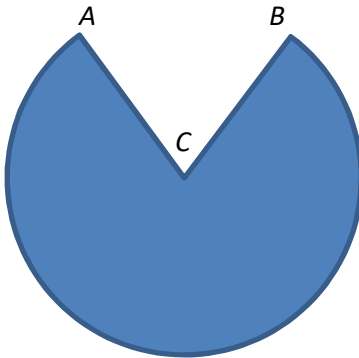


Tougher Optimization Problems

- 1) Mike, who is standing on the deck of a yacht that is travelling due west at 6 km/h, sees a sailboat sailing southwest at 4 km/h, 3 km northwest of the yacht. How close to each other do these boats get? *(Answer: 0.171 km)*
- 2) Stan needs to move some excess topsoil from his farm. He can hire a dump truck and a driver for \$60/h. The driver will take 30 minutes to deliver a load of topsoil and return to the farm. One person will take 40 hours to load the truck with soil. Labourers get \$18/h (whether they are loading the truck with soil or waiting for the truck to return). How many labourers should Stan hire to minimize the cost per load? What is the minimum cost? *(Answer: 16 labourers, \$1044 per load)*
- 3) A picture window is in the shape of an equilateral triangle. Each side measures 4 m. Celia will glue a rectangular piece of stained glass on the window so that one side of the rectangle lies on the base of the triangle. Determine the maximum area for the piece of stained glass. *(Answer: $2\sqrt{3}$ m)*
- 4) A cone-shaped drinking cup is made from a circular piece of paper of radius 10 cm by cutting out a sector and joining the edges CA and CB shown in the diagram below. Determine the maximum volume of the drinking cup. *(Answer: 403.1 cm^3)*



- 5) A cone with height h is inscribed in a larger cone with height H so that its vertex is at the centre of the base of the larger cone. Prove that the inner cone has a maximum volume when its height is one third the height of the larger cone.