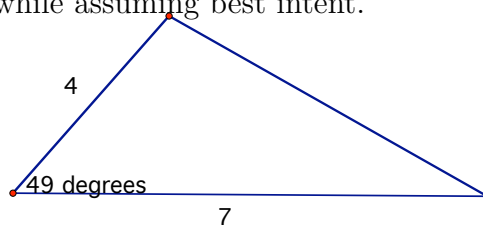
There will be a chance to earn up to 4% extra credit for final exam. Each point will correspond with one of the following:

- Mastery of the problem: Do you understand all of the steps in solving the problem? Would you be able to solve the problem if given a slightly different question?
- Presentation of the problem: You are presenting *new* material to your classmates that will be on their exam next week. Your peers need this time to be *taught* the material (not merely shown an example). Take care to explain the steps you take and why you take them.
- Presentation: Do all group members speak (needed for everyone to get the extra credit!)? Did you anticipate questions from the audience?
- Fielding questions: Can you understand someone's question about the material and formulate a cohesive answer? Note that these will be posted in the threaded discussion so you will have to monitor your post and make sure to answer questions in a timely fashion.

As always, while working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

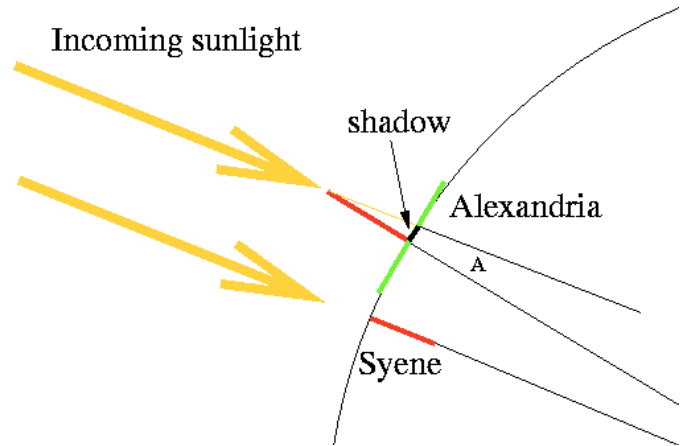
1. The following triangle is not a right triangle.



- (a) Calculate the area of the triangle:
 - (b) If you are given the lengths of two sides of a triangle and the angle between them, find a formula to compute the area of the given triangle.
 - (c) Explain/justify the formula you derived in part (b).
2. Suppose a triangle with area 6 has sides of lengths 3 and 8. Find the angle between these two sides. Be careful.
 3. Consider a moving pod that is 8 ft by 8ft by 16 feet. If you have a (very heavy) white board that is 17 feet long and 4 feet high, will it fit in the moving pod? What about a curtain rod that is 20 feet long?
 4. Find the distance that the earth travels in 1 day in its path around the sun. Use the approximations that a year is 365 days and that the path of the earth around the sun is a circle. Find the distance the earth travels in December. Assume the distance from the middle of the sun to the middle of the earth is 92.96 million miles.

5. A weather balloon is floating above a straight road. To estimate its height above the ground, the balloonists simultaneously measure the angle of depression to two consecutive mileposts on the road on the same side of the balloon. The angles of depression are found to be 20° and 22° . How high is the balloon?

6. Eratosthenes learned that at noon on the summer solstice the sun shone directly down a deep well in a town called Syene. Eratosthenes was surprised to notice in his home of Alexandria the sun was not directly overhead at noon on that day but in fact cast a 12.28m shadow of a 100 m building. He realized he might be able to compute the distance around the earth! To help with the computation Eratosthenes hired a man to measure (by walking) from

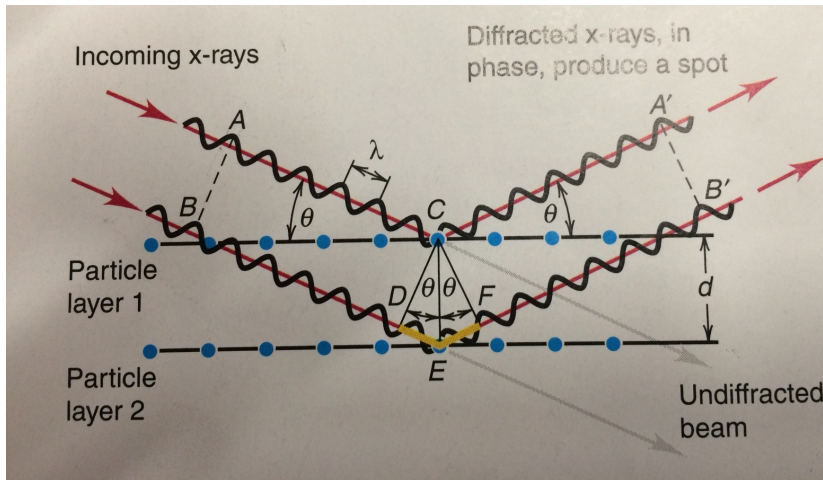


Alexandria to Syene who confirmed a distance of 800km. Use this data and the picture shown above to find the distance around (a great circle of) the earth.

7. A block is sliding down a frictionless ramp with an angle of inclination of 60° . The block is sliding down the ramp with an acceleration of $9.16 \frac{m}{s^2}$. Use trigonometry to find out which of the following planets the block is on:

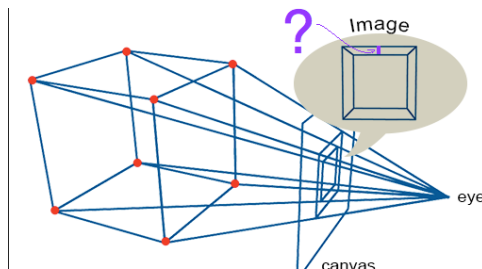
Planet	gravity in ($\frac{m}{s^2}$)	Planet	gravity in ($\frac{m}{s^2}$)	Planet	gravity in ($\frac{m}{s^2}$)
Mercury	3.724	Jupiter	24.89	Neptune	11.662
Venus	8.918	Saturn	10.58	Mars	3.724
Earth	9.8	Uranus	8.918		

8. Interference patterns of bright and dark regions appear when light passes through adjacent slits spaced at the distance of the light's wavelength. Since x-ray wavelengths are about the same size as the spaced between layers of particles in many solids, the spaces act as 'slits' and diffract x-rays. We can use this fact to measure the distance (d) between layers of atoms (a key feature in a crystal structure).



Find how out of phase wave B will be with A. That is, find the distances $DE + EF$.

9. Some bugs have a cycles where the population booms and then dwindles significantly due to regular environmental conditions or breeding habits of the bugs themselves. Consider one such bug whose population in 1995 was recorded at its highest levels to be 300,000 in one area. This population dropped to 177,000 by 2003 but it they again reached the 300,000 level in 2011.
 - (a) Create a model using a sinusoidal formula to write the population as a function of times in years.
 - (b) What will the bug population be in 2018?
10. You'd like to project the image of a box on a screen as shown in the figure below. Assume the box you'd like to project has dimensions $2' \times 2' \times 2'$ and will be $3'$ "behind" the screen. Assume that the eye is 2 feet away from the center of the screen. Note that the image on the screen is of a "box inside a box". Find the width of this "box inside a box" that is colored purple in the figure below.



11. Create your own problem. You must have this approved by the instructor.