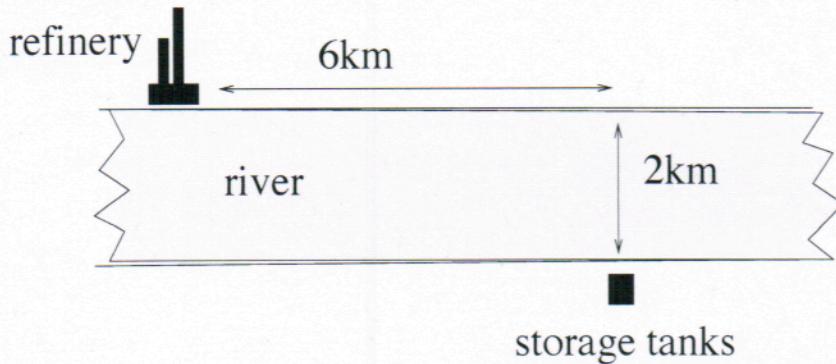
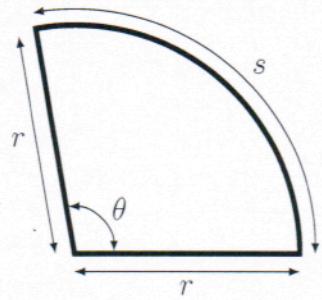


6. (12 points) An oil refinery is located on the north bank of a straight river that is 2 km wide. A pipeline is to be constructed from the refinery to storage tanks located on the south bank of the river 6 km east of the refinery. The cost of laying pipe is \$300,000/km over land to a point P on the north bank and \$500,000/km under the river to the tanks.



- (a) To minimize the cost of the pipeline, where should P be located? Be sure to justify you have found the minimum.
- (b) What is the resultant minimum cost?

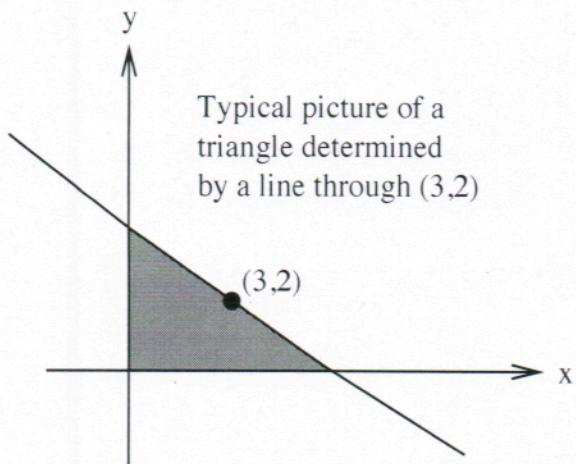
2. (12 points) You are a rancher. You wish to create an enclosure using fencing. The enclosure should have an area of 2000 square meters. The enclosure will have the shape of a circular sector as shown below.



For θ in radians, the area of such a sector is $\frac{1}{2}r^2\theta$ and the length of the curved part of the sector is $s = r\theta$.

Determine r and θ so that the amount of fencing needed is minimized.

7. (12 points) Find the equation of the line passing through the point $(3,2)$ which cuts off the triangle of least area from the first quadrant.



8. (12 points) Nurl is designing a cylindrical container of volume 50π cubic centimeters. The top and bottom of the cylinder must be made of a material costing \$10 per square centimeter, while the rest of the container is made of a cheaper material that costs only \$3.20 per square centimeter. What is the surface area of the cheapest container Nurl can design?

7. (12 points) A load must be suspended 6 meters below a high ceiling using cables attached to two supports that are 2 meters apart (see figure). How far below the ceiling (labeled x) should the cables be joined to minimize the total length of cable used? What is the minimum amount of cable needed? (Leave your answers in **exact** form and make sure to justify your minimum in some way.)

