Average and Instantaneous Rate of Change

1. Given the function  and the values of x0 = 3 and x1 = 4, find:
   1. The average rate of change of y with respect to x over the interval [x0, x1].
   2. The instantaneous rate of change of y with respect to x at x0.
   3. The slope of the tangent line at x1.
   4. The slope of the secant line between points x0 and x1.
   5. Make a sketch of and show the secant and tangent lines at their respective points.
2. Repeat problem #1 for  and the values x0 = 2 and x1 = 3.
3. Find the slope of the graph  at a general point x. What is the slope of the tangent line at x0 = 6?
4. Suppose that .
   1. Find the average rate of change of y with respect to x over the interval [1, 3].
   2. Find the instantaneous rate of change of y with respect to x at point x = 1.
5. A rocket is propelled upward and reaches a height of  in t seconds.
   1. How high does it reach in 35 seconds?
   2. What is the average velocity of the rocket during the first 35 seconds?
   3. What is the average velocity of the rocket during the first 200 meters?
   4. What is the instantaneous velocity of the rocket at the end of the 35 seconds?
6. A particle moves in the positive direction along a straight line so that after t nanoseconds, its traversed distance is given by  nanometers.
   1. What is the average velocity of the particle during the first 2 nanoseconds?
   2. What is the instantaneous velocity of the particle at t = 2 nanoseconds?

Answer Key

* 1. \frac {7}{2}
  2.  3
  3.  4
  4. \frac {7}{2}
  5.  \frac {-1}{6}
  6.  \frac {-1}{4}
  7.  \frac {-1}{9}
  8.  \frac {-1}{6}

1. 2x, 12
   1.  \left ( \frac {\sqrt{3}}{6} - \frac{1}{2} \right ) 
   2.  -\frac{1}{2}
   3. 6002.5 \;\mathrm{m}
   4. 171.5 \;\mathrm{m/sec}
   5. 31.3 \;\mathrm{m/sec}
   6. 343 \;\mathrm{m/sec}
   7. 39.6 \;\mathrm{m/sec}
   8. 118.8 \;\mathrm{m/sec}