Related Rates

1. A 3 meter ladder is leaning against a vertical wall. The base of the ladder is sliding away from the wall at a rate of 1 meter per minute. How fast is the top of the ladder going down the wall when the base of the ladder is 0.5 meters from the wall? 1.5 meters from the wall? 2.5 meters from the wall? 2.99 meters from the wall?

2. If a snowball melts so that its surface area decreases at a rate of 1 $cm^2/min$, find the rate at which the diameter decreases when the diameter is 10 cm.

3. At noon, ship A is 150 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/hr. How fast is the distance between the two ships changing at 4:00 PM?

4. An ornithologist on the ground is watching an ivory-billed woodpecker through a scope as it approaches head-on at a speed of 30 miles per hour at a (constant) altitude of 80 feet. At what rate (in radians per minute) is the angle of the scope changing when the horizontal distance between the bird and the woman is 200 feet? (Hint: Make sure to change miles to feet. 1 mile = 5280 feet.)

5. **(Extra Credit Challenge)** A street light is mounted at the top of a 15 ft pole. A man 6 ft tall walks away from the pole with a speed of 5 ft/sec along a straight path. How fast is the tip of his shadow moving when he is 40 ft from the pole? (Note: The speed of the tip of the shadow along the ground is not the same thing as the rate at which the shadow is lengthening.)