Problem U3 (Unified Concepts)
In this question you are asked to examine forces and moments as vectors in 3 D

A twin engined transport aircraft has its engines positioned such that their center of mass is forward of the wings. Each engine is attached by a strut. The wings are swept back at an angle of about 25°, and have a slight upward dihedral angle. Using a coordinate system centered on the starboard wing root (where the wing intersects the fuselage), the center of mass of the starboard engine is at a point with position vector \( \vec{r}_s \). The position vector of the port wing tip, \( T \), is \( \vec{r}_t \). The weight of the engine is 50000 N and acts vertically downward through the center of mass. Answer the following questions, expressing your answers as vectors.

a) What is the moment created by the weight of the port engine about the wing root?

b) What is the component of this moment acting along the line \( OT \)?

c) What is the component of this moment acting perpendicular to the direction of the wing?

d) Physically what do the components of the moment you calculated in b) and c) do to the wing?