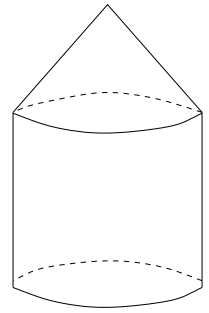


1. Melvin the Moonshiner is constructing a new still for use in the backwoods. For the purposes of this problem, all you need to know about Melvin's still is that it is in the shape of a cylinder topped with a cone, as shown in the figure to the right. Melvin figures that the still must have a volume of 1 m^3 , and in order to be able to carry it around, he must be able to reach around it, which requires it to be no more than 2 m around. Finally, to reduce the chance that it will be spotted, he wants the *cross-sectional area* of the still to be as small as possible. What dimensions should Melvin's still have? (It may be useful to note that the volume of a cylinder is $V_1 = \pi r^2 h$, while that of a cone is $V_2 = \frac{1}{3}\pi r^2 T$, where r is in either case the radius and h and T are the heights of the cylinder and cone, respectively.) (5 points)



2. Cyndy the Surreptitious DEA Agent is investigating Melvin's still. Melvin suspects her presence when she is 500 feet southwest of the still. Melvin's pickup truck is due south of the still (and Melvin) and due east of Cyndy. If they at this moment both begin moving towards the truck, Cyndy at 5 ft/min and Melvin (trundling the still) at 3 ft/min, how fast is the distance between them changing? (5 points)