**Worksheet 08/23** Calculus 3 – Fall'18 **Group nr:** ___ **Names:** ______________________________

**1.** (adapted pb. 54, section 11.2)

(a) Find the tensions in the cables shown (see picture in the textbook or on the board).

(b) Part (a) was implicitly asking only the magnitudes of the tension forces that arise in each cable. Now find the vectors expressing those tensions (in terms of the standard basis $\mathbf{i}, \mathbf{j}$).

**2.** (pb. 22, section 11.3) Use vectors and dot product to determine, to the nearest degree, the acute angle formed by two diagonals of a cube.

**3.** (a) Describe (geometrically and algebraically) all vectors in 3-space which are orthogonal to $< 0, 1, 1 >$.

(b) Find two vectors that are orthogonal to $< 0, 1, 1 >$ and to each other.

**4.** (adapted pbs. 32 and 33, section 11.3) If $L$ is a line in 2-space or 3-space that passes through two given points $A$ and $B$, then the distance from another given point $P$ to the line $L$, $d(P, L)$, can be obtained as follows: decompose the vector $\vec{AP}$ as $\vec{AP} = \mathbf{u} + \mathbf{v}$, where $\mathbf{u}$ is a vector parallel to $\vec{AB}$ and $\mathbf{v}$ is a vector perpendicular to $\vec{AB}$; then $d(P, L) = \|\mathbf{v}\|$.

(a) Apply the method above to find the distance between the point $P(1, 1, 1)$ and the line that passes through the points $A(1, 0, 0)$ and $B(0, 0, 3)$.

(b)* Use dot-product to find general expressions for $\mathbf{u}, \mathbf{v}$ above and show that

$$d(P, L) = \|\mathbf{v}\| = \frac{\sqrt{\|\vec{AP}\|^2 \|\vec{AB}\|^2 - (\vec{AP} \cdot \vec{AB})^2}}{\|\vec{AB}\|}$$