4. If we make the units explicit, the function is

$$\theta = (4.0\,\mathrm{rad/s})t - \left(3.0\,\mathrm{rad/s^2}\right)t^2 + \left(1.0\,\mathrm{rad/s^3}\right)t^3$$

but generally we will proceed as shown in the problem – letting these units be understood. Also, in our manipulations we will generally not display the coefficients with their proper number of significant figures.

(a) Eq. 11-6 leads to

$$\omega = \frac{d}{dt}\left(4t - 3t^2 + t^3\right) = 4 - 6t + 3t^2 \ .$$

Evaluating this at $t = 2$ s yields $\omega_2 = 4.0$ rad/s.

(b) Evaluating the expression in part (a) at $t = 4$ s gives $\omega_4 = 28$ rad/s.

(c) Consequently, Eq. 11-7 gives

$$\alpha_{\mathrm{avg}} = \frac{\omega_4 - \omega_2}{4 - 2} = 12\ \mathrm{rad/s^2} \ .$$

(d) And Eq. 11-8 gives

$$\alpha = \frac{d\omega}{dt} = \frac{d}{dt}\left(4 - 6t + 3t^2\right) = -6 + 6t \ .$$

Evaluating this at $t = 2$ s produces $\alpha_2 = 6.0$ rad/s^2.

(e) Evaluating the expression in part (d) at $t = 4$ s yields $\alpha_4 = 18$ rad/s^2. We note that our answer for α_{avg} does turn out to be the arithmetic average of α_2 and α_4 but point out that this will not always be the case.