

Due Tuesday 1/18. Group submission accepted, but see website for the rules.

1. Describe in words and sketch a picture for the set of points  $(x, y, z)$  in 3-space that satisfy each of the following:

(a)  $x^2 + y^2 + z^2 \leq 4$

(b)  $(y - 1)(z - 3) = 0$

(c)  $x^2 + z^2 - 6z = 0$

2. A weight of 200 N is in equilibrium suspended by two cables which make angles of  $30^\circ$ , and  $45^\circ$ , respectively, with the horizontal ceiling (see picture on the board).

(a) Find the magnitude of the tension in each cable.

(b) Represent each of the tension forces in the cables as vectors (in terms of the standard basis  $\mathbf{i}, \mathbf{j}$ ), and check that the sum of the forces acting on the object is  $\mathbf{0}$  (corresponding to equilibrium).

**3.** (similar to pb. 55 section 13.1, textbook) Determine the necessary air speed and heading that a pilot must maintain in order to fly her commercial jet west at a speed of 480 mi/hr relative to the ground in a crosswind that is blowing  $60^\circ$  south of east at 20 mi/hr.

**4.** Use vectors and dot product to determine, to the nearest degree, the acute angle formed by two diagonals of a cube. Does the size of the cube matter? Briefly explain.