

## Related Rates

### **Related Rates Problem**

The problem involves the rates of change of two or more related variables with respect to time. The procedure involves finding an equation that relates the variables and using the Chain Rule to differentiate both sides with respect to time.

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### **Guidelines for Solving a Related Rates Problem**

- 1) Read the problem carefully, draw a diagram if needed, and label all changing quantities with variables.
  - 2) Determine what information you know and what you want to find.
  - 3) Write an equation that relates the variables for the rates of change that are given and the rate of change you must find.
  - 4) Differentiate both sides of the equation with respect to  $t$ .
  - 5) Substitute the given numerical information into the equation, and solve for the unknown rate.
  - 6) Include appropriate units for your answer.
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### **Some Helpful Formulas**

Pythagorean Theorem:  $a^2 + b^2 = c^2$

Circumference of a Circle:  $C = \pi d$  or  $C = 2\pi r$

Area of a Circle:  $A = \pi r^2$

Volume of a Sphere:  $V = \frac{4}{3}\pi r^3$

Surface Area of a Sphere:  $A = 4\pi r^2$

Volume of a right circular Cylinder:  $V = \pi r^2 h$

Volume of a Cone:  $V = \frac{1}{3}\pi r^2 h$

Volume of a Cube:  $V = s^3$

Surface area of a Cube:  $A = 6s^2$