1. The sides of a square increase in length at a rate of $2m/s$.
   a. At what rate is the area af the square changing when the sides are $10m$ long?
   b. At what rate is the area of the square changing when the sides are $20m$ long?
   c. Draw a graph that shows how the rate of change of the area varies with the side length.

2. A 5m ladder leans against a wall. The bottom of the ladder is 1.5m from the wall at time $t = 0$ and slides away from the wall at a rate of $0.8m/s$.
   a. Find the velocity of the top of the ladder at time $t = 1$s.
   b. At what time do each end of the ladder move at the same velocity?

3. A road perpendicular to a highway leads to a farmhouse located 2km away. An automobile travels past the farmhouse at a speed of 80km/h. How fast is the distance between the car and the farmhouse increasing when the automobile is 6km past the intersection of the highway and the road?

4. A swimming pool is 50m long and 20m wide. Its depth decreases linearly along the length from $3m$ to $1m$ (from the deep end to the shallow end). It is initially empty and is filled in at a rate of $1m^3$/min. How fast is the water level rising 4 hours after the filling begins? How long will it take to fill the pool?

5. A person of height 1.8m walks away from a 5m lamppost at a speed of 1.2m/s. Find the rate at which his shadow is increasing in length.

6. An inverted conical water tank with a height of 12 feet and a radius of 6 feet is drained through a hole in the vertex at a rate of 2 cubic feet per second (see figure 1). What is the rate of change of the water depth when the water depth is 3 feet? (*Hint: Use similar triangles.*)

7. For each of the following functions f:
   i. Find the critical point(s) of f on the given interval;
   ii. Determine the absolute extreme values of f on the given interval when they exist;
   iii. Use a graphing utility to confirm your conclusions.
   a. $f(x) = x^2 - 10$ on $[-2, 3]$.
   b. $f(x) = \sin(3x)$ on $[-\pi/4, \pi/3]$.
   c. $f(x) = x^2 + \arccos x$ on $[-1, 1]$.

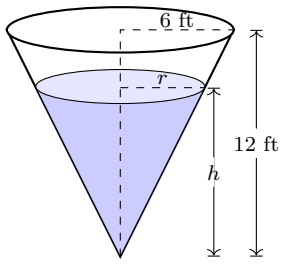
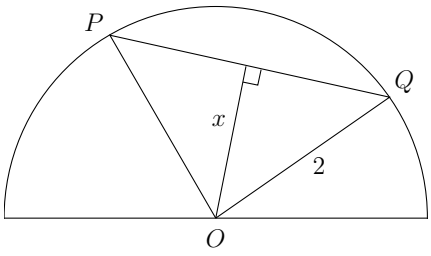


Figure 1: Problem 3

WeBWorK style questions.

8. We want to maximize the area of an isosceles triangle of height x inscribed in a circle of radius 2 as shown in the picture.



a. The area of the triangle PQO can be written $A(x) = \alpha x\sqrt{\beta - x^2}$. Find α and β.

$$\alpha = \qquad , \beta = \qquad .$$

b. The domain of $A(x)$ is

$$\leq x \leq \qquad .$$

c. The maximal area is

$$A = \qquad .$$