

## **2.8 Related Rates (Part One)**

Most quantities encountered in science or in everyday life vary with time. If two such quantities are related by an equation, and if we know the rate at which one of them changes, then, by differentiating the equation with respect to time, we can find the rate at which the other quantity changes.

### **Steps:**

1. If possible, draw a diagram.
2. Write the equations and given information.
3. Relate things. Use substitution if necessary.
4. Differentiate.
5. Substitute known values and solve.

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1. A 6-foot tall man is running away from the base of a streetlight that is 15 feet high. If he moves at the rate of 18 feet per second, how fast is the length of his shadow changing?
2. A cube of ice is melting; the side  $s$  of the cube is decreasing at the constant rate of 2 inches per minute. How fast is the volume  $V$  decreasing?
3. Air is leaking out of a spherical balloon at the rate of 3 cubic inches per minute. When the radius is 5 inches, how fast is the radius decreasing?
4. Two small airplanes start from a common point  $A$  at the same time. One flies east at the rate of 300 kilometres per hour and the other flies south at the rate of 400 kilometres per hour. After 2 hours, how fast is the distance between them changing?
5. A 13-foot ladder leans against a vertical wall. If the bottom of the ladder is slipping away from the base of the wall at the rate of 2 feet per second, how fast is the top of the ladder moving down the wall when the bottom of the ladder is 5 feet from the base?

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