HW 1
Math 261, S19

Please see the course syllabus for details on how to turn in your homework assignments. This one is due at the beginning of your class on **Friday, February 1**.

1. Do you understand that the homework in this class is not intended to be comprehensive preparation for the exams and that you really should try the suggested homework problems and exam practice problems, too? (Yes or no, please.)
2. (5 pts.) True or False
   (a) The inner product of two vectors in $\mathbb{R}^3$ is a vector in $\mathbb{R}^3$.
   (b) If $\mathbf{u} = \mathbf{0} = \langle 0, 0, 0\rangle$ is the zero vector in $\mathbb{R}^3$, then $\mathbf{u} \cdot \mathbf{v} = 0$.
   (c) If $\mathbf{u} \cdot \mathbf{v} = 0$, then either $\mathbf{u} = \mathbf{0}$ or $\mathbf{v} = \mathbf{0}$.
   (d) If for every vector $\mathbf{v}$ in $\mathbb{R}^3$ we have $\mathbf{u} \cdot \mathbf{v} = 0$, then $\mathbf{u} = \mathbf{0}$.
   (e) If $\mathbf{u_1} \cdot \mathbf{v} = 5$ and $\mathbf{v} \cdot \mathbf{u_2} = 3$, then $(\mathbf{u_1} + \mathbf{u_2}) \cdot \mathbf{v} = 8$.
3. (3pts.) Find a unit vector pointing in the direction of $\mathbf{v} = \langle 3, 4, 0\rangle$.
4. (3pts.)
   (a) Compute the projection of $\langle 2, 2, 2\rangle$ onto $\langle 1, 1, 1\rangle$.
   (b) Compute the projection of $\langle 2, 2, 0\rangle$ onto $\langle 2, -2, 0\rangle$.
   (c) Compute the projection of $\langle 2, 2, 2\rangle$ onto $\langle 1, 2, 3\rangle$.

   Hint: Make a sketch before you start computing.
5. (3pts.) Compute the area of the triangle formed by vectors $\langle 0, 1, 1\rangle$ and $\langle 1, 0, 1\rangle$, along with the line segment connecting their endpoints.
6. (3pts.) Some shapes in $\mathbb{R}^3$ (e.g., circles, lines, planes, etc.) can be described by equations: this means that the shapes are composed of all the points whose coordinates satisfy the equations.
   (a) Consider the shape defined by all points that satify simultaneously the two equations $\{x - 1 = 0, z - 5 = 0\}$. Please name both the shape **and** a point that the shape goes through.
   (b) Consider the shape defined by all points that satify the equation $\{(x - 1)(z - 5) = 0\}$. Please name both the shape **and** a point that the shape goes through.
7. (3pts.) Sketch a circle of radius 2 that lies in the plane $y = 5$ and is centered at $(1, 5, 3)$. (We don't require sketches on exams, but sketching and understanding 3D figures are important skills in Calc 3.)