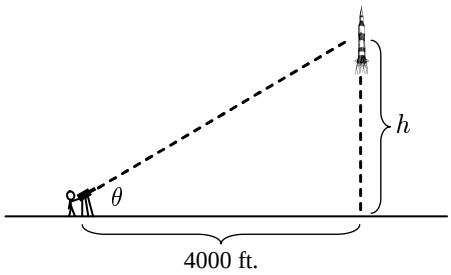
Math 141

Name:_____

Homework 6

1. A man with a video camera is standing 4000 ft. from the base of a rocket launching pad, recording the launch:



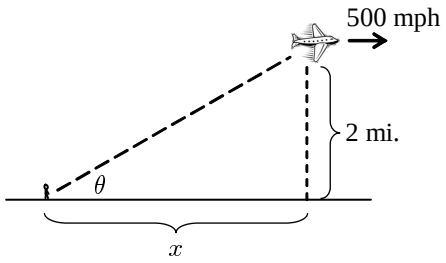
Because the rocket is ascending, the man must constantly adjust the angle of the camera to match the angle of elevation of the rocket.

(a) Find a formula relating the height h of the rocket and the angle θ to which camera must be set.

(b) Use your answer to part (a) to find a formula relating $\frac{dh}{dt}$ and $\frac{d\theta}{dt}$.

(c) Suppose that the rocket is ascending at a rate of 600 ft/sec. How quickly is the angle θ increasing at the instant that $\theta = 0.5$ radians?

2. An airplane flies directly over an observer standing on the ground. The following picture shows the position of the plane a short while later:



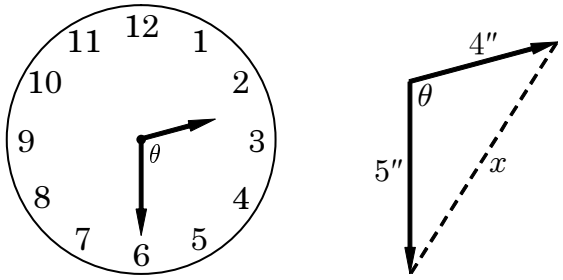
The plane maintains a constant altitude of 2 miles, and a constant forward speed of 500 mph.

(a) Find a formula for the distance x in terms of the angle θ.

(b) Use your answer to part (a) to find a formula relating $\dfrac{dx}{dt}$ and $\dfrac{d\theta}{dt}$.

(c) How quickly is the angle θ decreasing at the instant that $x = 8$ miles? Express your answer in radians per minute.

3. Consider a clock with an hour hand and a minute hand:



The hour hand is 4 inches long, the minute hand is 5 inches long, and both hands rotate with constant speed. Let θ represent the clockwise angle from the hour hand to the minute hand, and let x represent the distance between the tips of the two hands.

(a) How quickly is the hour hand rotating? Express your answer in radians per hour.

(b) How quickly is the minute hand rotating? Express your answer in radians per hour.

(c) What is $\dfrac{d\theta}{dt}$? Express your answer in radians per hour.

(d) Look up the "law of cosines", and use it to find an equation relating x and θ.

(e) Use your answer to part (d) to find a formula relating $\frac{dx}{dt}$ and $\frac{d\theta}{dt}$.

(f) How quickly is the distance x changing when the clock reads 2:30?