Q1 1- The displacement of an accelerating particle is given by $s = k\, v^m\, a^n$ where k is a dimensionless constant, **a** is the acceleration and **v** is the velocity. (One) Determine by dimensional analysis the values of the constants m and n in order for the equation to be dimensionally correct.

  2- Can one get the value of k from this analysis ?

Q2 A stone is dropped from a bridge that is 940 m above the water. Another stone is thrown vertically downward form this bridge 1.0 s after the first stone is dropped. Both stones strike the water at the same time.
(a) How long will it take the first stone to strike the water?

(b) What was the initial speed of the second stone?

Q3 An object moves along the x-coordinate according to the equation $x(t) = (3 - 4t^2 + 9t^3)$ m. Determine:

(a) the average velocity between t = 1 s and t = 2 s?

(b) the instantaneous acceleration at t = 1 s.

Q4 A person walks 12.0 km, 20o south of east, and then walks 15.0 km, 10o south of west. Call these displacements **A** and **B**, respectively.
  1- Write down in unit-vector notation these two displacements **A** and **B**. Take east along the positive x-axis and north along the positive y-axis.

  2- Find the magnitude and direction of the resultant vector.

Q5 At t = 0 , a particle leaves the origin with a velocity **vo** = 12 **j** m/s. Its acceleration is given by **a** = (**i** - 4 **j**) m/s2. When the particle reaches its maximum y coordinate, the y component of its velocity is zero. Find:

(a) the time the particle takes to reach the maximum y coordinate, and

(b) the coordinates of the particle at that time.

Q6 A cannon on the ground shoots out a ball at 60o to the horizontal with an initial speed of 30 m/s. The ball strikes a target located at a horizontal distance of 70 m from the cannon and at a height H above the ground.

(a)   How long is the ball in the air?

(b)   What is the value of H?

Q7 A spacecraft is circling the moon in an orbit of radius 1800 km. The spacecraft takes 19.0 h to complete one revolution about the moon.

(a) Find the speed of the spacecraft.

(b) Find the centripetal acceleration of the spacecraft.

Q8 Two blocks, connected by a string, are pulled across a smooth horizontal surface by a force applied to one of the blocks, as shown in the figure. F = 20 N, M = 1.5 kg.

(a) What is the acceleration of the system?
(b) What is the tension T in the connecting string?

Q9 A block of mass M = 30 kg moves with constant velocity along an inclined plane under the action of a force F, as shown in the figure. Take q = 5o and mk = 0.10. Determine the force F.