79. We choose positive coordinate directions (different choices for each item) so that each is accelerating positively, which will allow us to set $a_2 = a_1 = R\alpha$ (for simplicity, we denote this as $a$). Thus, we choose rightward positive for $m_2 = M$ (the block on the table), downward positive for $m_1 = M$ (the block at the end of the string) and (somewhat unconventionally) clockwise for positive sense of disk rotation. This means that we interpret $\theta$ given in the problem as a positive-valued quantity. Applying Newton's second law to $m_1$, $m_2$ and (in the form of Eq. 11-37) to $M$, respectively, we arrive at the following three equations (where we allow for the possibility of friction $f_2$ acting on $m_2$).

$$\begin{aligned} m_1 g - T_1 &= m_1 a_1 \\ T_2 - f_2 &= m_2 a_2 \\ T_1 R - T_2 R &= I\alpha \end{aligned}$$

(a) From Eq. 11-13 (with $\omega_0 = 0$) we find

$$\theta = \omega_0 t + \frac{1}{2}\alpha t^2 \implies \alpha = \frac{2\theta}{t^2} .$$

(b) From the fact that $a = R\alpha$ (noted above), we obtain $a = 2R\theta/t^2$.

(c) From the first of the above equations, we find

$$T_1 = m_1 (g - a_1) = M\left(g - \frac{2R\theta}{t^2}\right) .$$

(d) From the last of the above equations, we obtain the second tension:

$$T_2 = T_1 - \frac{I\alpha}{R} = M\left(g - \frac{2R\theta}{t^2}\right) - \frac{2I\theta}{Rt^2}$$