

**Post class assignment:**

**Solve the following problems:**

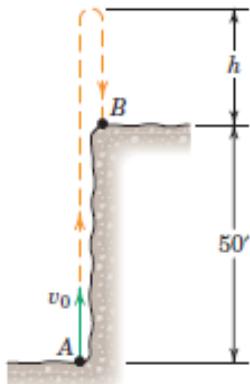
**2/2** The displacement of a particle is given by  $s = 2t^3 - 30t^2 + 100t - 50$ , where  $s$  is in feet and  $t$  is in seconds. Plot the displacement, velocity, and acceleration as functions of time for the first 12 seconds of motion. Determine the time at which the velocity is zero.

**2/3** The velocity of a particle which moves along the  $s$ -axis is given by  $v = 2 + 5t^{3/2}$ , where  $t$  is in seconds and  $v$  is in meters per second. Evaluate the displacement  $s$ , velocity  $v$ , and acceleration  $a$  when  $t = 4$  s. The particle is at the origin  $s = 0$  when  $t = 0$ .

**2/4** The velocity of a particle along the  $s$ -axis is given by  $v = 5s^{3/2}$ , where  $s$  is in millimeters and  $v$  is in millimeters per second. Determine the acceleration when  $s$  is 2 millimeters.

**2/12** A projectile is fired vertically with an initial velocity of 200 m/s. Calculate the maximum altitude  $h$  reached by the projectile and the time  $t$  after firing for it to return to the ground. Neglect air resistance and take the gravitational acceleration to be constant at  $9.81 \text{ m/s}^2$ .

**2/13** A ball is thrown vertically upward with an initial speed of 80 ft/sec from the base  $A$  of a 50-ft cliff. Determine the distance  $h$  by which the ball clears the top of the cliff and the time  $t$  after release for the ball to land at  $B$ . Also, calculate the impact velocity  $v_B$ . Neglect air resistance and the small horizontal motion of the ball.



**Problem 2/13**

**2/59** At time  $t = 0$ , the position vector of a particle moving in the  $x$ - $y$  plane is  $\mathbf{r} = 5\mathbf{i}$  m. By time  $t = 0.02$  s, its position vector has become  $5.1\mathbf{i} + 0.4\mathbf{j}$  m. Determine the magnitude  $v_{av}$  of its average velocity during this interval and the angle  $\theta$  made by the average velocity with the positive  $x$ -axis.

**2/60** A particle moving in the  $x$ - $y$  plane has a velocity at time  $t = 6$  s given by  $4\mathbf{i} + 5\mathbf{j}$  m/s, and at  $t = 6.1$  s its velocity has become  $4.3\mathbf{i} + 5.4\mathbf{j}$  m/s. Calculate the magnitude  $a_{av}$  of its average acceleration during the 0.1-s interval and the angle  $\theta$  it makes with the  $x$ -axis.

**2/61** The velocity of a particle moving in the  $x$ - $y$  plane is given by  $6.12\mathbf{i} + 3.24\mathbf{j}$  m/s at time  $t = 3.65$  s. Its average acceleration during the next 0.02 s is  $4\mathbf{i} + 6\mathbf{j}$  m/s<sup>2</sup>. Determine the velocity  $\mathbf{v}$  of the particle at  $t = 3.67$  s and the angle  $\theta$  between the average-acceleration vector and the velocity vector at  $t = 3.67$  s.

**2/62** A particle which moves with curvilinear motion has coordinates in millimeters which vary with the time  $t$  in seconds according to  $x = 2t^2 - 4t$  and  $y = 3t^2 - \frac{1}{3}t^3$ . Determine the magnitudes of the velocity  $\mathbf{v}$  and acceleration  $\mathbf{a}$  and the angles which these vectors make with the  $x$ -axis when  $t = 2$  s.