291H
Alex Valentino
Initial quiz

Survey:

1. *What's the highest level of math course have you taken? When was the last math course you took?*
   I took the Rutgers-Newark equivalent of Math 300. I also went through a semester of calculus taught out of Spivak.

2. *Have you taken any multi-variable calculus? Are you proficient at working with equations of a plane and a straight-line? Do you feel confident working with vector projection?*
   I haven't taken any multi-variable classes in highschool. I did do a semester of E&M in highschool where I learned Maxwell's equations. I feel I am proficient at working with plane equations and lines. I am iffy on vector projection, but I am currently refreshing with a linear algebra textbook.

3. *What's your main motivation for taking this course? In other words, what are you hoping to get out of this course?*
   I love math and physics, and to gain a better understanding of either I see that this course is the best one I can take now.

4. *What issues do you anticipate in transitioning into learning math at the college level?*
   I have already done a year at college, so this question isn't exactly geared toward me. But, I fully understand the time commitment needed to master the subject. Math is a skill, and to get good one must practice, a lot. I, for one, can't wait to embrace the challange that 291 will provide.

5. *Should there be a need to combine the two recitation sessions into one (either occasionally or permanently), using the Th5:40–7:00pm period, would this suitable to your schedule?*
   I don't think so. By spacing it out I think that leads to better absorption of the material and less wandering eyes during lecture.

Quiz:

1. *(True or False) A straight-line in the three dimensional space is described by a linear equation of the form $ax + by + cz = d$ in terms of the three rectangular coordinates x, y, z of points in the three dimensional space.* True. A common form for a line in $\mathbb{R}^2$ is $ax + by = d$, if one was going to fix x and y and add a factor of cz to the left hand side and let c and d vary, it would clearly just be linear in a new plain.

2. *(True or False) Given two linear equations $ax + by + cz = d$ and $a'x + b'y + c'z = d'$in the three variables x, y, z. Then the set of joint solutions to the system*

$$\begin{cases} ax + by + cz = d \\ a'x + b'y + c'z = d' \end{cases}$$

   is either empty or consists of a unique solution.
   False. If $a = a', b = b', c = c', d = d'$ then there would be an infinite number of solutions to the system of linear equations above.

291H
Alex Valentino
Initial quiz

3. *Which of the following does not parametrize a straight-line or some portion of a line? Briefly explain your answer.*

   (a) $r(t) = \langle 2+3t, 9-t, 12+7t\rangle$
   Since all of the terms are linear, the function in terms of x, y, z will also be linear.

   (b) $r(t) = \langle 1-t^2, 3+3t^2, t^3\rangle$
   The t^3 term will be "faster" than the t^2, thus it won't exhibit linear behavior.

   (c) $r(t) = \langle 2cos^2(t), 5+3cos^2(t), sin^2(t)\rangle$
   Since $sin^2(t) = 1 - cos^2(t)$, the equation above is all in terms of $cos^2(t)$. Therefore since all the derivatives are just going to scalar multiples of each other this function, too will exhibit linear behavior within the domain restriction of.

   (d) $r(t) = \langle t^3, 4-8t^3, 8+3t^3\rangle$
   Much as the problem before was all in terms of $cos^2(t)$, here it is all in terms of t^3. Better yet since t^3 is bijective over $\mathbb{R}$ this function will be a line in $\mathbb{R}^3$.

4. *Determine the value(s) of the parameter r in the following system of two linear equations in the two variables x and y*

$$x + 2y = 3$$
$$(r^2 - 3r + 2)y = r - 1$$

   such that it has

   (a) exactly one solution;
   Let $r \in \mathbb{R}, r \neq 1, 2$. This will make the system of linear equations linearly independent, as the two occurrences of the system being linearly dependent are below.

   (b) no solution;
   Let $r = 2$. Then the polynomial in the second row evaluates to 0, and $r - 1 = 1$. However, it is impossible for $0x+0y = 1$. Therefore for $r = 2$ there are no solutions to this equation.

   (c) infinitely many solutions – try to provide a formula for the general solution in this case.
   Let $r = 1$, this will result in the 2nd equation will go to zero on both sides. Therefore the set of all solutions is $\{(x, \frac{3-x}{2}) : x \in \mathbb{R}\}$.

5. *Is it possible to construct a function $f(x)$ which is continuous on $[0,1]$, differentiable in $(0,1)$, such that $|f(x)| \leq \frac{1}{2}$ for all x in $(0,1), f(0) = 0, andf(1) = -1$? If your answer is positive, provide an example of such a function; if your answer is negative, explain why it can't be done.*
   It is impossible. By the intermediate value theorem there must exist a $c \in (0,1)$ where $f'(c) = f(1) - f(0) = -1$. This is a contradiction as $|f(x)| \leq \frac{1}{2}$ but $|-1| > \frac{1}{2}$. Therefore no function can exist.