#	Question	Answer(s)
1	Kind of a funny question—where can I find the link for this zoom on the 16A website? I always just go back to the very first piazza post to find it	Links are posted in the calendar on the course website.
2	are there labs on Monday?	There will be no lab next week!
3	when we are in person, how are office hours held?	TAs and ASEs would be in an office/small classroom and you could walk in for any questions/discussion topics you had.
4	What's the difference between trilateration and triagulation	Trilateration uses the distance from the reference. Triangulation uses the angles to do a similar calculation.
5	So are we just trying to make right triangles and solving for the unkown side?	No, we're going to use the distance from multiple satellites and find a position that is that distance from each satellite
6	Can't d1 = d2 if the person is between the satellites?	yes. the more important thing is that the satellites are not in the same place.
7	what if d1 = d2 but they're on opposite sides of me	That's fine. As long as the satellites are not on top of each other.
8	wait why cant we just use one satellite again?	There will be two possible points (on either sides of the satellite) with the same distance.
9	Does this have anything to do with degree of polynomial and number of solutions?	It's not the degree of the polynomial, but the dimensionality. Close though
10	why is V speed and not velocity	We don't have any measure of direction or vector, so its just speed.
11	What does APS mean?	Acoustic / Audio Position System. This is our mock GPS system that we'll use in lab
12	Wait so why in a trilateration system the three satelites can't be co-linear?	Because you don't have full dimensionality, you'll have a linearly dependent measurement. We'll see this more in the math later.
13	does the signal have to contain information about the initial time the satellite sent the signal?	yup!
14	Is it more complicated to have synced clocks and a one way signal or a two way signal but no synced clocks?	More complicated to do the latter. Having synchronized clocks between satellites is a very helpful way to facilliate communication
15	Why is GPS 3*10^8m/s if we cannot use light to measure distance since it would be blocked by clouds?	Any EM wave travels in the speed of light.
16	How does the satellite send the signal to so many devices over the world simultaneously?	It sends signals to everywhere, i.e. broadcasting.
17	wait so for 3d situation, we only need four satellite spheres? does this mean for 4d situations, we'd need 5?	correct!
18	whar's a sample?	A sample means the signal at a certain time stamp (a certain moment). Here it's the code of the song at a certain time.
19	wouldn't you want to reduce the size of the sample too?	it depends on the information in the song. Depending on the rate the song is played, we may not need to sample too fast.
20	sample as song or time for max distance	Having a long song in time helps the song travel further without repeating / looping. Ex: if the full length of the song equals 55 meters in distance, every 55 meters will look the same in the song.
21	Can u explain again why we need longer "songs"?	Since the "song" is repeating, when we receive it, we don't know home many times it has repeated while propagating in the space, so we have the ambiguity issue. A long "song" helps to increase the distance we can measure without ambiguity.
22	why is gps 300 km and aps 55 m	GPS travels at speed of light. APS travels at speed of sound, much slower. So in the same amount of time, APS will travel not as far

23	How do we synchronize when to start receiving?	In our course we assume clocks are synchronized. The exact time to start receiving actually does not matter. What matters is the time delay. We can start receiving at any time.
24	How long do we listen to the song before we make a decision	That depends on the system. If the song is really clear / loud, we may be able to very quickly determine how far we are. If the song is really quiet or unclear, then we may need a longer wait time to build confidence in our distance.
25	How are ties broken between which shift the received signal most closely matches?	We try to design the songs so that "ties" never happen, except when we have multiples of the distance (i.e. if the song is 55m, then 10m, 65m, 120m, etc. will be the same; then there are some other methods).
26	wait what are the red numbers in the recieved signal and how did we get them from the shift?	the red numbers in the "r" are just assuming some random noise.
27	will a question like this be in scope for the midterm?	No, this lecture is not in scope for Monday's midterm
28	Why the length is 5 if norm is sqrt 5	live answered
29	if the shift is 1, why is it [3, 0, 1, 2] instead of [1, 2, 3, 0]?	When we receive the signal, we have time delay. So if "0" is sent out at t=0, we will receive it at t=1; then "1" is sent out at t=1, we receive it at t=2; so we have [3, 0, 1, 2].
30	why don’t we use absolute value instead of squaring?	There is a different norm (the 1-norm) that does use absolute value. But we're specifically using the euclidean norm, which uses square root. Depending on the setting, you may use one or the other. For geometry, we use eucliean norm. Think of your trig rules (x^2 + y^2 = z^2).
31	why does sign matter? everything is squared and only addition is inside the root	Yes $\|r-s\|^2$ and $\|s-r\|^2$ will be the same.
32	Why do we only need 24 satellites for the globe?	the short answer is that number gives full coverage of the globe with the fewest satellites.
33	How did she expand (r-s)^2 into (r-s)^T*(r-s)	If we write r and s as a column vectors (recall Module 1), then $\|r-s\|^2$ will be the same as a matrix multiplication (r-s)^T*(r-s)
34	why do we need to square it if all of the values in the norm are squared	It help us get rid of the square root and make the math nicer.
35	Why cant we just calculate the euclidian norm of the difference between r and every shift vector and then square that value? Why should we do $\|ei\|^2$?	"the euclidian norm of the difference between r and every shift vector and then square that value" is exactly $\|ei\|^2$
36	i thought the norm was just a scalar value so how can we exapnd $\|e\|^2$ to this?	The terms we expanded to still give us scalar values
37	how is $\|s_i\|^2$ not dependent on i?	We assume s_i all have the same values, since it wraps circularly.
38	Is inner product just dot product?	Yes
39	Is inner product dot product?	yes
40	what does <v, w> indicate? do the <> tell us we’re taking the dot product of two vectors?	Yes
41	is there an outer product too?	yes. Instead of v^T w, its v * w^T

42	On homework assignments, if we want to take the inner product of <1,2> and <3,4>, would we write <<1,2>,<3,4>>, or is <1,2>.<3,4> ok	We use [ ] or ( ) for vectors and <> for inner products. So (1,2) and (3,4) are two vectors, and <(1,2) , (3,4)> is their inner product.
43	Can you take the inner product of more than 2 vectors?	No, the inner product defined for just 2 vectors