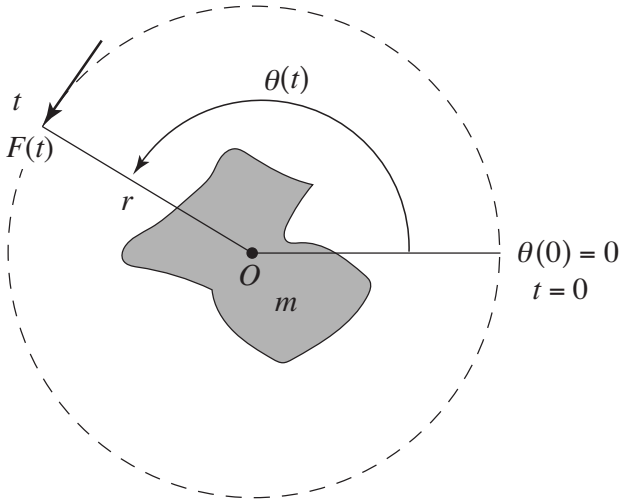
Quiz **Name**

1. A randomly shaped flat object of mass m is placed in the plane as shown in the figure. The object and the lever (of negligible weight) that is attached to it are free to rotate around the point O. A variable force of magnitude $F(t)$ acts on the lever perpendicularly to it and in so doing rotates the object in a counterclockwise way The distance from the action of the force to the point O is fixed and equal to r. The rotation starts at time $t = 0$ at the indicated position. The angle $\theta(t)$



in radians measures the angular distance of the rotation of the lever (and hence the object) at any time $t \geq 0$. The following is known (in the units meter-kilogram-seconds): $\theta(t) = t^3, r = 0.75\,\text{m}$, $F(t) = 24t$ newtons, and the index of inertia of the rotating object is a constant I in $\text{kg} \cdot \text{m}^2$.

a. Find formulas for the angular velocity and the angular acceleration of the rotating object at any time t.

b. Write an expression for the torque produced by the force $F(t)$ at any time t.

c. Write down the formula that relates the torque, the index of inertia and the angular acceleration. (This is the rotational analogue of Newton's $F = ma$.) Use your formula to determine the index of inertia I.