Math 32 – Workshop #2

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1. Find the center and the radius of the sphere by writing it in the form

$$(x-h)^2 + (y-k)^2 + (z-l)^2 = r^2,$$

and sketch the sphere.

   (a) $x^2 + y^2 + z^2 - 4x + 2y - 6z = 130$

   (b) $2x^2 + 2y^2 + 2z^2 = 22 - 20x$

2. Write equations or inequalities $\mathbb{R}^3$ that describe the set of points. Sketch a picture.

   (a) The solid rectangular region (a box!) in the first octant bounded by the coordinate planes and the planes $x = 6$, $y = 1$, $z = 3$.

   (b) The outside of the sphere (no boundary) that has center $(0, 1, -4)$ and is tangent to the xy-plane.

   (c) The inside of the sphere with center at $(-2, 5, 4)$ and passing through the point $(0, 1, 0)$. What changes if we include the boundary?

   (d) The sphere, and its inside, that has a diameter connecting the points $(3, 5, -3)$ and $(7, 3, 1)$.

3. The vector $\vec{\mathbf{v}} = \langle 2, 5 \rangle$ is in $\mathbb{R}^3$ and is the position vector for $P(2, 5)$.

   (a) Sketch this position vector starting at the origin.

   (b) Sketch $\vec{\mathbf{v}}$ when it starts at the point $(4, 1)$, and also when it starts at the point $(-6, -2)$. In each case, where does it end?

   (c) How many different places can this vector be drawn?

4. A vector $\vec{\mathbf{v}}$ in $\mathbb{R}^3$ has initial point $(-2, 5, 4)$, and terminal point $(3, 5, -3)$.

   (a) Find $\vec{\mathbf{v}}$ in component form, and also in $\vec{\mathbf{i}}, \vec{\mathbf{j}}, \vec{\mathbf{k}}$-form.

   (b) Find two unit vectors parallel to $\vec{\mathbf{v}}$.

   (c) Find a vector of length 4 that is parallel to $\vec{\mathbf{v}}$.

5. We have two vectors in $\mathbb{R}^3$, $\vec{\mathbf{v}} = \langle 1, 2, 3 \rangle$, $\vec{\mathbf{w}} = \langle -4, 1, -2 \rangle$. Compute the following.

   (a) $\vec{\mathbf{v}} - 3\vec{\mathbf{w}}$

   (b) $|\vec{\mathbf{v}}|\vec{\mathbf{w}}$