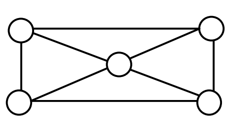
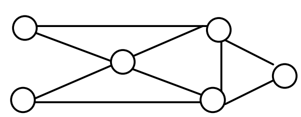
Math 44 Review sheet for final exam, Spring 2008

(1) Problem on graphs. For example, given a graph with vertices of degrees 2,2,3,3,3,3,5, and 5, can you draw it?
(2) Cellular automata question, like on the handout.
(3) Pattern problem – extend a pattern throughout the plane, like problem 1 on the first exam.
(4) Pigeonhole property problem, like problem 8 on the first exam.
Examples: Given any seven numbers chosen from {–32, –16, –8, –4, –2, –1, 1, 2, 4, 8, 16, 32}, explain why there will always be
(a) A pair with sum 0. (b) A pair with quotient of –1.
(c) A pair with quotient of 2.
(d) A pair with product of –32.
(e) A pair whose sum is evenly divisible by 5
(f) In each case above, can you find six numbers that don't exhibit the property?.
(5) Problem asking about some of the projects students did, and maybe the visit to Dale Seymour's house – if you were there and paying attention, this should be easy!!
(6) Be familiar with the simplest knots and links: the trefoil knot, the figure 8 knot, the Borromean rings, … and the "unknot!"
(7) How to apply symmetries in the plane.
For example, rotation of 180 degrees applied to p gives ____
Reflection of p gives ______
Translation of p gives ______
Glide of p gives ________
(8) A problem like those on the handout on rotational symmetry, in which you had to complete a figure so that the result had certain specified symmetries.
(9) A problem on the Fibonacci numbers like 3 on exam 1.
(10) Eulerizing a graph, for example as when we made polyhedral string figures or with the flea market problem handout.
(11) Difference between Hamiltonian cycles and Eulerian circuits. For example, one of these graphs has an Euler circuit, but not a Hamiltonian cycle, and the other is vice versa. Which is which?





(12) Questions on te art galler theorem, modular arithmetic and what it is used for, and the area of a circle (see the first section of chapter 2), or the Pythagorean theorem.
(13) Poinsot stars problem, like the handout
(14) Finding the fractal dimension of a fractal, like we did in class.
(15) Finding a tiling with a given polyomino, as we did on the take home exam.
(16) Measuring cup problem, like on exam 1.
Some answers:
(4) (a) Use pairs (–32,32),(–16,16),…(–1,1) as pigeonholes, etc.
(b) Use pairs (–32,32),(–16,16),…(–1,1)

(c) Use pairs (–32,-16),(–8,-4),(–2,–1),(1,2), (4,8),(16,32)
(d) Use pairs (–32,1),(–16,2), etc.
(e) . Use same pairs as (a), or (–32,–8),(–16,–4),(–2,2),(–1,1),(4,16),(8,32).
(f) Pick one from each pigeonhole

(7)) d, q, p, b.

(11) That on the left has a Ham. Cycle (go around the vertices clockwise, for example), but no Euler circuit (four of the degrees are odd), while that on the right has Euler circuits (all degrees are even!) Remember, an Euler circuit travels over each edge once and returns to the start, while a Ham. Cycle travels to each vertex once and returns to the start.