

Homework 2

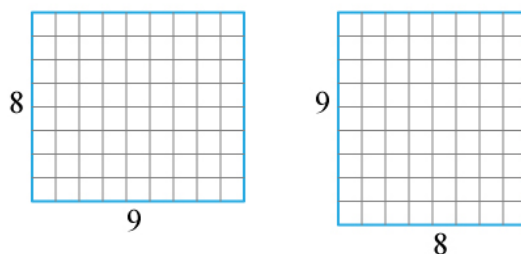
MATH 261 Computational Geometry
due 5:00pm on Thursday, January 9

Solve the following problems from the textbook, and write your solutions clearly and neatly. Make sure to explain your reasoning and provide mathematical details that support your answers. For a few tips on writing solutions, see [this helpful guide for mathematical writing](#).

There are no CS only problems on this homework, so everyone should do all 9 problems.

You may write or type your solutions electronically, or write them on paper and scan/photograph them. If you photograph your papers, please use a scanning app to produce a single PDF file containing your solutions. Upload your written solutions to the [Homework 2](#) assignment on Moodle.

1. Exercise 1.23
2. Exercise 1.29 — Prove this directly using the definition of what it means for a guard to cover a polygon, without using Theorem 1.32.
3. Exercise 1.41 — State your conjecture, and explain why you think your conjecture might be true.
4. Exercise 1.45 — *Hint*: If all edges of the Greek cross have length 1, then the resulting square must have edge length $\sqrt{5}$. Find a diagonal of the Greek cross with length $\sqrt{5}$.
5. Exercise 1.46 — *Hint*: What must be the edge length of the resulting square?
6. Exercise 1.52
7. A *translation dissection* is a dissection such that the pieces may only be translated, not rotated or flipped. Find a two-piece translation dissection of an 8×9 rectangle to a 9×8 rectangle. For this, each piece will be an orthogonal polygon. Your cuts may consist of many straight segments that meet at right angles.



8. Draw a single plot that shows the following functions $f(n)$ for $n > 1$:
 - (a) $f(n) = 1$
 - (b) $f(n) = n$
 - (c) $f(n) = n^2$

(d) $f(n) = \log(n)$

(e) $f(n) = n \log(n)$

Your plot should show the relative growth rates of these functions for large n . (This will help us compare the runtime complexities of algorithms that we will soon encounter.)

- 9.** In Chapter 1, the authors of our text state nine unsolved problems. Which of these problems do you find most interesting? Explain *why* this problem is interesting to you, and *how* you could begin to work toward solving the problem.