MAT 203 Test 1 - Spring, 2016 Name_____
100 Points Covers Chapters 12 and 13, Stewart's 7th Ed.

SUBMIT PROBLEMS ON SEPARATE PAPER. IN ORDER. FOLLOW HOMEWORK RULES (ONE-SIDE ONLY, MARGIN). EXCEPT DON'T FOLD YOUR TEST, OK? Remember, no double jeopardy. Any work that depends on previous work will be graded as though the previous work is correct. I'm afraid there's a lot of that on this test, but it should only hurt my weekend. LEAVING EXTRA ROOM AROUND YOUR WORK HELPS ME MAKE SURE YOU DON'T GET HURT TWICE FOR A PREVIOUS MISTAKE.

Work up to 2 Bonus problems, for up to 120 points.

1. (10 pts) Find parametric equations *and* vector equation for the line *L* that is the intersection of the two planes $\begin{matrix} P_1: & x - y + 3z = -2 \\ P_2: & 2x + 2y + 5z = 1 \end{matrix}$.

2. We're going to try to work our way up in dimensions, here, unlike the practice test.
   a. (10 pts) (Line) Let $A = (2,3,-1)$ and $B = (3,5,2)$. Form the vector $\bar{u} = \overrightarrow{AB}$, and write the vector equation for the line $L$ containing $A$ and $B$. If you were expecting parametric equations, go for that, then use your pametric equations to build the vector equation.
   b. (10 pts) (Line Segment) Write the equation for the line segment, from $A$ to $B$.
   c. (10 pts) (Plane, Vector Equation) Let $C = (3,4,1)$. Form the vector $\bar{v} = \overrightarrow{AC}$, and write the vector equation for the plane containing *A, B,* and *C*. (Again, if you're geared-up for parametric equations, go for it.)
   d. **Bonus** (10 pts) (Plane, General Equation) Write the general equation for the plane $P$ containing the 3 points, *A*, *B* and *C*.
   e. (10 pts) (Area of Parallelogram) Find the area of the parallelogram defined by the vectors $\bar{u}$ and $\bar{v}$.
   f. (10 pts) (Volume of a parallelepiped) Let $D = (4,6,3)$. Form the vector $\bar{w} = \overrightarrow{AD}$, and find the volume of the parallelepiped defined by $\bar{u}, \bar{v},$ and $\bar{w}$.

3. Distance questions.
   a. (10 pts) Find the distance from the point *D* to the line *L*.
   b. (10 pts) Find the distance from the point *D* to the plane *P*.
   c. **Bonus** (The one I can never do, but everyone else can.) (Distance between 2 planes) Take your answer from #2d, above, and I don't care *what* your *a*, *b*, *c*, and *d* are. But say your #2d was $P: ax + by + cz = d$. Add 40 to the right hand side, so you have a parallel plane $P_2: ax + by + cz = d + 40$. Find the distance between your $P$ you built for #2d, and the $P_2$ you just built.

4. (10 pts) Describe and sketch the cylinder $9y^2 + 4z^2 = 36$. Its traces in the *yz*-plane and $x = k$ planes are key.

5. **Bonus** (10 pts) Here's one that got a poor treatment in class. Describe with sketch and words, as best you can, what the cone $\frac{x^2}{16} = \frac{y^2}{9} + \frac{z^2}{25}$ looks like. Note, there are no "creases" in the round cone coffee filter. Your teacher just confused straight-line traces with sharp edges in the coffee filter.

6. **Bonus** (10 pts) The path of a particle is described by the vector function $\bar{r}(t) = \langle 3\sin(t), 7\cos(t), t \rangle$. Sketch the projection of this curve in the *xy*-, *xz*- and *yz*-planes, and use these to help you sketch the curve in space. Also give a verbal description. And don't panic over the final sketch in 3-D.

7. (10 pts) Let $\bar{r}(t) = \left\langle \sin\left(\frac{\pi}{3}t\right), \cos\left(\frac{\pi}{3}t\right), 7 \right\rangle$. Find the unit tangent, unit normal and binormal functions. This curve apparently lives in the plane $z = 7$. Can you draw it? Can you show me $\bar{T}, \bar{N},$ and $\bar{B}$ at $t = 2$?