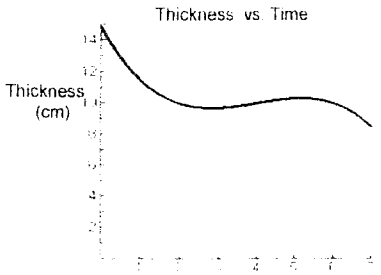
Practice

1. The thickness of the ice on a lake for one week is modelled by the function $T(d) = -0.1d^3 + 1.2d^2 - 4.4d + 14.8$ where T is the thickness in cm and d is the number of days after December 31st.



   a) Determine how fast the thickness of the ice is changing on day 4.
   b) What is the instantaneous rate of change on day 4?

2. The displacement, in metres, of a ball rolling in a straight line on a grassy hill is given approximately by $d = -t^2 + 6t + 5$ where t is measured in seconds
   a) Find the average velocity over the following time periods.
      $t \in [2,4]$ $t \in [2,3]$ $t \in [2,2.5]$ $t \in [2,2.1]$
   b) Find the instantaneous velocity at 2 seconds.

3. The profit, in dollars, for producing x units of an instruction manual is $P(x) = 8000 + 20x + 0.1x^2$ for the first 200 units of the manual.
   a) Find the average rate of change of P with respect to x when the production level is changing from:
      x = 100 to x = 110 x = 100 to x = 105 x = 100 to x = 101
   b) Find the instantaneous rate of change of P with respect to x, when x = 100. (This is called the marginal profit.)

Answers:

1. 0.4 cm/day
2. a) 0 m/s, 1 m/s, 1.5 m/s, 1.9 m/s b) 2 m/s
3. a) 41, 40.5, 40.1 b) 40

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