

## Rectilinear Motion

- 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 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  $t = 4$ .
- 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.
- Two objects in motion from  $t = 0$  to  $t = 3$  seconds have positions  $x_1(t) = \cos(t^2 + 1)$  and  $x_2(t) = \frac{e^t}{2t}$ , respectively. How many times during the 3 seconds do the objects have the same velocity? (Requires use of graphing calculator.)
- A particle moves on a line according to the law  $s = f(t)$  so that its velocity  $v = ks$ , where  $k$  is a nonzero constant. Its acceleration is
  - $k^2v$
  - $k^2s$
  - $k$
  - 0
  - none of these
- 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  $t > 3$