Solution 23.22

$$\dot{\theta} = \frac{d\theta}{dt} = \frac{\theta(t_{i+1}) - \theta(t_{i-1})}{2h} = \frac{0.67 - 0.70}{4} = -0.0075 \ \text{rad/s}$$

$$\dot{r} = \frac{dr}{dt} = \frac{r(t_{i+1}) - r(t_{i-1})}{2h} = \frac{6030 - 5560}{4} = 117.5 \ \text{m/s}$$

$$\ddot{\theta} = \frac{d^2\theta}{dt^2} = \frac{\theta(t_{i+1}) - 2\theta(t_i) + \theta(t_{i-1})}{h^2} = \frac{0.67 - 2(0.68) + 0.70}{(2)^2} = 0.0025 \ \text{rad/s}^2$$

$$\ddot{r} = \frac{d^2r}{dt^2} = \frac{r(t_{i+1}) - 2r(t_i) + r(t_{i-1})}{h^2} = \frac{6030 - 2(5800) + 5560}{(2)^2} = -2.5 \ \text{m/s}^2$$

$$\vec{v} = 117.5 \ \vec{e}_r - 43.5 \ \vec{e}_\theta$$
$$\vec{a} = -2.82625 \ \vec{e}_r + 12.7375 \ \vec{e}_\theta$$