

1. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = 3 \log(-t)$
2. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -3e^{2t}$
3. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -3 \ln(-2t)$
4. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -5 \sin(2t)$
5. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -4 \cos(t)$
6. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -3 \ln(5t)$
7. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -\ln(-2t)$
8. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -2 \sin(t)$
9. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = -(10)^{-4t}$
10. Find the velocity, acceleration, and jerk functions for the following position function:  $s(t) = 4 \cos(-t)$

- ANSWERS:
1.  $a(t) = \frac{\ln 10}{3}$     $v(t) = \frac{1}{3}$     $j(t) = \frac{\ln 10}{9}$
  2.  $a(t) = -6e^{2t}$     $v(t) = -12e^{2t}$     $j(t) = -24e^{2t}$
  3.  $a(t) = \frac{t}{3}$     $v(t) = \frac{2t}{3}$     $j(t) = \frac{2}{3}$
  4.  $a(t) = -10 \cos(2t)$     $v(t) = 20 \sin(2t)$     $j(t) = 40 \cos(2t)$
  5.  $a(t) = 4 \sin(t)$     $v(t) = 4 \cos(t)$     $j(t) = -4 \sin(t)$
  6.  $a(t) = \frac{t}{1}$     $v(t) = \frac{2t}{1}$     $j(t) = \frac{2}{1}$
  7.  $a(t) = \frac{t}{3}$     $v(t) = \frac{2t}{3}$     $j(t) = \frac{2}{3}$
  8.  $a(t) = -2 \cos(t)$     $v(t) = 2 \sin(t)$     $j(t) = -2 \cos(t)$
  9.  $a(t) = \frac{t}{9}$     $v(t) = \frac{2t}{9}$     $j(t) = \frac{2}{9}$

Solutions:

$$1. \quad \text{Apply the formula(s):} \quad \frac{d}{dt} b^{f(t)} = (\ln b) b^{f(t)} \frac{d}{dt} f(t) \quad \frac{d}{dt} t^n = nt^{n-1}$$

$$s(t) = 3 \log(-t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [3 \log(-t)] = \frac{3}{(\ln 10)t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} \left[ \frac{3}{(\ln 10)t} \right] = \frac{-3}{(\ln 10)t^2}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} \left[ \frac{-3}{(\ln 10)t^2} \right] = \frac{6}{(\ln 10)t^3}$$

$$2. \quad \text{Apply the formula(s):} \quad \frac{d}{dt} e^{f(t)} = e^{f(t)} \frac{d}{dt} f(t)$$

$$s(t) = -3e^{2t}$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-3e^{2t}] = -6e^{2t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [-6e^{2t}] = -12e^{2t}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [-12e^{2t}] = -24e^{2t}$$

$$3. \quad \text{Apply the formula(s):} \quad \frac{d}{dt} \ln f(t) = \frac{1}{f(t)} \frac{d}{dt} f(t) \quad \frac{d}{dt} t^n = nt^{n-1}$$

$$s(t) = -3 \ln(-2t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-3 \ln(-2t)] = \frac{-3}{t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} \left[ \frac{-3}{t} \right] = \frac{3}{t^2}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} \left[ \frac{3}{t^2} \right] = \frac{-6}{t^3}$$

$$4. \quad \text{Apply the formula(s):} \quad \frac{d}{dt} \sin f(t) = (\cos f(t)) \frac{d}{dt} f(t) \quad \frac{d}{dt} \cos f(t) = -(\sin f(t)) \frac{d}{dt} f(t)$$

$$s(t) = -5 \sin(2t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-5 \sin(2t)] = -10 \cos(2t)$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [-10 \cos(2t)] = 20 \sin(2t)$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [20 \sin(2t)] = 40 \cos(2t)$$

$$5. \quad \text{Apply the formula(s):} \quad \frac{d}{dt} \sin f(t) = (\cos f(t)) \frac{d}{dt} f(t) \quad \frac{d}{dt} \cos f(t) = -(\sin f(t)) \frac{d}{dt} f(t)$$

$$s(t) = -4 \cos(t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-4 \cos(t)] = 4 \sin(t)$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [4 \sin(t)] = 4 \cos(t)$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [4 \cos(t)] = -4 \sin(t)$$

6. Apply the formula(s):  $\frac{d}{dt} \ln f(t) = \frac{1}{f(t)} \frac{d}{dt} f(t)$      $\frac{d}{dt} t^n = nt^{n-1}$

$$s(t) = -3 \ln(5t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-3 \ln(5t)] = \frac{-3}{t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} \left[ \frac{-3}{t} \right] = \frac{3}{t^2}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} \left[ \frac{3}{t^2} \right] = \frac{-6}{t^3}$$

7. Apply the formula(s):  $\frac{d}{dt} \ln f(t) = \frac{1}{f(t)} \frac{d}{dt} f(t)$      $\frac{d}{dt} t^n = nt^{n-1}$

$$s(t) = -\ln(-2t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-\ln(-2t)] = \frac{-1}{t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} \left[ \frac{-1}{t} \right] = \frac{1}{t^2}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} \left[ \frac{1}{t^2} \right] = \frac{-2}{t^3}$$

8. Apply the formula(s):  $\frac{d}{dt} \sin f(t) = (\cos f(t)) \frac{d}{dt} f(t)$      $\frac{d}{dt} \cos f(t) = -(\sin f(t)) \frac{d}{dt} f(t)$

$$s(t) = -2 \sin(t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-2 \sin(t)] = -2 \cos(t)$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [-2 \cos(t)] = 2 \sin(t)$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [2 \sin(t)] = 2 \cos(t)$$

9. Apply the formula(s):  $\frac{d}{dt} 10^{f(t)} = (\ln 10) 10^{f(t)} \frac{d}{dt} f(t)$

$$s(t) = -(10)^{-4t}$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [-(10)^{-4t}] = 4(\ln 10)^1 10^{-4t}$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [4(\ln 10)^1 10^{-4t}] = -16(\ln 10)^2 10^{-4t}$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [-16(\ln 10)^2 10^{-4t}] = 64(\ln 10)^3 10^{-4t}$$

10. Apply the formula(s):  $\frac{d}{dt} \sin f(t) = (\cos f(t)) \frac{d}{dt} f(t)$      $\frac{d}{dt} \cos f(t) = -(\sin f(t)) \frac{d}{dt} f(t)$

$$s(t) = 4 \cos(-t)$$

$$v(t) = \frac{d}{dt} s(t) = \frac{d}{dt} [4 \cos(-t)] = 4 \sin(-t)$$

$$a(t) = \frac{d}{dt} v(t) = \frac{d}{dt} [4 \sin(-t)] = -4 \cos(-t)$$

$$j(t) = \frac{d}{dt} a(t) = \frac{d}{dt} [-4 \cos(-t)] = -4 \sin(-t)$$