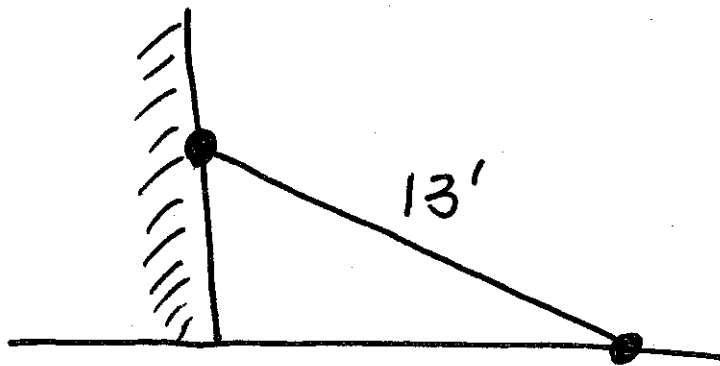


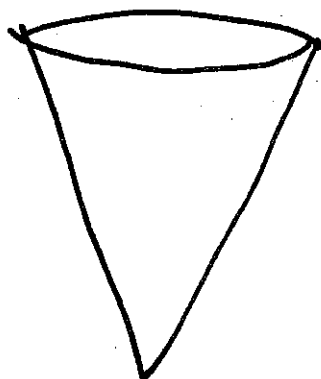
RR-01**Sliding Ladder Problem**

A 13 foot ladder leans against a tall wall. If the bottom is pulled away from the wall at 3 ft/sec, how fast is the top of the ladder sliding down the wall when the bottom is 5 ft from the wall?



RR-02**Conical Tank Problem**

Water is poured into an inverted conical tank at a rate of $\frac{2}{3}$ in³/sec. If the tank is 6" tall and has radius 2", how fast does the water level rise when the water is 4" deep?



A 6' tall man walks towards a street light on a post 20' above the ground at a rate of 5 ft/sec. Find the rate of change of the length of his shadow when he is 24' from the base of the lamppost.

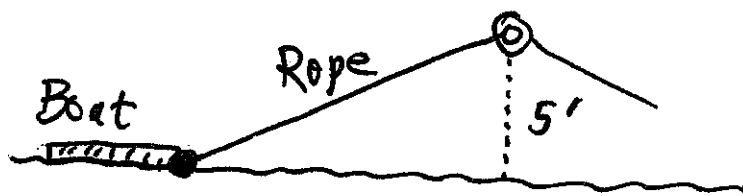
RR-04

Moving Along a Curve Problem

An object moves around the circle
 $x^2 + y^2 = 9$. At $(\sqrt{3}, \sqrt{6})$, its x -coordinate
is increasing at a rate of 20 units/sec.
How fast is its y -coordinate changing?

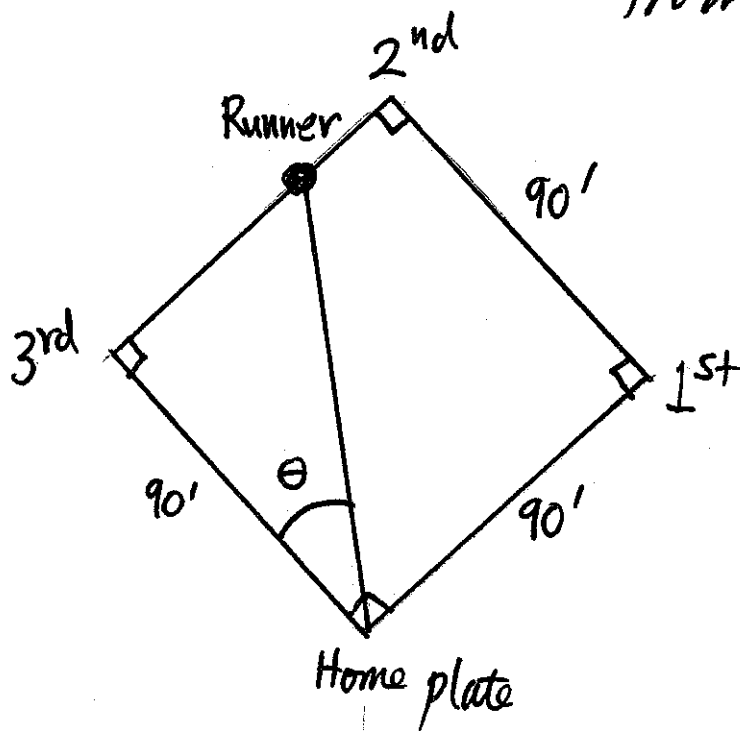
RR-05**Towing a Boat Problem**

A rope is attached to the bow of a boat. The rope is drawn over a pulley that is $5'$ higher than the bow of the boat at a rate of 2 ft/sec . How fast is the boat docking when the length of rope from bow to pulley is $13'$?



RR-06**Baseball Runner Problem**

A baseball player runs from 2nd to 3rd base at 24 ft/sec. Let θ be the angle between the 3rd base line and the runner when viewed from home plate. How fast is θ changing when the runner is 30' from 3rd base?



RR-07

Kite Problem

A kite is $100'$ above the ground and is blown away from the kite holder in a direction parallel to the ground at 10ft/sec. At what rate must the string be let out when the length of string already let out is $200'$?

RR-08**Searchlight Problem**

A helicopter 3000' high moves horizontally at 100 ft/sec. It flies directly over a searchlight that rotates so as to always light up the helicopter. How many radians/sec is the searchlight rotating when the distance between the searchlight and helicopter is 5000' ?

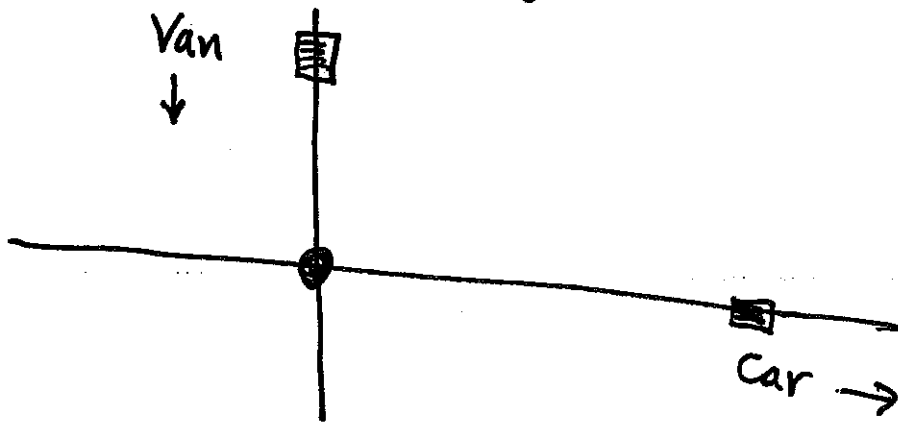
RR-09

Rising Balloon Problem

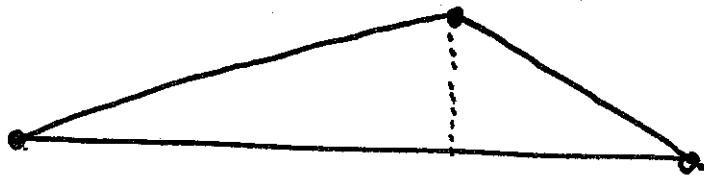
A hot air balloon is tracked by a range finder 500' from the liftoff point. When the angle of elevation is $\pi/4$, the angle is increasing at a rate of 0.14 radians/min. How fast is the balloon rising at that moment?

RR-10**Two Cars Problem**

A Van travels towards an intersection from the north while a Car travels away from the intersection going east. When the Van is 0.6 mi north of the intersection and the Car is 0.8 mi east of the intersection, the distance between them is increasing at 20 mph. If at that instant the Van is moving at 60 mph, what is the speed of the car?



The altitude of a triangle is increasing at a rate of 1 cm/min and the area of the triangle increasing at a rate of $2 \text{ cm}^2/\text{min}$. At what rate is the base of the triangle changing when the altitude is 10 cm and area is 100 cm^2 ?



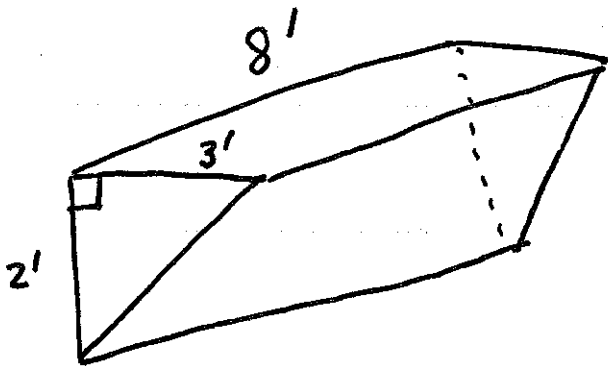
When air expands adiabatically (without gaining/losing heat) then $P V^{1.4} = C$ $\leftarrow$ constant

pressure $\rightarrow$ $\leftarrow$ volume

Suppose at a certain moment in time we have $V = 400 \text{ cm}^3$, $P = 80 \text{ kPa}$, and P is decreasing at 10 kPa/min . What rate is the volume increasing at that moment?

RR-13**Water Trough Problem**

A water trough is 8' long. The back is vertical and the two vertical ends are right triangles that are 3' across the top and 2' down the back. Water flows into the trough at a rate of $5 \text{ ft}^3/\text{min}$. What is the rate of change of the depth of the water in the trough when the depth is $\frac{3}{2} \text{ ft}$?



RR-14**Law of Cosines Problem**

Two sides of a triangle have lengths 4 cm and 5 cm. If the angle between them is increasing at $\frac{1}{10}$ radians/min, how fast is the length of the third side changing when the angle is 60° ?

Hint: Law of Cosines: $C^2 = a^2 + b^2 - 2ab \cos \theta$

