

## Linear Motion Practice

Date \_\_\_\_\_ Period \_\_\_\_\_

A particle moves along a horizontal line. Its position function is  $s(t)$  for  $t \geq 0$ . For each problem, find the velocity function  $v(t)$ , the acceleration function  $a(t)$ , and the times  $t$  when the particle changes directions.

1)  $s(t) = -t^3 + 28t^2 - 196t$

2)  $s(t) = t^3 - 9t^2$

3)  $s(t) = t^3 - 10t^2$

4)  $s(t) = -t^3 + 15t^2$

A particle moves along a horizontal line. Its position function is  $s(t)$  for  $t \geq 0$ . For each problem, find the velocity function  $v(t)$ , the acceleration function  $a(t)$ , and the intervals of time when the particle is moving left and moving right.

5)  $s(t) = t^3 - 9t^2$

6)  $s(t) = -t^3 + 30t^2 - 225t$

7)  $s(t) = t^3 - 10t^2$

8)  $s(t) = -t^3 + 10t^2$

**A particle moves along a horizontal line. Its position function is  $s(t)$  for  $t \geq 0$ . For each problem, find the velocity function  $v(t)$ , the acceleration function  $a(t)$ , and the intervals of time when the particle is slowing down and speeding up.**

9)  $s(t) = t^3 - 23t^2 + 120t$

10)  $s(t) = -t^3 + 11t^2 - 24t$

11)  $s(t) = t^3 - 30t^2 + 225t$

12)  $s(t) = t^3 - t^2 - 56t$

## Answers to Linear Motion Practice (ID: 1)

1)  $v(t) = -3t^2 + 56t - 196$ ,  $a(t) = -6t + 56$

Changes direction at:  $t = \left\{ \frac{14}{3}, 14 \right\}$

3)  $v(t) = 3t^2 - 20t$ ,  $a(t) = 6t - 20$

Changes direction at:  $t = \left\{ \frac{20}{3} \right\}$

5)  $v(t) = 3t^2 - 18t$ ,  $a(t) = 6t - 18$

Moving left:  $0 < t < 6$ , Moving right:  $t > 6$

6)  $v(t) = -3t^2 + 60t - 225$ ,  $a(t) = -6t + 60$

Moving left:  $0 \leq t < 5$ ,  $t > 15$ , Moving right:  $5 < t < 15$

7)  $v(t) = 3t^2 - 20t$ ,  $a(t) = 6t - 20$

Moving left:  $0 < t < \frac{20}{3}$ , Moving right:  $t > \frac{20}{3}$

2)  $v(t) = 3t^2 - 18t$ ,  $a(t) = 6t - 18$

Changes direction at:  $t = \{6\}$

4)  $v(t) = -3t^2 + 30t$ ,  $a(t) = -6t + 30$

Changes direction at:  $t = \{10\}$

8)  $v(t) = -3t^2 + 20t$ ,  $a(t) = -6t + 20$

Moving left:  $t > \frac{20}{3}$ , Moving right:  $0 < t < \frac{20}{3}$

9)  $v(t) = 3t^2 - 46t + 120$ ,  $a(t) = 6t - 46$

Slowing down:  $0 \leq t < \frac{10}{3}$ ,  $\frac{23}{3} < t < 12$ , Speeding up:  $\frac{10}{3} < t < \frac{23}{3}$ ,  $t > 12$

10)  $v(t) = -3t^2 + 22t - 24$ ,  $a(t) = -6t + 22$

Slowing down:  $0 \leq t < \frac{4}{3}$ ,  $\frac{11}{3} < t < 6$ , Speeding up:  $\frac{4}{3} < t < \frac{11}{3}$ ,  $t > 6$

11)  $v(t) = 3t^2 - 60t + 225$ ,  $a(t) = 6t - 60$

Slowing down:  $0 \leq t < 5$ ,  $10 < t < 15$ , Speeding up:  $5 < t < 10$ ,  $t > 15$

12)  $v(t) = 3t^2 - 2t - 56$ ,  $a(t) = 6t - 2$

Slowing down:  $\frac{1}{3} < t < \frac{14}{3}$ , Speeding up:  $0 \leq t < \frac{1}{3}$ ,  $t > \frac{14}{3}$