

1. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{-2}{t^2} + \frac{-4}{t} + 1 - 3t - 2t^2 - 3t^3 + 2t^4$$

2. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{-2}{t^2} + \frac{3}{t} - 2 + 2t + 2t^2 + 5t^3$$

3. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{3}{t^2} + \frac{1}{t} - 3 - 4t$$

4. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{2}{t^2} + \frac{1}{t} - 2 - 5t + 3t^2$$

5. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{-4}{t} - 1 - 2t - 4t^2 - 3t^3$$

6. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{2}{t^3} + \frac{1}{t^2} + \frac{-2}{t} - 1 + 5t + 5t^2 + 2t^3$$

7. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{1}{t^3} + \frac{-5}{t^2} + \frac{1}{t} + 1 - 5t + t^2 + 4t^3$$

8. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{-2}{t} + 2 + 2t - 4t^2$$

9. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{5}{t} - 2 - 4t - 4t^2$$

10. Find the velocity, acceleration, and jerk functions for the following position function:

$$s(t) = \frac{-5}{t} + 2t - t^2$$

1.  $a(t) = \frac{1}{4}t^3 + 8t^2 - 9t - 4t - 3 - \frac{t^2}{4} + \frac{t^3}{4}$       $a(t) = -\frac{1}{2}t^2 + \frac{t^4}{8} - 4 - 18t + 24t^2$       $f(t) = \frac{1}{24}t^5 + \frac{t^4}{18} - 18t + 48t$
2.  $a(t) = \frac{4}{3}t^2 + 2 + 4t + 15t^2$       $a(t) = -\frac{12}{9}t^4 + \frac{t^3}{6} + 4 + 30t$       $f(t) = \frac{4}{8}t^5 + \frac{t^4}{18} + 30$
3.  $a(t) = -\frac{6}{9}t^3 + \frac{t^2}{1} - 4$       $a(t) = \frac{18}{2}t^3 + \frac{t^4}{6} - 7t^2 - 6$       $f(t) = -\frac{7}{2}t^5 + \frac{t^4}{6}$
4.  $a(t) = -\frac{4}{4}t^3 + \frac{t^2}{1} - 5 + 6t$       $a(t) = \frac{12}{2}t^3 + \frac{t^4}{2} + 6$       $f(t) = -\frac{4}{8}t^5 + \frac{t^4}{6}$
5.  $a(t) = -\frac{4}{4}t^2 - 2 - 8t - 9t^2$       $a(t) = -\frac{8}{8}t^3 - 8 - 18t$       $f(t) = -\frac{2}{4}t^4 - 8t - 18$
6.  $a(t) = -\frac{6}{9}t^4 + \frac{t^3}{2} + 5 + 10t + 6t^2$       $a(t) = \frac{24}{24}t^5 + \frac{t^4}{6} + \frac{t^3}{4} + 10 + 12t$       $f(t) = -\frac{120}{120}t^6 + \frac{t^5}{24} + \frac{t^4}{12} + 12$
7.  $a(t) = -\frac{3}{3}t^4 + \frac{t^3}{10} + \frac{t^2}{1} + 2t + 12t^2$       $a(t) = \frac{12}{12}t^5 + \frac{t^4}{30} + \frac{t^3}{2} + 2 + 24t$       $f(t) = -\frac{60}{60}t^6 + \frac{t^5}{120} + \frac{t^4}{9} + 24$
8.  $a(t) = \frac{2}{2}t^2 + 2 + 8t$       $a(t) = -\frac{4}{4}t^3 - 8$       $f(t) = \frac{12}{12}t^4$
9.  $a(t) = -\frac{2}{5}t^4 - 4 - 8t$       $a(t) = \frac{10}{10}t^3 - 8$       $f(t) = -\frac{30}{30}t^4$
10.  $a(t) = \frac{2}{5}t^2 - 2 + 12t$       $a(t) = -\frac{10}{10}t^3 - 2$       $f(t) = \frac{30}{30}t^4$

ANSWERS:

Solutions:

$$1. v(t) = \frac{d}{dt} -2t^{-2} + -4t^{-1} + 1 - 3t - 2t^2 - 3t^3 + 2t^4 = 4t^{-3} + 4t^{-2} - 3 - 4t - 9t^2 + 8t^3 = \frac{4}{t^3} + \frac{4}{t^2} - 3 - 4t - 9t^2 + 8t^3 \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} 4t^{-3} + 4t^{-2} - 3 - 4t - 9t^2 + 8t^3 = -12t^{-4} + -8t^{-3} - 4 - 18t + 24t^2 = \frac{-12}{t^4} + \frac{-8}{t^3} - 4 - 18t + 24t^2 \quad \blacktriangleleft$$

$$\text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} -12t^{-4} + -8t^{-3} - 4 - 18t + 24t^2 = 48t^{-5} + 24t^{-4} - 18 + 48t = \frac{48}{t^5} + \frac{24}{t^4} - 18 + 48t \quad \blacktriangleleft \text{Apply:}$$

$$j(t) = \frac{d}{dt}a(t)$$

$$2. v(t) = \frac{d}{dt} -2t^{-2} + 3t^{-1} - 2 + 2t + 2t^2 + 5t^3 = 4t^{-3} + -3t^{-2} + 2 + 4t + 15t^2 = \frac{4}{t^3} + \frac{-3}{t^2} + 2 + 4t + 15t^2 \quad \blacktriangleleft$$

$$\text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} 4t^{-3} + -3t^{-2} + 2 + 4t + 15t^2 = -12t^{-4} + 6t^{-3} + 4 + 30t = \frac{-12}{t^4} + \frac{6}{t^3} + 4 + 30t \quad \blacktriangleleft \text{Apply:}$$

$$a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} -12t^{-4} + 6t^{-3} + 4 + 30t = 48t^{-5} + -18t^{-4} + 30 = \frac{48}{t^5} + \frac{-18}{t^4} + 30 \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$3. v(t) = \frac{d}{dt} 3t^{-2} + t^{-1} - 3 - 4t = -6t^{-3} + -t^{-2} - 4 = \frac{-6}{t^3} + \frac{-1}{t^2} - 4 \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} -6t^{-3} + -t^{-2} - 4 = 18t^{-4} + 2t^{-3} = \frac{18}{t^4} + \frac{2}{t^3} \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} 18t^{-4} + 2t^{-3} = -72t^{-5} + -6t^{-4} = \frac{-72}{t^5} + \frac{-6}{t^4} \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$4. v(t) = \frac{d}{dt} 2t^{-2} + t^{-1} - 2 - 5t + 3t^2 = -4t^{-3} + -t^{-2} - 5 + 6t = \frac{-4}{t^3} + \frac{-1}{t^2} - 5 + 6t \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} -4t^{-3} + -t^{-2} - 5 + 6t = 12t^{-4} + 2t^{-3} + 6 = \frac{12}{t^4} + \frac{2}{t^3} + 6 \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} 12t^{-4} + 2t^{-3} + 6 = -48t^{-5} + -6t^{-4} = \frac{-48}{t^5} + \frac{-6}{t^4} \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$5. v(t) = \frac{d}{dt} -4t^{-1} - 1 - 2t - 4t^2 - 3t^3 = 4t^{-2} - 2 - 8t - 9t^2 = \frac{4}{t^2} - 2 - 8t - 9t^2 \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} 4t^{-2} - 2 - 8t - 9t^2 = -8t^{-3} - 8 - 18t = \frac{-8}{t^3} - 8 - 18t \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} -8t^{-3} - 8 - 18t = 24t^{-4} - 18 = \frac{24}{t^4} - 18 \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$6. v(t) = \frac{d}{dt} 2t^{-3} + t^{-2} + -2t^{-1} - 1 + 5t + 5t^2 + 2t^3 = -6t^{-4} + -2t^{-3} + 2t^{-2} + 5 + 10t + 6t^2 = \frac{-6}{t^4} + \frac{-2}{t^3} + \frac{2}{t^2} + 5 + 10t + 6t^2 \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt} -6t^{-4} + -2t^{-3} + 2t^{-2} + 5 + 10t + 6t^2 = 24t^{-5} + 6t^{-4} + -4t^{-3} + 10 + 12t = \frac{24}{t^5} + \frac{6}{t^4} + \frac{-4}{t^3} + 10 + 12t \quad \blacktriangleleft$$

$$\text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt} 24t^{-5} + 6t^{-4} + -4t^{-3} + 10 + 12t = -120t^{-6} + -24t^{-5} + 12t^{-4} + 12 = \frac{-120}{t^6} + \frac{-24}{t^5} + \frac{12}{t^4} + 12 \quad \blacktriangleleft$$

$$\text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$7. v(t) = \frac{d}{dt}t^{-3} + -5t^{-2} + t^{-1} + 1 - 5t + t^2 + 4t^3 = -3t^{-4} + 10t^{-3} + -t^{-2} - 5 + 2t + 12t^2 = \frac{-3}{t^4} + \frac{10}{t^3} + \frac{-1}{t^2} - 5 + 2t + 12t^2 \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt}(-3t^{-4} + 10t^{-3} + -t^{-2} - 5 + 2t + 12t^2) = 12t^{-5} + -30t^{-4} + 2t^{-3} + 2 + 24t = \frac{12}{t^5} + \frac{-30}{t^4} + \frac{2}{t^3} + 2 + 24t \quad \blacktriangleleft$$

Apply:  $a(t) = \frac{d}{dt}v(t)$

$$j(t) = \frac{d}{dt}(12t^{-5} + -30t^{-4} + 2t^{-3} + 2 + 24t) = -60t^{-6} + 120t^{-5} + -6t^{-4} + 24 = \frac{-60}{t^6} + \frac{120}{t^5} + \frac{-6}{t^4} + 24 \quad \blacktriangleleft$$

Apply:  $j(t) = \frac{d}{dt}a(t)$

$$8. v(t) = \frac{d}{dt}(-2t^{-1} + 2 + 2t - 4t^2) = 2t^{-2} + 2 - 8t = \frac{2}{t^2} + 2 - 8t \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt}(2t^{-2} + 2 - 8t) = -4t^{-3} - 8 = \frac{-4}{t^3} - 8 \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt}(-4t^{-3} - 8) = 12t^{-4} = \frac{12}{t^4} \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$9. v(t) = \frac{d}{dt}(5t^{-1} - 2 - 4t - 4t^2) = -5t^{-2} - 4 - 8t = \frac{-5}{t^2} - 4 - 8t \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt}(-5t^{-2} - 4 - 8t) = 10t^{-3} - 8 = \frac{10}{t^3} - 8 \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt}(10t^{-3} - 8) = -30t^{-4} = \frac{-30}{t^4} \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$

$$10. v(t) = \frac{d}{dt}(-5t^{-1} + 2t - t^2) = 5t^{-2} + 2 - 2t = \frac{5}{t^2} + 2 - 2t \quad \blacktriangleleft \text{Apply: } v(t) = \frac{d}{dt}s(t)$$

$$a(t) = \frac{d}{dt}(5t^{-2} + 2 - 2t) = -10t^{-3} - 2 = \frac{-10}{t^3} - 2 \quad \blacktriangleleft \text{Apply: } a(t) = \frac{d}{dt}v(t)$$

$$j(t) = \frac{d}{dt}(-10t^{-3} - 2) = 30t^{-4} = \frac{30}{t^4} \quad \blacktriangleleft \text{Apply: } j(t) = \frac{d}{dt}a(t)$$