

Calculus I, Section 3.1, #50
Derivatives of Polynomials and Exponential Functions

The equation of motion of a particle is $s = t^4 - 2t^3 + t^2 - t$, where t is in seconds.¹

- (a) Find the velocity and acceleration as functions of t .

$$s(t) = t^4 - 2t^3 + t^2 - t$$

so

$$v(t) = s'(t) = 4t^3 - 6t^2 + 2t - 1$$

$$a(t) = v'(t) = s''(t) = 12t^2 - 12t + 2$$

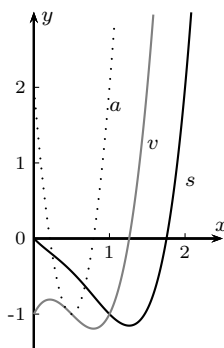
- (b) Find the acceleration after 1 s.

$$a(t) = 12t^2 - 12t + 2$$

so

$$\begin{aligned} a(1) &= 12(1)^2 - 12(1) + 2 \\ &= 2 \text{ m/s}^2 \end{aligned}$$

- (c) Graph the position, velocity, and acceleration functions on the same screen.



¹Stewart, *Calculus, Early Transcendentals*, p. 181, #50.