

**Learning objectives:**

1. Applications of derivative in measuring rates of change
2. Motions of particles in physics.
3. Current in electrodynamics.
4. Marginal cost in economics.

**Example 1.** The position of a particle is given by the equation  $s(t) = t^3 - 6t^2 + 9t$ , where  $t$  is measured in seconds and  $s$  is measured in meters.

1. Find the velocity at time  $t$ .
2. What is the velocity after 2 s? After 4 s?
3. When is the particle at rest?
4. When is the particle moving forward (that is, in the positive direction)?

5. Draw a diagram to represent the motion of the particle.
6. Find the total distance traveled by the particle during the first five seconds.
7. Find the acceleration at time  $t$  and after 4 s.
8. When is the particle speeding up? When is it slowing down?

**Example 2.** The charge flowing through a circuit varies with times as  $q(t) = 10t + 0.1 \sin(50t + \pi)$  coulombs.

1. Find the amount of current in amperes flowing through the circuit at time  $t$ .
2. What are the maximum and minimum values of the current flowing through the circuit.

**Example 3.** The cost of producing  $x$  units of an item is given by  $10,000 + 5x + 0.01x^2$  dollars. Find the cost of producing one more item after 500 items have been produced.