57. With counterclockwise positive, the angular acceleration α for both masses satisfies $\tau = mgL_1 - mgL_2 = I\alpha = (mL_1^2 + mL_2^2)\alpha$, by combining Eq. 11-37 with Eq. 11-32 and Eq. 11-26. Therefore, using SI units,

$$\alpha = \frac{g\,(L_1 - L_2)}{L_1^2 + L_2^2} = \frac{(9.8)(0.20 - 0.80)}{0.80^2 + 0.20^2} = -8.65 \text{ rad/s}^2$$

where the negative sign indicates the system starts turning in the clockwise sense. The magnitude of the acceleration vector involves no radial component (yet) since it is evaluated at $t = 0$ when the instantaneous velocity is zero. Thus, for the two masses, we apply Eq. 11-22 and obtain the respective answers for parts (a) and (b):

$$\begin{aligned} |\vec{a}_1| = |\alpha| L_1 &= \left(8.65\,\text{rad/s}^2\right)(0.80\,\text{m}) = 6.9 \text{ m/s}^2 \\ |\vec{a}_2| = |\alpha| L_2 & \\ &= \left(8.65\,\text{rad/s}^2\right)(0.20\,\text{m}) \\ &= 1.7 \text{ m/s}^2 \; . \end{aligned}$$