All: page 37: 5, 6, 7, 8 (me)
G1: page 37: 14, 15, page 57: 41, 44
G2: page 37: 16, 17, page 57: 42, 43 (me)
(In other words, do: page 37: 5, 6, 7, 8, 16, 17, page 57: 42, 43)

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Exercise 5

For n $\geq$ 3, describe the elements of D_n. (Hint: You will need to consider two cases: n is even and n is odd.)

The elements of D_n are just reflections and rotations of the n-gon.
If n is even, D_n will have n − 1 rotations, n reflections, and the identity, for a total of 2n operations.
If n is odd, D_n will have n − 1 rotations, n reflections, and the identity, for a total of 2n operations.

How many elements does D_n have?

2n

Exercise 6

In D_n, explain geometrically why a reflection followed by a reflection must be a rotation.

Well, if the only two operations that do something are rotation and reflection, then because of closure, if a reflection followed by a reflection has to be contained in the group, then it must be a rotation if it isn't the identity.

I don't know if that's geometrical enough, so here's my second attempt: flipping a shape twice either puts all the corners back where they were or puts them back where they were with some offset for all of them.

Exercise 7

In D_n, explain geometrically why a rotation followed by a rotation must be a rotation.
Because rotating a shape (x + y) degrees is the same thing as rotating that shape x degrees, followed by rotating it y degrees.

Exercise 8

In D_n, explain geometrically why a rotation and a reflection taken together in either order must be a reflection.

Exercise 16

Describe the symmetries of a parallelogram that is neither a rectangle nor a rhombus. Describe the symmetries of a rhombus that is not a rectangle.

Exercise 17

Describe the symmetries of a non-circular ellipse. Do the same for a hyperbola.

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Exercise 42

Suppose F_1 and F_2 are distinct reflections in a dihedral group D_n such that $\mathrm{F}_1\mathrm{F}_2 = \mathrm{F}_2\mathrm{F}_1$.
Prove that $\mathrm{F}_1\mathrm{F}_2 = \mathrm{R}_{180^\circ}$

Exercise 43

Let R be any fixed rotation and F any fixed reflection in a dihedral group.
prove that $\mathrm{R}^k\mathrm{F}\mathrm{R}^k = \mathrm{F}$