Parallel Lines

Proofs updated.

Parallel postulate: Given a line and a point not on the line, there is exactly one line through the given point parallel to the given line.

Theorems to prove:

(a) A 180° rotation about a point on a line takes the line to itself.

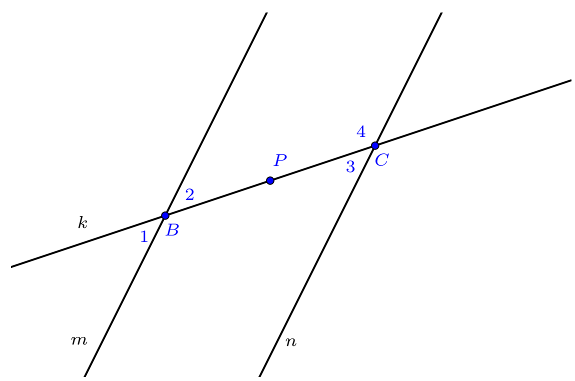
(b) A 180° rotation about a point not on a line takes the line to a parallel line.

(c) If two parallel lines are cut by a transversal alternate interior and corresponding angles are congruent.

(d) If two lines are cut by a transversal so that alternate interior (or corresponding) angles are congruent, then the lines are parallel.

Fix note: Below are two different proofs. Please consider them separately. And in each proof, which of the details should be included, and which should be omitted?

Problem 1 *Given that parallel lines m and n are cut by transversal k, prove that alternate interior angles are congruent.*



First proof:

Learning outcomes:
Author(s): Brad Findell

(a) *Let A and B be the intersections of transversal k with lines m and n, respectively.*

(b) *Let P be the midpoint of $\overline{BC}$*

(c) *Rotate $180°$ about P, which takes k to itself.*

(d) *The rotation maps B to C and C to B because distances are preserved.*

(e) *The rotation maps m to a parallel line through C, which must be n by the uniqueness of parallels.*

(f) *The rotation maps n to m by the same reasoning.*

(g) *The rotation swaps $\angle 2$ and $\angle 3$. These alternate interior angles must be congruent because the rotation preserves angle measures.*

Second proof:

(a) *Let A and B be the intersections of transversal k with lines m and n, respectively.*

(b) *Translate line m along line k to the right by distance BC.*

(c) *The translation maps B to C, and it maps m to n because the rotation maintains parallels.*

(d) *The translation maps $\angle 1$ to $\angle 3$. These corresponding angles must be congruent because the translation preserves angle measures.*