MathPro Tutoring Practice Tests

This chapter test correlates with:

Calculus of a Single Variable, 8th ed.		Calculus with Analytic Geometry, 8th ed.
by Larson, Hostetler, Edwards	or	by Larson, Hostetler, Edwards
Houghton Mifflin, 2006		Houghton Mifflin, 2006

Section 2.6: Related Rates

[Also:
7th edition, Section 2.6
6th edition, Section 2.6]

A few notes:

- If you are using a different textbook, this may not be a comprehensive chapter test for you.
- Solutions are available at www.mathprotutoring.com/tests.
- Angle measures are represented using radian measure, unless there is a pressing reason to use degree measure. If degree measure is used, there will always be a ° symbol.
- This test is copyright material. You must obtain express written permission from Linda Sinclair (linda@mathprotutoring.com) in order to duplicate and/or share this test with others.
- Please check www.mathprotutoring.com/tests soon for new tests. New ones will be added just as quickly as they are created.

Calculus Sections 2.6 Related Rates

1. A square is expanding with time. How is the rate at which the area increases related to the rate at which a side increases?

2. A cube is expanding with time. How is the rate at which the volume increases related to the rate at which a side increases?

3. A particle moves along the graph of $xy = x + 10$ so that $\frac{dx}{dt} = 4x + 4$. What is $\frac{dy}{dt}$ when $x = 2$?

4. A bug crawls along the graph of $y = x^2 + 4x + 1$. If its x-value is increasing at a rate of 3 cm/min, at what rate is its y-value increasing at the point (2,13)?

5. A stone dropped into a still pond causes a circular wave. If the radius of the wave expands at a constant rate of 2 ft/sec,

   a. How fast does the diameter of the wave increase?

   b. How fast does the circumference of the wave increase?

c. How fast does the area expand when the radius is 3 ft?

6. Air is being pumped into a spherical balloon at a rate of $20\ ft^3/min$. At what rate is the radius changing when the radius is 3 ft?

7. A 13-foot ladder leaning against the side of a house is sliding down the wall at a rate of 1 ft/sec. How fast is the base of the ladder moving away from the house, when the top of the ladder is 5 ft high?

8. An oil tank in the shape of a circular cylinder of radius 8 m is being filled at a constant rate of $10\ m^3/min$. How fast is the level of the oil rising?

9. A conical tank with vertex down is leaking water at a rate of $2\ m^3/hr$. The radius of the tank is equal to its height. At what rate is the radius of the surface of the water decreasing when the water level is 1 m?

10. Suppose that the water that leaks out of the tank in Question 9 is being collected in a cylindrical tank of radius 2 m. How fast does the water level rise in the cylindrical tank?

11. The radius of a sphere is expanding at a rate of 4 cm/sec.
    a. How fast is the volume of the sphere increasing when its volume is $\frac{500}{3}\pi$ cm^3?

    b. How much volume does the sphere gain as the sphere's radius grows from $r = 5$ to $r = 6$?