Do the following problems from Shutz Chapter 1.14: 1, 3, 8, 17, 21

Do the following problems from Shutz Chapter 2.9: 2,11,13,14,25,28,29,30

1. Frame $\bar{\mathcal{O}}$ moves with velocity v with respect to frame $\mathcal{O}$.
(a) A rod in frame $\bar{\mathcal{O}}$ makes an angle $\bar{\theta}$ with respect to the forward direction of motion. What is the angle θ measured in frame $\mathcal{O}$?
(b) An object in frame $\bar{\mathcal{O}}$ is fired with velocity u at angle $\bar{\theta}$ with respect to forward direction of motion. What is angle θ measured in $\mathcal{O}$? How about if the object is a light ray?

2. A particle with rest mass m and 4-momentum $\vec{p}$ is observed by someone moving with 4-velocity $\vec{u}$. Show that:
(a) the energy observed is $E = -\vec{p} \cdot \vec{u}$
(b) the rest mass they observe is $m^2 = -\vec{p} \cdot \vec{p}$
(c) the 3-vector (ordinary) momentum they observe has magnitude $|\mathbf{p}| = [(\vec{p} \cdot \vec{u})^2 + \vec{p} \cdot \vec{p}]^{1/2}$
(d) The ordinary velocity they measure is: $|\mathbf{v}| = \left(1 + \frac{\vec{p} \cdot \vec{p}}{(\vec{p} \cdot \vec{u})^2}\right)^{1/2}$
(e) The 4-vector $\vec{v}$, whose components in the observer's frame are $v^0 = 0$, $v^i = dx^i/dt =$ ordinary velocity, is given by $\vec{v} = -\vec{u} - \vec{p}/(\vec{p} \cdot \vec{u})$.