2) (5 pts) ANL (Algorithm Analysis)

A program that runs an O(Nlog(N)) algorithm to sort an array of N polygons takes 10 seconds to sort 1,000,000 polygons. How long, **in milliseconds**, would it be expected for the program to take when sorting 1,000 polygons?

Let T(N) = cNlog(N) be the run time of the program for sorting N polygons. Using the given information, we have:

$$T(10^6) = c(10^6)\log(10^6) = 10{,}000ms$$
$$c(10^6)\,6\log(10) = 10{,}000ms$$
$$c = \frac{10^4 ms}{6(10^6)\log(10)} = \frac{1ms}{600\log(10)}$$

Now, let's solve for T(1000):

$$T(10^3) = \frac{1ms}{600\log(10)} \times 10^3 \times \log(10^3)$$
$$= \frac{1ms}{600\log(10)} \times 10^3 \times 3 \times \log(10)$$
$$= \frac{3000ms}{600} = \mathbf{5ms}$$

Grading: 1 pt set up equation with constant c
2 pts solve for c (no simplification required)
1 pt plug in N = 1000
1 pt arrive at the final answer

Full credit if the ratio method is used properly, but if it isn't max 1 point.