Related Rates   (Related Derivatives)
Equations relating derivatives

Example: A cylindrical tank leaks water at 1 cubic meter/hour. What is the rate at which the height of the water is decreasing?

Example: A hot air balloon is rising and being pushed away by the wind. At what rate is the distance changing?

Related Rate Problem Strategy:
1. ***Draw a picture and name the variables and constants. Use t for time***. Assume all variables are differentiable functions of t.
2. ***Write down the numerical information*** (in terms of the symbols you have chosen).
3. ***Write down what we are asked to find*** (usually a rate, expressed as a derivative).
4. ***Write an equation that relates the variables***. You may have to combine two or more equations to get a single equation that relates the variable whose rate you want to the variables whose rates you know.
5. ***Differentiate both sides of the equation implicitly with respect to t***. Then express the rate you want in terms of the rate and variables whose values you know.
6. ***Evaluate and interpret***. Use known values to find the unknown rate.

Example 2 "A Rising Balloon"

Example: The base of a rectangular tub has length equal to one meter and width equal to four meters. The height of the tub is two meters. Water is flowing through a leak in the bottom of the tub at a rate of one cubic meter per hour. What is the rate at which the water level is decreasing?

Example 3: "A Highway Chase"

Example 4: Filling a conical tank

Exploration #1   Sliding Ladder