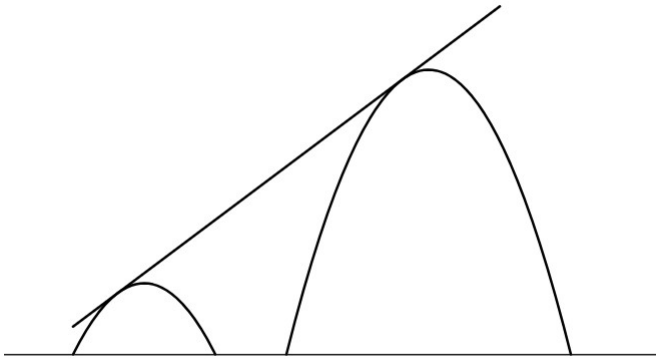
1. **Two Arches Problem.** Two small arches have the shape of parabolas. The first is given by $f(x) = 1 - x^2$ for $-1 \leq x \leq 1$and the second by $g(x) = 4 - (x-4)^2$ for $2 \leq x \leq 6$. A board is placed on top of these arches so it rests on both as pictured below. What is the slope of the board?



2. **This Oscillating Function Again??** We saw in class that

$$f(x) = \begin{cases} x \sin \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$

Is continuous at $x = 0$. Show that f is not differentiable at $x = 0$, that is, $f'(0)$ does not exist.

3. **Recognizing a Transcendental Function.** Using the Power Rule, Sum Rule, definition of e^x, and limits at infinity to show that $f(x) = e^x$ is not a polynomial (cannot be written as $f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$ for any a's or degree n).

4. **Triangles of Constant Area.** Let L be the tangent line to the hyperbola $xy = 1$ at $x = a$ where $a > 0$. Show that the area of the right triangle formed by L and the two positive axes does not depend on a.

