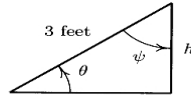**Inverse functions Worksheet**

1. **(a)** Express ψ in Figure 1 in terms of h.   Ans: $\psi = \cos^{-1} h/3$

   (b) What is $\dfrac{d\psi}{dt}$ at a moment when h = 2 feet and $\dfrac{dh}{dt} = -1$ foot per minute?
   Ans: $1/\sqrt{5}$ rad/min

2. The top of a 13-foot-long ladder is sliding down a tall vertical wall while its base is sliding away from the wall along the horizontal ground. When the base of the ladder is five feet from the wall, it is moving away from the wall at the rate of two feet per second.

   (a) What is the angle between the ground and the ladder at that time? Ans: $\cos^{-1}(5/13)$ rad.

   (b) At what rate is the angle decreasing at that moment? Ans: $-1/6$ rad/s.

3. A five-meter-tall vertical post casts a shadow on the horizontal ground. What is the rate of change of the length of the shadow with respect to the angle x between the sun's rays and the ground when the angle is $\pi/4$ radians? Ans: -10 m/rad.

4. An airplane is flying at an altitude of 400 feet and the speed of 200 feet per second directly away from a searchlight on the ground. At what rate is the angle between the ray of light and ground changing when the angle is 30°? Ans: $-1/8$ rad/s.

5. A man is watching a helium balloon rise vertically over his daughter's head. She released the balloon from a point 5 feet above the ground and it rises at the constant rate of 3 feet per second. Her father is 30 feet from her and his eyes are 5 feet above the ground. Give a formula for the rate of change with respect to time of the angle between his line of sight and the horizontal as a function of the time (seconds) since the release of the balloon. Ans: $\dfrac{10}{100+t^2}$