1. Suppose that $AB$ is the diameter of a circle with center $O$ and that $C$ is a point on one of the two arcs joining $A$ and $B$. Show that $CA$ and $CB$ are orthogonal.

2. In the figure here, $D$ is the midpoint of side $AB$ of triangle $ABC$, and $E$ is one-third of the way between $C$ and $B$. Use vectors to prove that $F$ is the midpoint of line segment $CD$.

3. The acute angle between intersecting lines that do not cross at right angles is the same as the angle determined by vectors normal to the lines or by the vectors parallel to the lines.

4. a. Use this fact to find the acute angle between the lines $3x + y = 5$, $2x - y = 4$

   b. Find parametric equations for the line through $(0, -7, 0)$ and perpendicular to the plane $x + 2y + 2z = 13$.

5. Find equations for the plane through $P_0(2, 4, 5)$ perpendicular to the line
   $x = 5 + t, y = 1 + 3t, z = 4t$

6. Find the point of intersection of the line
   $x = 2t + 1, y = 3t + 2, z = 4t + 3$ and $x = s + 2, y = 2s + 4, z = -4s - 1$,
   and then find the plane determined by these lines.

7. Find the angles between the planes $x + y = 1, 2x + y - 2z = 2$. 