30. The function $\theta = \xi e^{\beta t}$ where $\xi = 0.40$ rad and $\beta = 2\,\mathrm{s}^{-1}$ is describing the angular coordinate of a line (which is marked in such a way that all points on it have the same value of angle at a given time) on the object. Taking derivatives with respect to time leads to $\frac{d\theta}{dt} = \xi\,\beta\,e^{\beta t}$ and $\frac{d^2\theta}{dt^2} = \xi\,\beta^2\,e^{\beta t}$.

(a) Using Eq. 11-22, we have

$$a_t = \alpha r = \frac{d^2\theta}{dt^2}\,r = \ 6.4\ \mathrm{cm/s}^2\ .$$

(b) Using Eq. 11-23, we have

$$a_r = \omega^2 r = \left(\frac{d\theta}{dt}\right)^2 r = \ 2.6\ \mathrm{cm/s}^2\ .$$