

## Rectilinear Motion Problems

- The position function of a particle moving on a coordinate line is given by  $s(t) = t^3 - 9t^2 + 24t + 5$ .
  - Write an expression for the velocity of the particle,  $v(t)$ .
  - Write an expression for the acceleration of the particle,  $a(t)$ .
  - When is the particle moving to the right? to the left?
  - Find the total distance traveled by the particle from  $t = 0$  to  $t = 4$ .
- Let  $s(t) = \frac{1}{3}t^3 + t^2 - 15t + 2$  describe the motion of a car for  $t > 0$ .
  - When is the car at rest?
  - When is the speed of the car constant?
  - When is the car speeding up? slowing down?
  - What is the total distance that the car travels from  $t = 0$  to  $t = 6$ ?
- If the position function of a particle is  $x(t) = \frac{t}{t^2 + 9}$  for  $t > 0$ , find when the particle is changing direction.
- A particle moves along a coordinate line according to the function  $s(t) = -t^3 + 4t^2 - 7$  over the interval  $1 \leq t \leq 5$ . What is the maximum speed of the particle?
- If the displacement from the origin of a particle moving along the  $x$ -axis is given by  $s = 3 + (t - 2)^4$ , then how many times does the particle reverse direction? What is the total distance that the particle travels from  $t = 1$  to  $t = 4$ ?
- If the position function of a particle is  $x(t) = \sin\left(\frac{t}{2}\right)$  for  $0 < t < 4\pi$ , find when the particle is changing direction.
- If the position function of a particle is  $x(t) = 2\sin^2 t + 2\cos^2 t$  for  $t > 0$ , find the velocity and acceleration of the particle.
- The velocity of a particle in motion along a line (for  $t \geq 0$ ) is  $v(t) = \ln(2 - t^2)$ . Find the acceleration when the object is at rest.
- A particle moves along the  $x$ -axis so that at any time  $t$  its position is given by  $x(t) = (t + 1)(t - 3)^3$ . For what values of  $t$  is the velocity of the particle increasing?
  - $t > 3$  only
  - $0 < t < 3$  only
  - $1 < t < 3$  only
  - $t < 1$  or  $t > 3$
  - $0 < t < 3$  or  $t > 3$