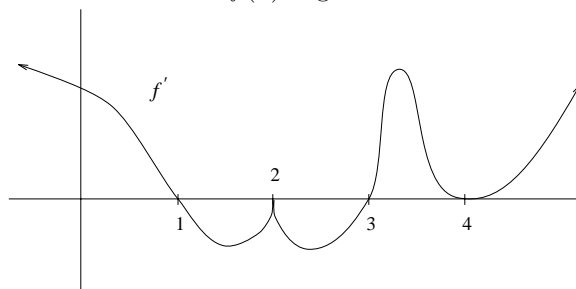


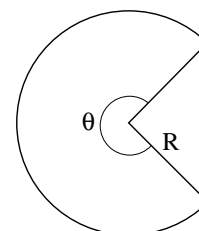
WORKSHEET 16

1. The graph of the **derivative** of a function $f(x)$ is given below.



- What are the critical points of $f(x)$?
 - Which critical point(s) correspond to relative extrema? Are they maxima or minima?
 - Graph $f(x)$.
2. If $f(x) = ax^3 + bx^2 + cx + d$, find values for a , b , c , and d so that $f(x)$ has a local maximum at $x = -1$, $f(-1) = 2$, and so that $f(x)$ has a local minimum at $x = 1$, $f(1) = -1$.
3. Find the shortest line segment with endpoints on the x - and y -axes going through the point $(1,8)$.

4. A garden is designed to be in the shape of a circular sector with radius R and angle θ . If the area A is to be a constant, find the dimensions (R, θ) which minimize the length of fence around the perimeter.

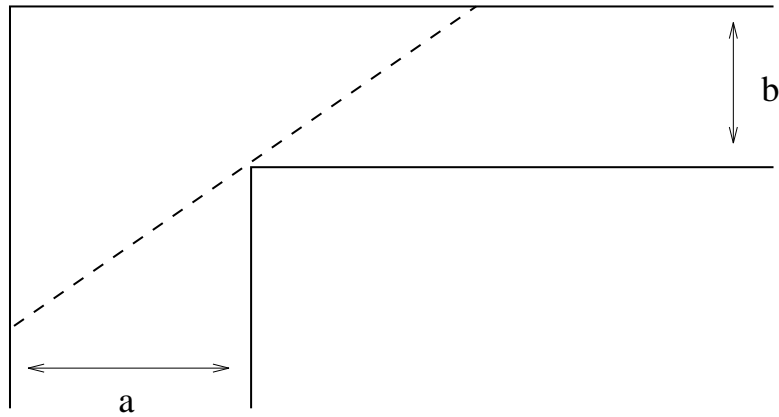


5. A sector with angle ϕ is cut from a circle of radius 12 inches, and the resulting edges are brought together to form a cone. Find the magnitude of ϕ so that the volume of the cone is maximized.
6. Twenty feet of wire are to be used to form two figures. In each of the following cases, how much should be used for each figure so that the total enclosed area is a maximum?
- equilateral triangle and square
 - square and regular pentagon
 - regular pentagon and hexagon
 - regular hexagon and circle

(Hint: The area of a regular polygon with n sides of length x is $A = \frac{n}{4} \cot(\frac{\pi}{n})x^2$.)

What can you conclude from this pattern?

7. Two hallways meet at right angles. Their widths are a and b as indicated in the picture. What is the greatest length of a ladder which can be carried horizontally around the corner?



8. a) Find the closest point on the graph of $f(x) = x^2$ to the point (a, b) .
b) Show that the line connecting $(0, b)$ to the closest point is normal to the graph at that point.
9. Suppose you wrap a rope tightly all the way around the earth. You then cut the rope and tie in a one foot long segment. How high off of the ground will you now be able to lift the rope, keeping it the same height all the way around?