

1. (1 pt) A street light is at the top of a 17 ft tall pole. A woman 6 ft tall walks away from the pole with a speed of 7 ft/sec along a straight path. How fast is the tip of her shadow moving when she is 35 ft from the base of the pole?

Note: You should draw a picture of a right triangle with the vertical side representing the pole, and the other end of the hypotenuse representing the tip of the woman's shadow. Where does the woman fit into this picture? Label her position as a variable, and label the tip of her shadow as another variable. You might like to use similar triangles to find a relationship between these two variables.

2. (1 pt) At noon, ship A is 40 nautical miles due west of ship B. Ship A is sailing west at 17 knots and ship B is sailing north at 25 knots. How fast (in knots) is the distance between the ships changing at 4 PM? (Note: 1 knot is a speed of 1 nautical mile per hour.)

Note: Draw yourself a diagram which shows where the ships are at noon and where they are "some time" later on. You will need

to use geometry to work out a formula which tells you how far apart the ships are at time  $t$ , and you will need to use "distance = velocity \* time" to work out how far the ships have travelled after time  $t$ .

3. (1 pt) When air expands adiabatically (without gaining or losing heat), its pressure  $P$  and volume  $V$  are related by the equation  $PV^{1.4} = C$  where  $C$  is a constant. Suppose that at a certain instant the volume is 450 cubic centimeters and the pressure is 93 kPa and is decreasing at a rate of 13 kPa/minute. At what rate in cubic centimeters per minute is the volume increasing at this instant? \_\_\_\_\_

(Pa stands for Pascal – it is equivalent to one Newton/(meter squared); kPa is a kiloPascal or 1000 Pascals. )

4. (1 pt) Air is being pumped into a spherical balloon so that its volume increases at a rate of  $50\text{cm}^3/\text{s}$ . How fast is the surface area of the balloon increasing when its radius is 14cm? Recall that a ball of radius  $r$  has volume  $V = \frac{4}{3}\pi r^3$  and surface area  $S = 4\pi r^2$ .