C. The New Lemmas: Deriving Former Hypotheses

1. Two added lemmas, corresponding to Hypothesis 3 and inserted Hypothesis 4 of Version 1

    a. Now deriving from "laws" material previously postulated

    b. Thereby avoiding impact on any proof

2. Lemma 1: the parallelogram rule, derived from Law 2

    a. Crucial need to make directionality in Law 2 explicit

    b. Thus explicit reduction of a feature of the old parallelogram hypothesis to a more fundamental claim; this may be the source of Law 2

3. Lemma 2: old hypothesis 4, now derived from more fundamental considerations

    a. Presupposes mean value theorem, referencing Galileo; unclear whether Newton realized the defects in Galileo's proof (eliminated by Huygens in *Horologium Oscillatorium*)

    b. Let Ab:Ad as AB:AD, with b and d arbitrary, and compare ratios of distances covered (represented by areas) as force changes versus distances covered with uniform forces

    c. ADEG an upper bound: uniform force at end of time AD; ABF a lower bound: uniform force at t=0

    d. Given bounds above and below, now take limits, obtaining result (see Appendix)

4. Comment: key feature in proof is constraint when taking the limits -- i.e. as B, D approach A and e approaches h

    a. Hold the ratios fixed: AB:AD, Ab:Ad, etc.

    b. Conclusion then for general points b and d, via ratios

    c. A feature of the way in which Newton takes geometric limits -- "first and last ratios"

5. Move in "Preliminaries" in part toward more secure foundations, but even more so toward claims that are more truly foundational -- i.e. more appropriate underpinnings of the theory to follow

    a. Toward putatively universal principles that can be said to comprise a simple, straightforward approach to conceptualizing motion

        (1) True even of Laws 3 and 4, for they can be taken to concern the proper point to which to refer motions

        (2) And also of Law 5, for it licenses the treatment of resistance as second-order, induced effects

    b. Making key elements of conceptualization more clear and explicit, as distinct from derived ones

        (1) Parallelogram rule less clearly an element in a way of conceptualizing motion

        (2) Even more so for originally inserted Hypothesis 4

    c. Why doing this unclear, but in spirit of response to Descartes' critique of Galileo's *Two New Sciences*, at least up to a point

    d. Also, though, to some extent being forced to add principles in order to be in position to answer questions, such as questions about true versus relative motions