

MATH 2210 HOMEWORK WORKSHEET 1

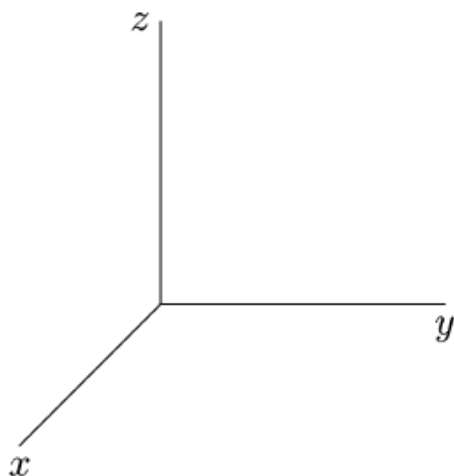
Name: _____

Three-Dimensional Coordinate Systems

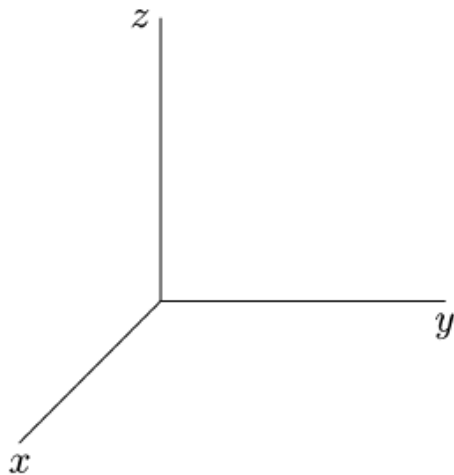
1. Plot the following points on the axes below.

$$(2, -2, -3)$$

$$(3, 4, 2)$$



2. Describe the surface defined by the equation $x^2 + y^2 + z^2 = 9$ and then graph it on the axes below.



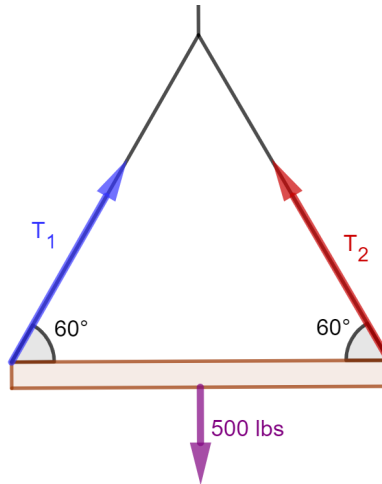
Vectors

3. Consider the vector $\langle -2, 4, \sqrt{5} \rangle$. Find a unit vector in the same direction as this vector; then find a vector of length 10 in the same direction of this vector.

4. Let $\mathbf{a} = 8\mathbf{i} + \mathbf{j} - 4\mathbf{k}$ and $\mathbf{b} = 5\mathbf{i} - 2\mathbf{j} + \mathbf{k}$. Find

$$\mathbf{a} + \mathbf{b}, \quad 4\mathbf{a} - 2\mathbf{b}, \quad |\mathbf{a}|, \quad |\mathbf{a} - \mathbf{b}|.$$

5. A crane suspends a 500-lb steel beam horizontally by support cables (with negligible weight) attached from a hook to each end of the beam. The support cables each make an angle of 60° with the beam. Find the tension vector in each support cable and the magnitude of each tension.



The Dot Product

6. Let $\mathbf{u} = \langle 0, 1, -1 \rangle$ and $\mathbf{v} = \langle -1, a, 1 \rangle$ for some real number a . What value of a will make \mathbf{u} and \mathbf{v} orthogonal? What value of a will produce an angle of $\pi/3$ between them?

7. Show that the vector $\text{orth}_{\mathbf{a}} \mathbf{b} = \mathbf{b} - \text{proj}_{\mathbf{a}} \mathbf{b}$ is orthogonal to \mathbf{a} . (It is called an **orthogonal projection** of \mathbf{b} .)