

Work the following on notebook paper.

1. A particle moves according to the function $s = t^3 - 12t^2 + 36t$, $t \geq 0$, where t is measured in seconds and s in meters.

- (a) Find the velocity at time t .
- (b) What is the velocity after 3s?
- (c) When is the particle at rest?
- (d) When is the particle moving forward?
- (e) Find the displacement of the particle after the first 8s.
- (f) Find the total distance traveled during the first 8s.
- (g) Draw a diagram to illustrate the motion of the particle.
- (h) Find the acceleration at time t and after 3s.
- (i) Graph the position, velocity, and acceleration functions for $0 \leq t \leq 8$.
- (j) When is the particle speeding up? When is it slowing down?

2. A particle moves along the x -axis, its position at time t given by

$$x(t) = \frac{t}{1+t^2}, \quad t \geq 0$$

where t is measured in seconds and x in meters.

- (a) Find the velocity at time t .
- (b) When is the particle moving to the right? When is it moving to the left?
- (c) Find the displacement of the particle during the first 4s.
- (d) Find the total distance traveled by the particle during the first 4s.
- (e) Find the acceleration at time t . When is it 0?
- (f) Graph the position, velocity, and acceleration functions for $0 \leq t \leq 4$.
- (g) When is the particle speeding up? When is it slowing down?

3. A particle moves in a vertical line so that its coordinate at time t is

$$y(t) = t^3 - 12t + 3, \quad t \geq 0.$$

- (a) Find the velocity and acceleration functions.
- (b) When is the particle moving upward, and when is it moving downward?
- (c) Find the displacement of the particle during the first 3s.
- (d) Find the distance that the particle travels in the time interval $0 \leq t \leq 3$.
- (e) Graph the position, velocity, and acceleration functions for $0 \leq t \leq 3$.
- (e) When is the particle speeding up? When is it slowing down?