Section 11.2: Vectors in Three Dimensions

The 3-D coordinate system: $\mathbb{R}^3$
Collectively, the $xy$, $xz$, and $yz$-planes are sometimes called the coordinate planes (or, $z = 0$, $y = 0$, and $x = 0$).
Textbook Interactive Figure 11.26
Example: the plane $y = 5$. 

Textbook Interactive Figure 11.30
Recall: distance between two points in $\mathbb{R}^2$:

$$|PQ| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Distance between any two points in $\mathbb{R}^3$:

$$|PQ| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

Midpoint between any two points in $\mathbb{R}^3$:

$$\text{Midpoint} = \left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}, \frac{z_2 + z_1}{2}\right)$$
Equation of a circle in $\mathbb{R}^2$:

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

What would the following equation look like in $\mathbb{R}^3$?

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2$$

What would the following inequality look like in $\mathbb{R}^3$?

$$(x - a)^2 + (y - b)^2 + (z - c)^2 \leq r^2$$
Vectors in $\mathbb{R}^3$

Example: Let $\mathbf{u} = 5i + j - 6k$ and $\mathbf{v} = <-1, 1, 2>$. 

(a) Find $\mathbf{u} + \mathbf{v}$.

(b) Find the magnitude of $\mathbf{u} + \mathbf{v}$. 