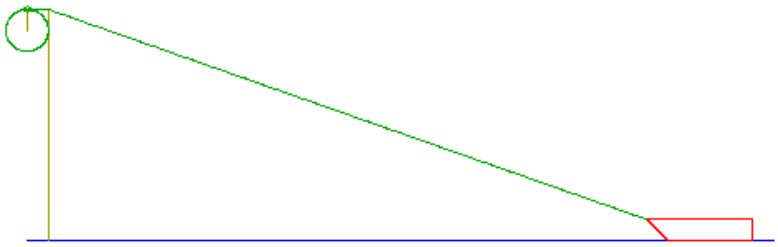
RELATED RATE PROBLEMS

1. A point P is moving along the curve $y = \sqrt{x}$ in such a way that its x–coordinate is increasing at the rate of 4 cm per second.

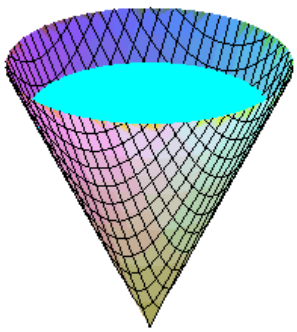
a. At what rate is its y–coordinate changing when $x = 4$?

b. At what rate is the slope of the tangent through P changing when $x = 4$?

2. A boat is being pulled toward a dock by means of a rope attached to the front tip of the bow. Initially there are 4,5 meters of rope out and the rope is taught and being reeled in by a circular device the top of which is 1,5 meters higher than the point where the rope is attached to the boat. This circular device has a radius of 15 centimeters and turns at the rate of one revolution every pi seconds. How fast is the boat moving along the water when there are 2,25 meters of rope out?



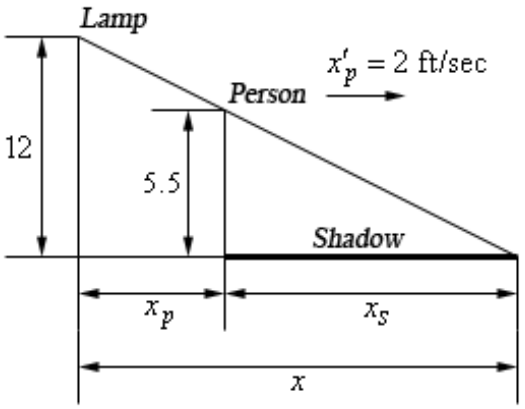
3. Water is being poured into a conical reservoir at the rate of pi cubic meters per second. The reservoir has a radius of 3 meters across the top and a height of 6 meters. At what rate is the depth of the water increasing when the depth is 3 meters?



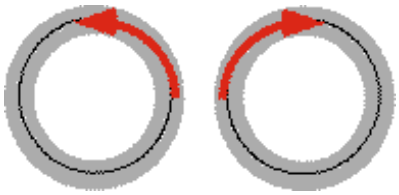
4. A light is on the top of a 12 ft tall pole and a 5,5 ft tall person is walking away from the pole at a rate of 2 ft/sec.

a. At what rate is the tip of the shadow moving away from the pole when the person is 25 ft from the pole?

b. At what rate is the tip of the shadow moving away from the person when the person is 25 ft from the pole?



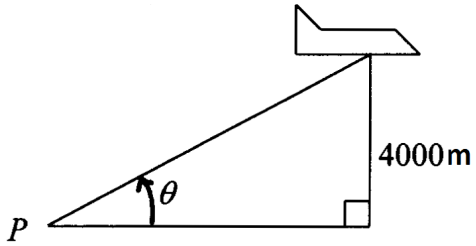
5. Two runners are running on circular tracks each of which has a circumference of 1320 feet. The tracks are 100 feet apart and the runners start opposite each other and move at the same constant rate of 880 ft/min. How fast are the runners separating when each has run 165 feet?



6. An aircraft is flying horizontally at a constant height of 4000 mt above a fixed observation point. P (see diagram). At a certain instant, the angle of elevation θ is 30°, and the speed of the aircraft is 300 km/hr.

a. How fast is θ decreasing at this instant?

b. How fast is the distance between the aircraft and the observation point changing at this instant?



7. A beacon that makes 1 revolution every 10 seconds is located on a ship anchored 4 km from a staight shoreline. How fast is the beam moving along the shoreline when it makes an angle of 45° with the shore?

8. (Asked in last year's 1^{st} midterm exam) Two sides of a triangle are 4 m and 5 m in lenght and the angle between them is increasing at a rate of 0.06 rad/s. Find the rate at which the height of the triangle which is orthogonal to the third side is decreasing when the angle between the sides of fixed length is $\pi/3$.

References

[1] http://www2.seminolestate.edu/lvosbury/calculusI_folder/RelatedRateProblems.htm

[2] http://www.math.wfu.edu/tutorials/Math111/RelatedRates.pdf