Some Hints for HW0,1

Math 321

Points:
1. Concept of vector (mag+direction). Properties of vector (space).
2. How to represent a vector and the direction vector (unit vector, unit is 1). Several angles and spherical coordiantes (using top view and side view)

1 Part of the hints for hw0

1. π (180 degree. We'll use radian a lot.) To show this, draw a line which goes through A and is parallel to BC.
2. $\pi/2$. Connect O and B. Use the property that if two edges of a triagle have the same length then the opposite angles are equal.
3. $\angle AOC = 2\angle ABC$. Connect BO and extend it so that BO intersects AC at D.
4. Denote the triagle as $\triangle ABC$. D midpoint of BC. E midpoint of AB. F midpoint of AC. AD, CE intersect at G. Suppose BG intersects AC at F'. Our goal is to show that F and F' are the same.
Here is one option: Connect DE. Draw a line which goes through D and is parrallel to CE, intersecting BF' at H. Connect HE.
You can show that DH and GE have the same length and thus $DHEG$ is a parallelogram. Then BF' goes through the midpoint of DE. Then F' must be the midpoint of the AC. (Later, we can show this using VECTORS)
5 should be solved using similar arguments. I talked about it in 301, 302. If you are still confused, just ask. (Later, we could show this using vectors.)
6. Also talked in 301, 302.

2 Hw 1

1. We need 2 numbers to specify the direction in $3D$ space. We need 3 numbers to specify a general vector. However,the direction has magnitude 1, thus you can be convinced that we can only use 2 numbers to specify the direction. Please figure out which two numbers you need. (Hint:The angles)
5. $\hat{r} = \cos\varphi\hat{x} + \sin\varphi\hat{y}$, $\hat{\varphi} = -\sin\varphi\hat{x} + \cos\varphi\hat{y}$, $\hat{z} = \hat{z}$
6. Similar to 5. But please figure this out and compare with that in book or online.
7. I'll do $A(1,1,1)$ as an example. Spherical: distance between O and A is $\sqrt{3}$. The angle between OA and $\hat{z}$ can be computed as $\theta = \cos^{-1}(< 1,1,1 > \cdot < 0,0,1 > /\sqrt{3})$. The angle φ can be determined using TOP VIEW. The angle is $\pi/4$. The coordinate is $(\sqrt{3}, \cos^{-1}(\sqrt{3}/3), \pi/4)$.
The cylindrical is easy which is $(\sqrt{2}, \pi/4, 1)$.

8. The hint is that you can change back to Cartesian coordinate and use the rules in Cartesian coordiante. Then switch back to spherical coordinate.