1. Our study of the ideal arch developed the equation \( C(x) \sin \theta(x) = -w \int_{-b}^{x} \sqrt{1 + f'(t)^2} \, dt + \text{const.} \)

Draw a careful diagram of an ideal arch that includes the graph of the center curve \( y = f(x) \). Use your diagram to explain the meaning of the terms \( C(x), \theta(x), C(x) \sin \theta(x), w, \) and \( b \). Also use your diagram to explain the meaning of the integral \( \int_{-b}^{x} \sqrt{1 + f'(t)^2} \, dt \).

2. Why did architects of the Renaissance regard the use of the number sequence 1, 2, 3, 4, \ldots derived from Pythagoras's musical ratios to be of importance in the designs of their plans and elevations?
3. A string under tension has length $L$. Plucking it produces a tone of frequency $f$. What are the lengths of the strings that produce (under the same tension) the second, third, fourth, and fifth harmonics?