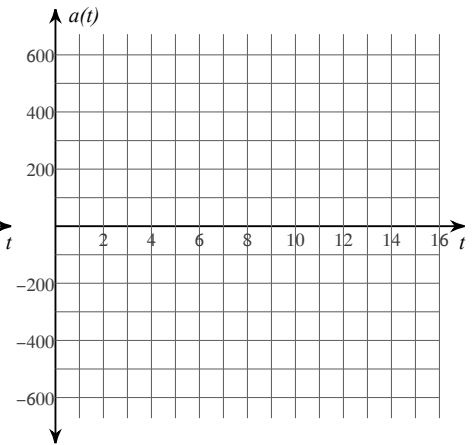
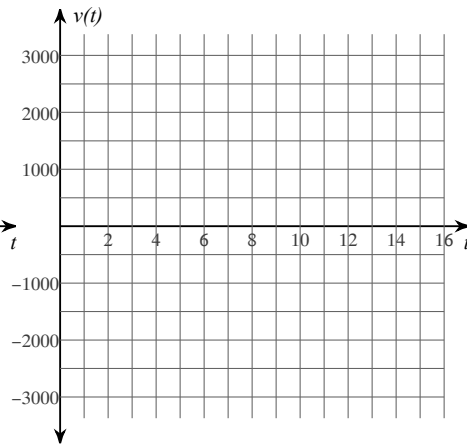
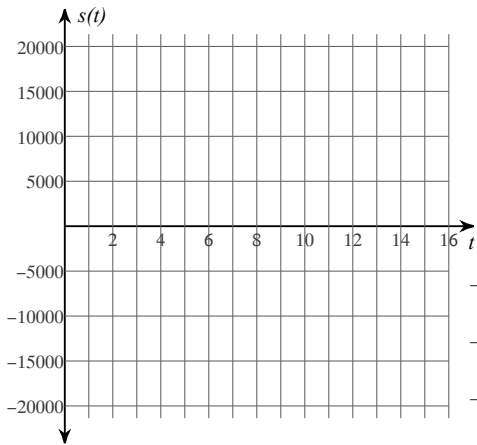


Particle Motion

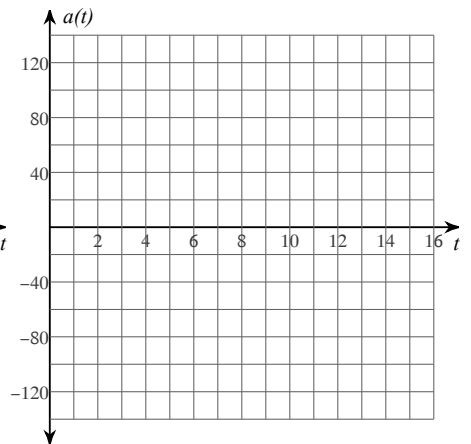
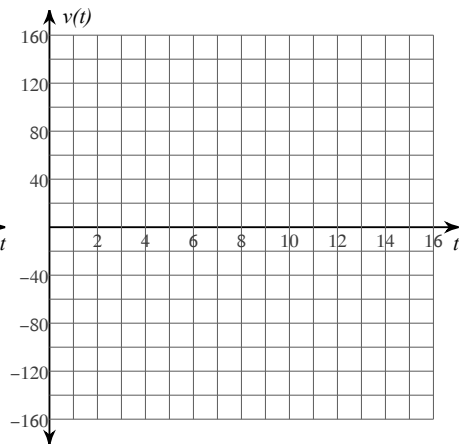
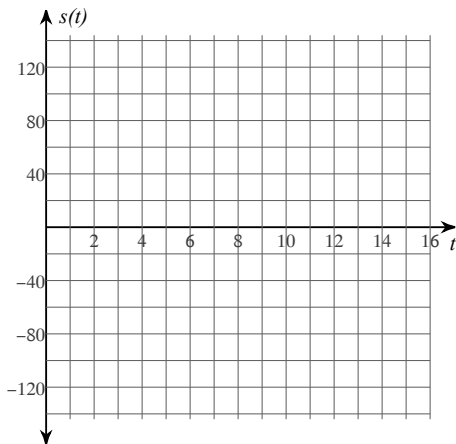
Date \_\_\_\_\_ Period \_\_\_\_\_

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  $a(t)$ , the times  $t$  when the particle changes directions, the intervals of time when the particle is moving left and moving right, the times  $t$  when the acceleration is 0, and the intervals of time when the particle is slowing down and speeding up. You may use the blank graphs to sketch  $s(t)$ ,  $v(t)$ , and  $a(t)$ .

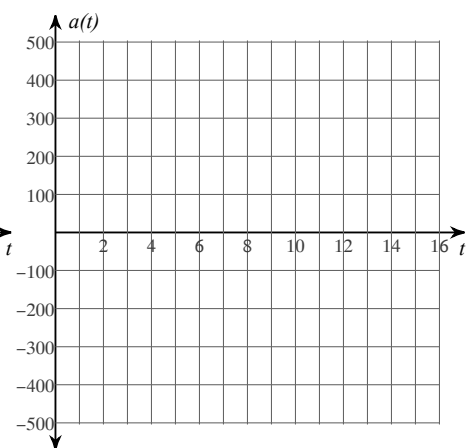
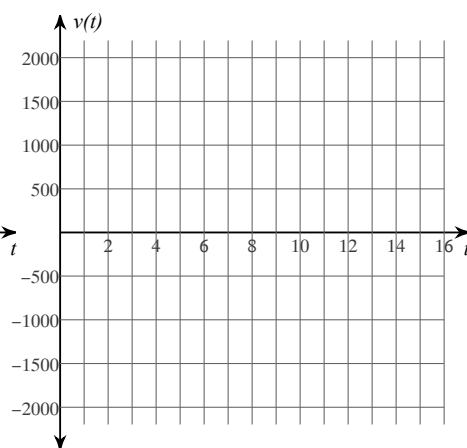
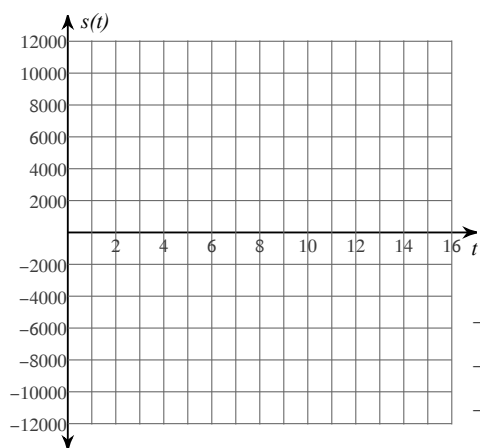
1)  $s(t) = -t^4 + 15t^3$



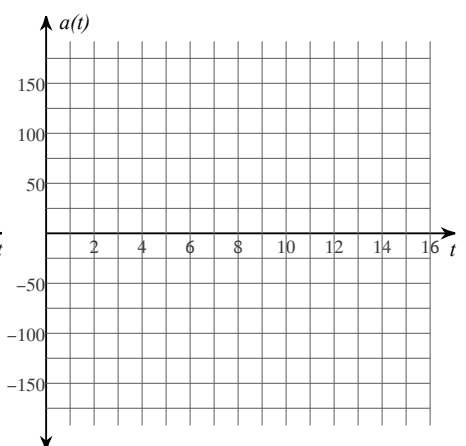
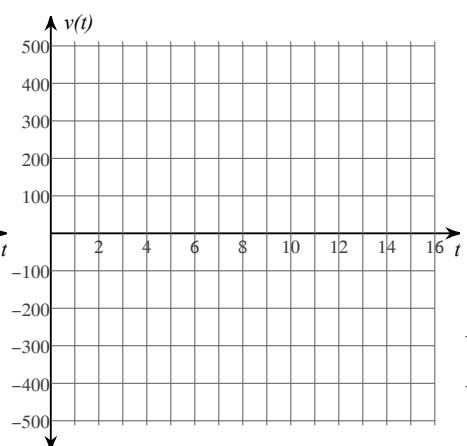
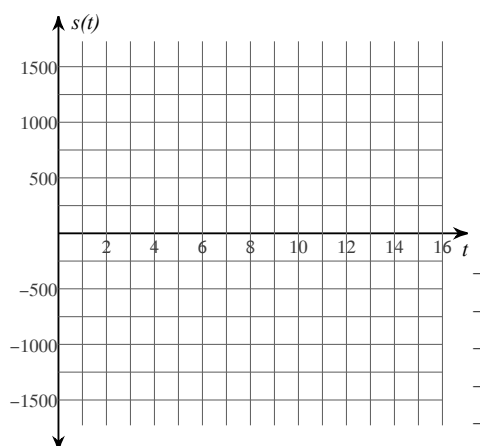
2)  $s(t) = t^3 - 13t^2 + 40t$



3)  $s(t) = t^4 - 13t^3$



4)  $s(t) = t^4 - 8t^3$

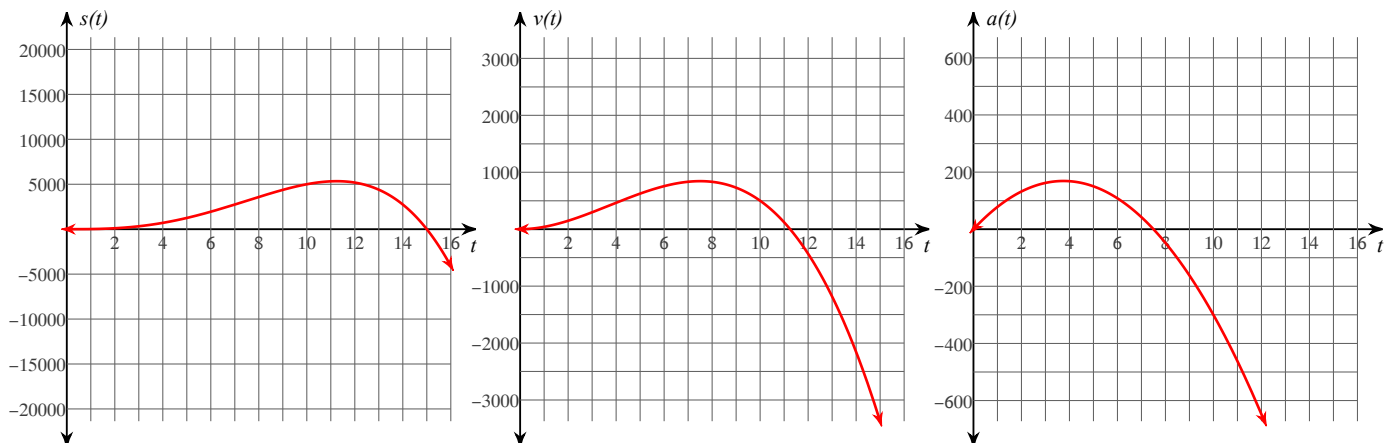


# Particle Motion

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  $a(t)$ , the times  $t$  when the particle changes directions, the intervals of time when the particle is moving left and moving right, the times  $t$  when the acceleration is 0, and the intervals of time when the particle is slowing down and speeding up. You may use the blank graphs to sketch  $s(t)$ ,  $v(t)$ , and  $a(t)$ .

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

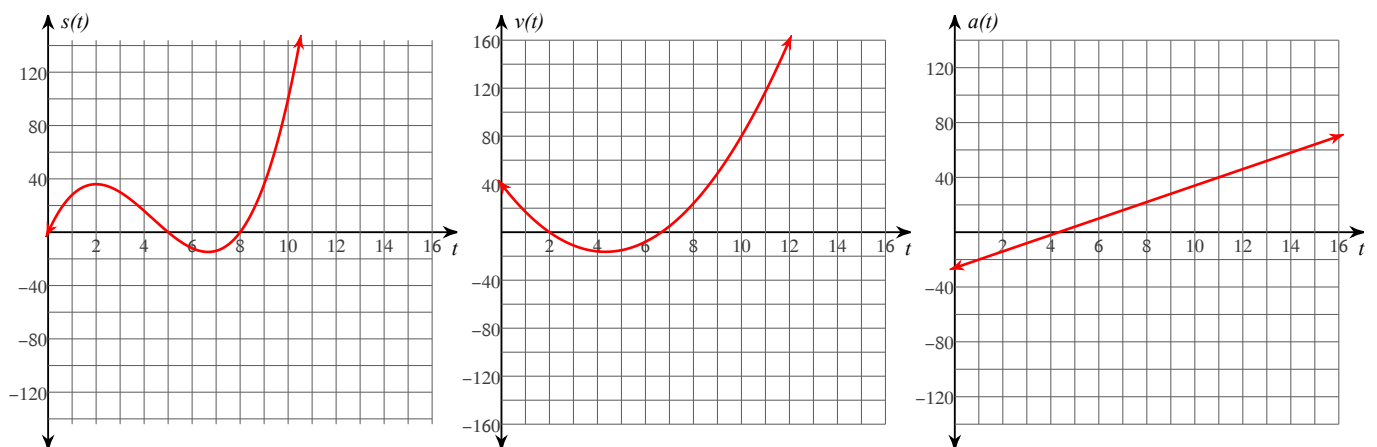


$v(t) = -4t^3 + 45t^2, a(t) = -12t^2 + 90t$

Changes direction at:  $t = \left\{ \frac{45}{4} \right\}$ , Moving left:  $t > \frac{45}{4}$ , Moving right:  $0 < t < \frac{45}{4}$

Acceleration zero at:  $t = \left\{ 0, \frac{15}{2} \right\}$ , Slowing down:  $\frac{15}{2} < t < \frac{45}{4}$ , Speeding up:  $0 < t < \frac{15}{2}, t > \frac{45}{4}$

2)  $s(t) = t^3 - 13t^2 + 40t$

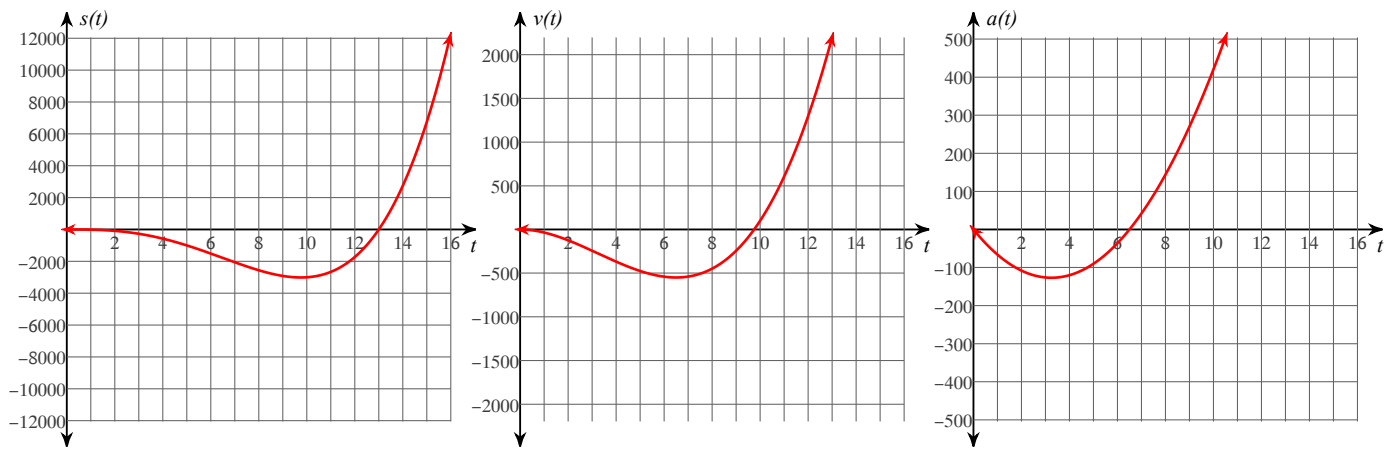


$v(t) = 3t^2 - 26t + 40, a(t) = 6t - 26$

Changes direction at:  $t = \left\{ 2, \frac{20}{3} \right\}$ , Moving left:  $2 < t < \frac{20}{3}$ , Moving right:  $0 \leq t < 2, t > \frac{20}{3}$

Acceleration zero at:  $t = \left\{ \frac{13}{3} \right\}$ , Slowing down:  $0 \leq t < 2, \frac{13}{3} < t < \frac{20}{3}$ , Speeding up:  $2 < t < \frac{13}{3}, t > \frac{20}{3}$

3)  $s(t) = t^4 - 13t^3$

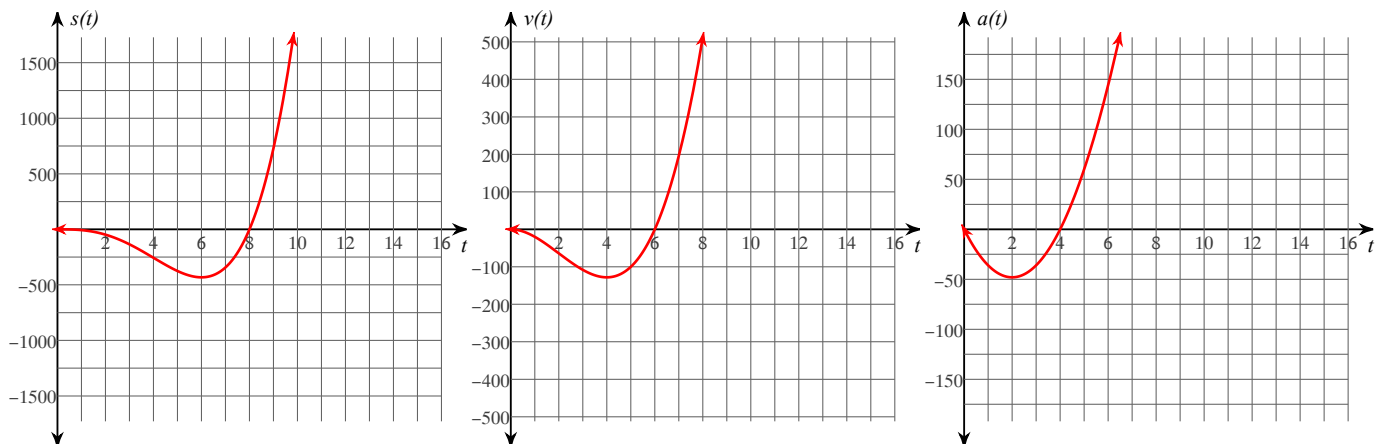


$v(t) = 4t^3 - 39t^2, a(t) = 12t^2 - 78t$

Changes direction at:  $t = \left\{ \frac{39}{4} \right\}$ , Moving left:  $0 < t < \frac{39}{4}$ , Moving right:  $t > \frac{39}{4}$

Acceleration zero at:  $t = \left\{ 0, \frac{13}{2} \right\}$ , Slowing down:  $\frac{13}{2} < t < \frac{39}{4}$ , Speeding up:  $0 < t < \frac{13}{2}, t > \frac{39}{4}$

4)  $s(t) = t^4 - 8t^3$



$v(t) = 4t^3 - 24t^2, a(t) = 12t^2 - 48t$

Changes direction at:  $t = \{6\}$ , Moving left:  $0 < t < 6$ , Moving right:  $t > 6$

Acceleration zero at:  $t = \{0, 4\}$ , Slowing down:  $4 < t < 6$ , Speeding up:  $0 < t < 4, t > 6$