Problem 10.39

This is a little bit obscurely presented, but the sketch more or less gives the information needed to do this problem. Again, it is a rotational N.S.L. problem.
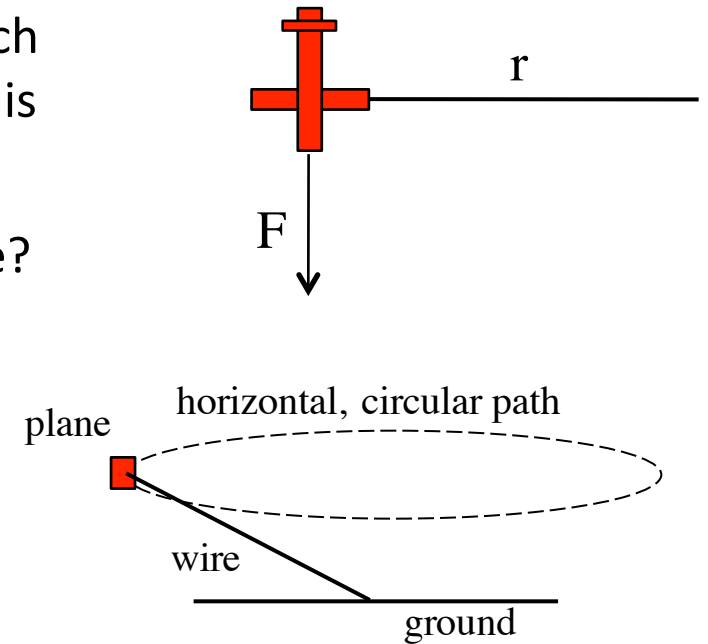
a.) What *torque* is produced by the plane engine?

$$\vec{r} x \vec{F} = \left| \vec{F} \right| r_\perp$$
$$= (.800 \text{ N})(30.0 \text{ m})$$
$$= 24.0 \text{ N} \cdot \text{m}$$

b.) What is the plane's *angular acceleration*?

Treating the plane like a point mass so it's moment of inertia is mr^2, we can write:

$$\sum \Gamma :$$

$$\vec{r} x \vec{F} = I \alpha$$

$$\Rightarrow \quad \alpha = \frac{\vec{r} x \vec{F}}{\left(mr^2 \right)}$$

$$= \frac{(24.0 \text{ N} \cdot \text{m})}{\left((.750 \text{ kg})(30.0 \text{ m})^2 \right)}$$

$$= 3.56 \text{x} 10^{-2} \text{ rad/s}^2$$

1.)

c.) What is the *translational acceleration* of the plane?

$$a = r\alpha$$

$$= (30.0 \text{ m/rad})(3.56 \text{x} 10^{-2} \text{ rad/s}^2)$$

$$= 1.07 \text{ m/s}^2$$

F

r