1. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = t + 4t^2 - 5t^3$

2. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = -2t^2 + 2t^4 + t^5$

3. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = 4t^2 + 5t^3 + t^4 + 2t^5 + 5t^6$

4. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = t - t^2 - 4t^3 - 4t^4$

5. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = 3 - t - t^2 + 2t^3$

6. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = 4t^2 - t^3 - 4t^4$

7. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = -5t + t^2 + 2t^3 - 5t^4 - 5t^5$

8. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = -3t - 5t^2 + 3t^3$

9. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = -5t - 3t^2 - 2t^3 + t^4$

10. Find the velocity, acceleration, and jerk functions for the following position function:
$s(t) = -t - t^2 + 3t^3 - t^4 - 5t^5$

Answers:

1. $v(t) = 1 + 8t - 15t^2 \quad a(t) = 8 - 30t \quad j(t) = -30$

2. $v(t) = -4t + 8t^3 + 5t^4 \quad a(t) = -4 + 24t^2 + 20t^3 \quad j(t) = 48t + 60t^2$

3. $v(t) = 8t + 15t^2 + 4t^3 + 10t^4 + 30t^5 \quad a(t) = 8 + 30t + 12t^2 + 40t^3 + 150t^4 \quad j(t) = 30 + 24t + 120t^2 + 600t^3$

4. $v(t) = 1 - 2t - 12t^2 - 16t^3 \quad a(t) = -2 - 24t - 48t^2 \quad j(t) = -24 - 96t$

5. $v(t) = -1 - 2t + 6t^2 \quad a(t) = -2 + 12t \quad j(t) = 12$

6. $v(t) = 8t - 3t^2 - 16t^3 \quad a(t) = 8 - 6t - 48t^2 \quad j(t) = -6 - 96t$

7. $v(t) = -5 + 2t + 6t^2 - 20t^3 - 25t^4 \quad a(t) = 2 + 12t - 60t^2 - 100t^3 \quad j(t) = 12 - 120t - 300t^2$

8. $v(t) = -3 - 10t + 9t^2 \quad a(t) = -10 + 18t \quad j(t) = 18$

9. $v(t) = -5 - 6t - 6t^2 + 4t^3 \quad a(t) = -6 - 12t + 12t^2 \quad j(t) = -12 + 24t$

10. $v(t) = -1 - 2t + 9t^2 - 4t^3 - 25t^4 \quad a(t) = -2 + 18t - 12t^2 - 100t^3 \quad j(t) = 18 - 24t - 300t^2$

Solutions:

1. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} t + 4t^2 - 5t^3 = 1 + 8t - 15t^2$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 1 + 8t - 15t^2 = 8 - 30t$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 8 - 30t = -30$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

2. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 2t^2 + 2t^4 + t^5 = -4t + 8t^3 + 5t^4$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 4t + 8t^3 + 5t^4 = -4 + 24t^2 + 20t^3$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 4 + 24t^2 + 20t^3 = 48t + 60t^2$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

3. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 4t^2 + 5t^3 + t^4 + 2t^5 + 5t^6 = 8t + 15t^2 + 4t^3 + 10t^4 + 30t^5$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 8t + 15t^2 + 4t^3 + 10t^4 + 30t^5 = 8 + 30t + 12t^2 + 40t^3 + 150t^4$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 8 + 30t + 12t^2 + 40t^3 + 150t^4 = 30 + 24t + 120t^2 + 600t^3$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

4. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} t - t^2 - 4t^3 - 4t^4 = 1 - 2t - 12t^2 - 16t^3$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 1 - 2t - 12t^2 - 16t^3 = -2 - 24t - 48t^2$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 2 - 24t - 48t^2 = -24 - 96t$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

5. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 3 - t - t^2 + 2t^3 = -1 - 2t + 6t^2$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 1 - 2t + 6t^2 = -2 + 12t$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 2 + 12t = 12$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

6. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 4t^2 - t^3 - 4t^4 = 8t - 3t^2 - 16t^3$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 8t - 3t^2 - 16t^3 = 8 - 6t - 48t^2$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 8 - 6t - 48t^2 = -6 - 96t$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

7. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 5t + t^2 + 2t^3 - 5t^4 - 5t^5 = -5 + 2t + 6t^2 - 20t^3 - 25t^4$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 5 + 2t + 6t^2 - 20t^3 - 25t^4 = 2 + 12t - 60t^2 - 100t^3$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} 2 + 12t - 60t^2 - 100t^3 = 12 - 120t - 300t^2$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

8. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 3t - 5t^2 + 3t^3 = -3 - 10t + 9t^2$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 3 - 10t + 9t^2 = -10 + 18t$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 10 + 18t = 18$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

9. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 5t - 3t^2 - 2t^3 + t^4 = -5 - 6t - 6t^2 + 4t^3$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 5 - 6t - 6t^2 + 4t^3 = -6 - 12t + 12t^2$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 6 - 12t + 12t^2 = -12 + 24t$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

10. $v(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - t - t^2 + 3t^3 - t^4 - 5t^5 = -1 - 2t + 9t^2 - 4t^3 - 25t^4$ ◀ Apply: $v(t) = \frac{\mathrm{d}}{\mathrm{d}t} s(t)$

$a(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 1 - 2t + 9t^2 - 4t^3 - 25t^4 = -2 + 18t - 12t^2 - 100t^3$ ◀ Apply: $a(t) = \frac{\mathrm{d}}{\mathrm{d}t} v(t)$

$j(t) = \dfrac{\mathrm{d}}{\mathrm{d}t} - 2 + 18t - 12t^2 - 100t^3 = 18 - 24t - 300t^2$ ◀ Apply: $j(t) = \frac{\mathrm{d}}{\mathrm{d}t} a(t)$

