

**Calculus Practice: Rectilinear Motion 4**

**A particle moves along a horizontal line. Its position function is  $s(t)$  for  $t \geq 0$ . For each problem, find the maximum speed and times  $t$  when this speed occurs, the displacement of the particle, and the distance traveled by the particle over the given interval.**

1)  $s(t) = -t^4 + 8t^3; 4 \leq t \leq 7$

2)  $s(t) = t^3 - 22t^2 + 105t; 3 \leq t \leq 4$

3)  $s(t) = t^3 - 20t^2 + 100t; 3 \leq t \leq 4$

4)  $s(t) = -t^4 + 14t^3; 10 \leq t \leq 16$

5)  $s(t) = -t^3 + 13t^2; 5 \leq t \leq 9$

6)  $s(t) = -t^2 + 14t - 40; 6 \leq t \leq 11$

7)  $s(t) = -t^3 + 11t^2 - 24t; 1 \leq t \leq 3$

8)  $s(t) = t^3 - 12t^2; 7 \leq t \leq 14$

9)  $s(t) = t^4 - 8t^3; 0 \leq t \leq 9$

10)  $s(t) = -t^3 + 28t^2 - 196t; 2 \leq t \leq 10$

**A particle moves along a vertical line. Its velocity function is  $v(t)$  for  $t \geq 0$ . For each problem, find the maximum speed and times  $t$  when this speed occurs over the given interval.**

11)  $v(t) = 4t^3 - 30t^2$ ;  $1 \leq t \leq 9$

12)  $v(t) = 4t^3 - 27t^2$ ;  $0 \leq t \leq 7$

13)  $v(t) = -2t + 15$ ;  $2 \leq t \leq 9$

14)  $v(t) = -3t^2 + 36t - 81$ ;  $1 \leq t \leq 4$

15)  $v(t) = 3t^2 - 36t + 81$ ;  $1 \leq t \leq 8$

16)  $v(t) = 4t^3 - 45t^2$ ;  $9 \leq t \leq 13$

17)  $v(t) = 4t^3 - 42t^2$ ;  $4 \leq t \leq 11$

18)  $v(t) = -2t + 17$ ;  $2 \leq t \leq 11$

19)  $v(t) = 4t^3 - 24t^2$ ;  $0 \leq t \leq 11$

20)  $v(t) = 4t^3 - 27t^2$ ;  $4 \leq t \leq 12$

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A particle moves along a horizontal line. Its position function is  $s(t)$  for  $t \geq 0$ . For each problem, find the maximum speed and times  $t$  when this speed occurs, the displacement of the particle, and the distance traveled by the particle over the given interval.

1)  $s(t) = -t^4 + 8t^3$ ;  $4 \leq t \leq 7$

Maximum speed: 196 at  $t = \{7\}$ 

Displacement: 87

Distance traveled: 265

2)  $s(t) = t^3 - 22t^2 + 105t$ ;  $3 \leq t \leq 4$

Maximum speed: 23 at  $t = \{4\}$ 

Displacement: -12

Distance traveled: 12

3)  $s(t) = t^3 - 20t^2 + 100t$ ;  $3 \leq t \leq 4$

Maximum speed: 12 at  $t = \{4\}$ 

Displacement: -3

Distance traveled:  $\frac{143}{27} \approx 5.296$ 

4)  $s(t) = -t^4 + 14t^3$ ;  $10 \leq t \leq 16$

Maximum speed: 5632 at  $t = \{16\}$ 

Displacement: -12192

Distance traveled:  $\frac{98363}{8} = 12295.375$ 

5)  $s(t) = -t^3 + 13t^2$ ;  $5 \leq t \leq 9$

Maximum speed: 55 at  $t = \{5\}$ 

Displacement: 124

Distance traveled:  $\frac{3428}{27} \approx 126.963$ 

6)  $s(t) = -t^2 + 14t - 40$ ;  $6 \leq t \leq 11$

Maximum speed: 8 at  $t = \{11\}$ 

Displacement: -15

Distance traveled: 17

7)  $s(t) = -t^3 + 11t^2 - 24t$ ;  $1 \leq t \leq 3$

Maximum speed: 15 at  $t = \{3\}$ 

Displacement: 14

Distance traveled:  $\frac{422}{27} \approx 15.63$ 

8)  $s(t) = t^3 - 12t^2$ ;  $7 \leq t \leq 14$

Maximum speed: 252 at  $t = \{14\}$ 

Displacement: 637

Distance traveled: 659

9)  $s(t) = t^4 - 8t^3$ ;  $0 \leq t \leq 9$

Maximum speed: 972 at  $t = \{9\}$ 

Displacement: 729

Distance traveled: 1593

10)  $s(t) = -t^3 + 28t^2 - 196t$ ;  $2 \leq t \leq 10$

Maximum speed: 96 at  $t = \{2\}$ 

Displacement: 128

Distance traveled:  $\frac{9856}{27} \approx 365.037$

A particle moves along a vertical line. Its velocity function is  $v(t)$  for  $t \geq 0$ . For each problem, find the maximum speed and times  $t$  when this speed occurs over the given interval.

11)  $v(t) = 4t^3 - 30t^2$ ;  $1 \leq t \leq 9$

Maximum speed: 486 at  $t = \{9\}$

12)  $v(t) = 4t^3 - 27t^2$ ;  $0 \leq t \leq 7$

Maximum speed:  $\frac{729}{4}$  at  $t = \left\{\frac{9}{2}\right\}$

13)  $v(t) = -2t + 15$ ;  $2 \leq t \leq 9$

Maximum speed: 11 at  $t = \{2\}$

14)  $v(t) = -3t^2 + 36t - 81$ ;  $1 \leq t \leq 4$

Maximum speed: 48 at  $t = \{1\}$

15)  $v(t) = 3t^2 - 36t + 81$ ;  $1 \leq t \leq 8$

Maximum speed: 48 at  $t = \{1\}$

16)  $v(t) = 4t^3 - 45t^2$ ;  $9 \leq t \leq 13$

Maximum speed: 1183 at  $t = \{13\}$

17)  $v(t) = 4t^3 - 42t^2$ ;  $4 \leq t \leq 11$

Maximum speed: 686 at  $t = \{7\}$

18)  $v(t) = -2t + 17$ ;  $2 \leq t \leq 11$

Maximum speed: 13 at  $t = \{2\}$

19)  $v(t) = 4t^3 - 24t^2$ ;  $0 \leq t \leq 11$

Maximum speed: 2420 at  $t = \{11\}$

20)  $v(t) = 4t^3 - 27t^2$ ;  $4 \leq t \leq 12$

Maximum speed: 3024 at  $t = \{12\}$