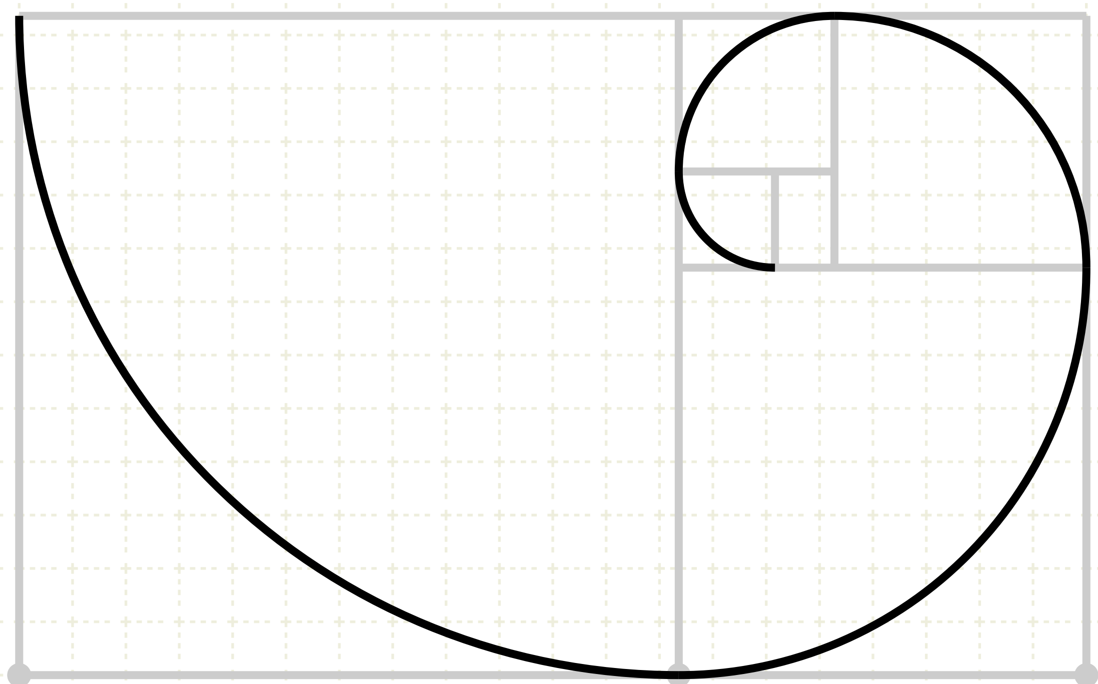
Euclid's Elements

Book VI



One can state, without exaggeration, that the observation of and the search for similarities and differences are the basis of all human knowledge.

Alfred Nobel

Table of Contents, Chapter 6

Table of Contents, Chapter 3

Proposition 29 of Book VI

To a given straight line to apply a parallelogram equal to a given rectilineal figure and exceeding by a parallelogrammic figure similar to a given one

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To a given straight line to apply a parallelogram equal to a given rectilineal figure and exceeding by a parallelogrammic figure similar to a given one

In other words

Given a straight line AB and

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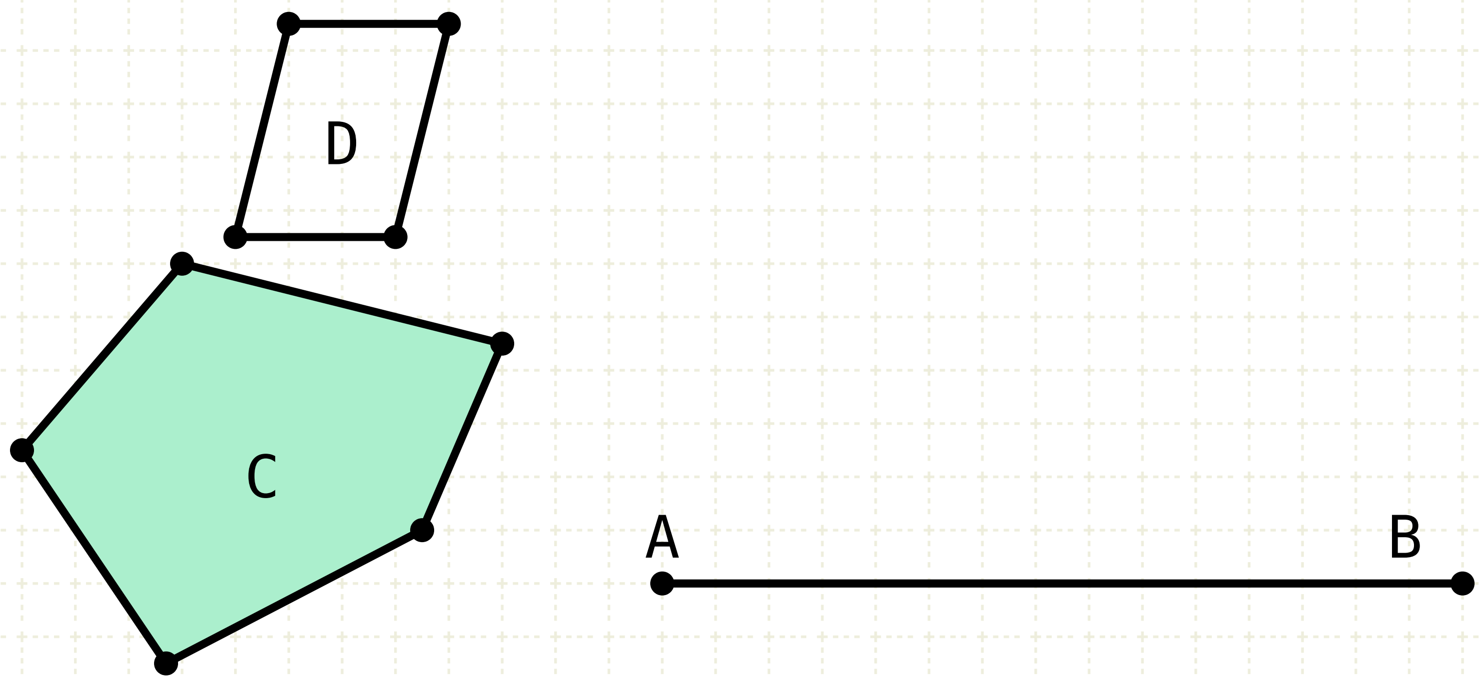

In other words

Given a straight line AB and

Let C be a rectilineal figure and D be a parallelogram

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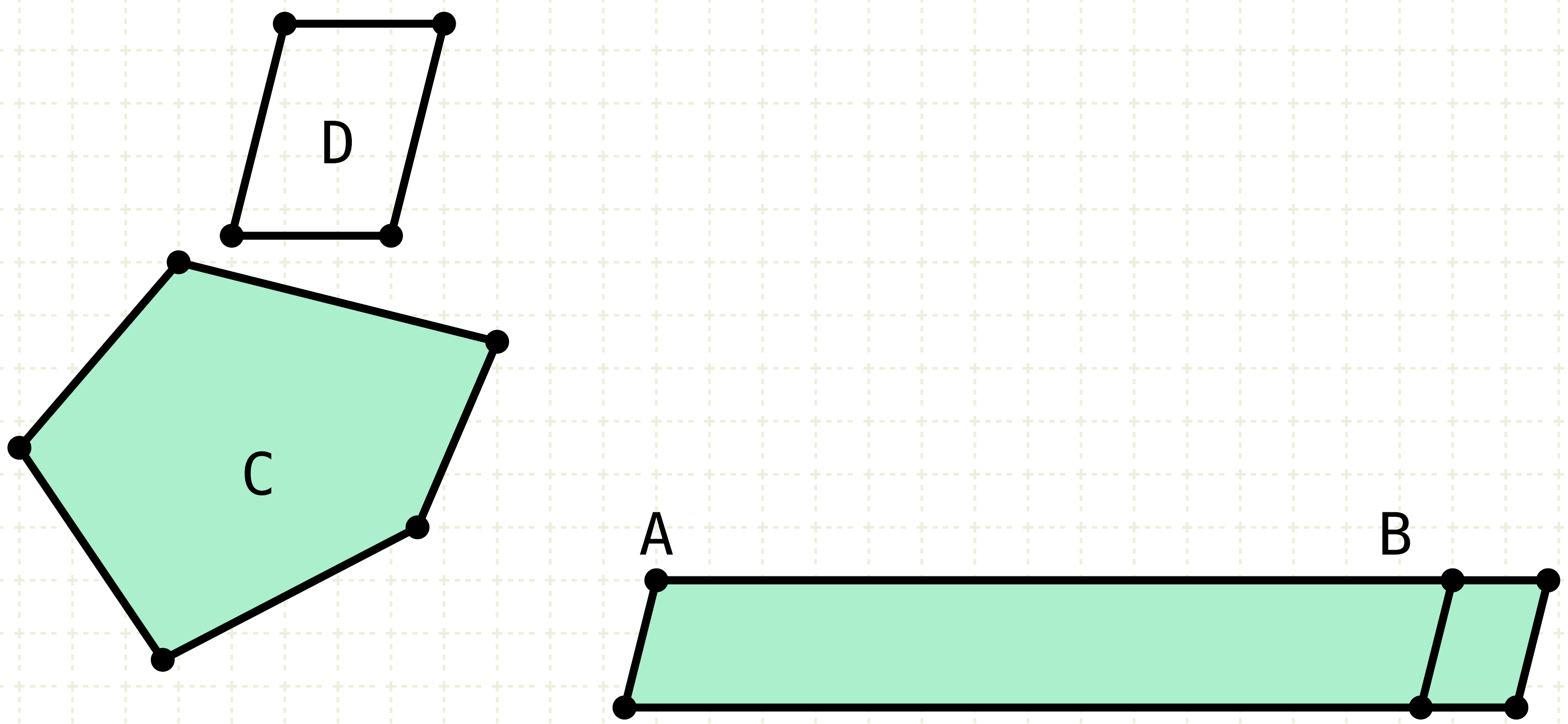

In other words

Given a straight line AB and

Let C be a rectilineal figure and D be a parallelogram

We want to draw a parallelogram on AB such that …

* If a parallelogram similar to parallelogram D is added, then…
* the sum is equal in area to C

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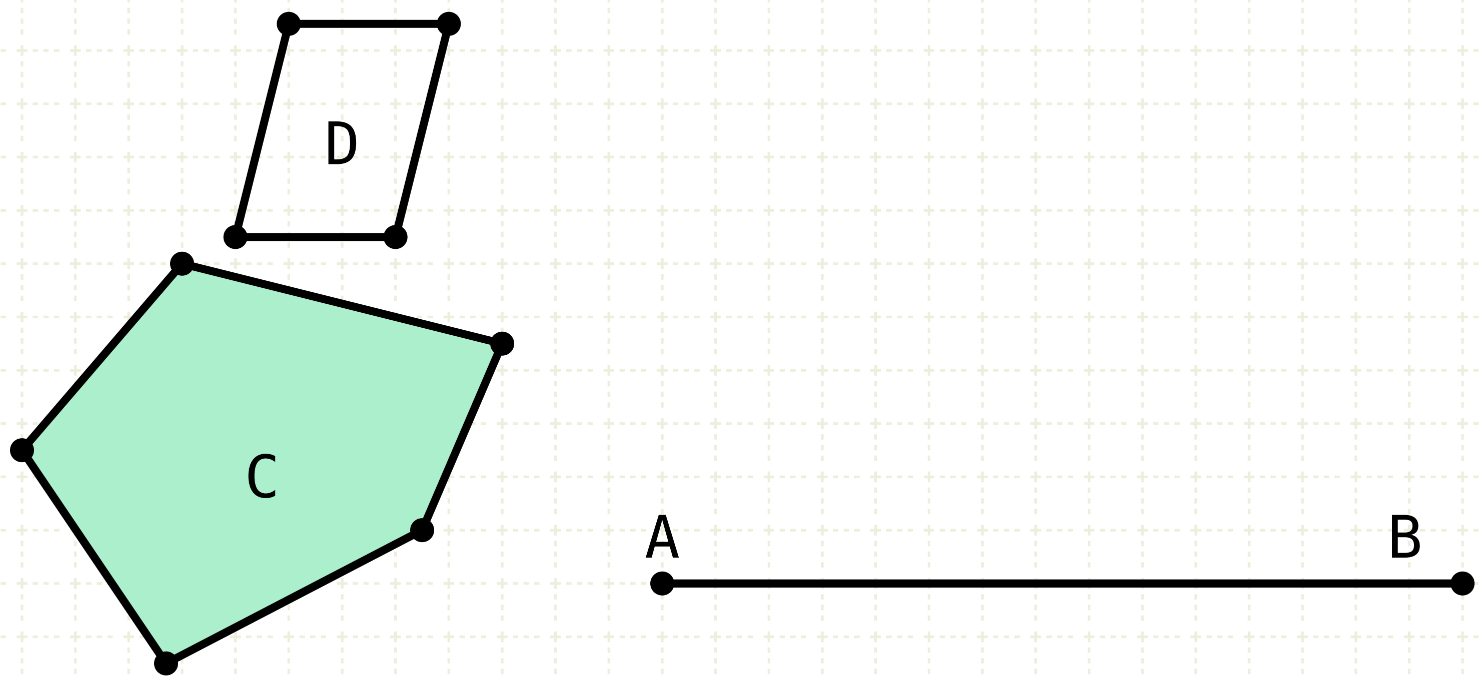

Construction

Proposition 29 of Book VI

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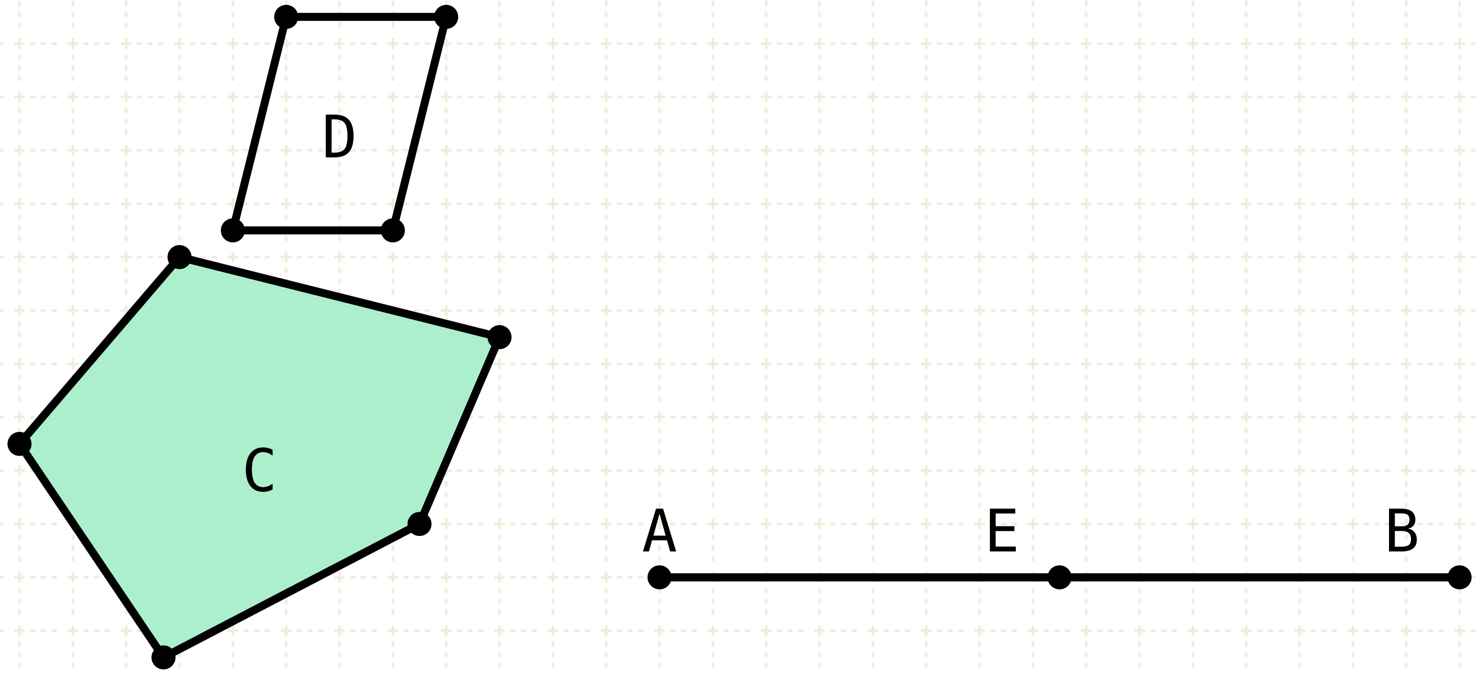

Construction

Bisect the line AB at point E

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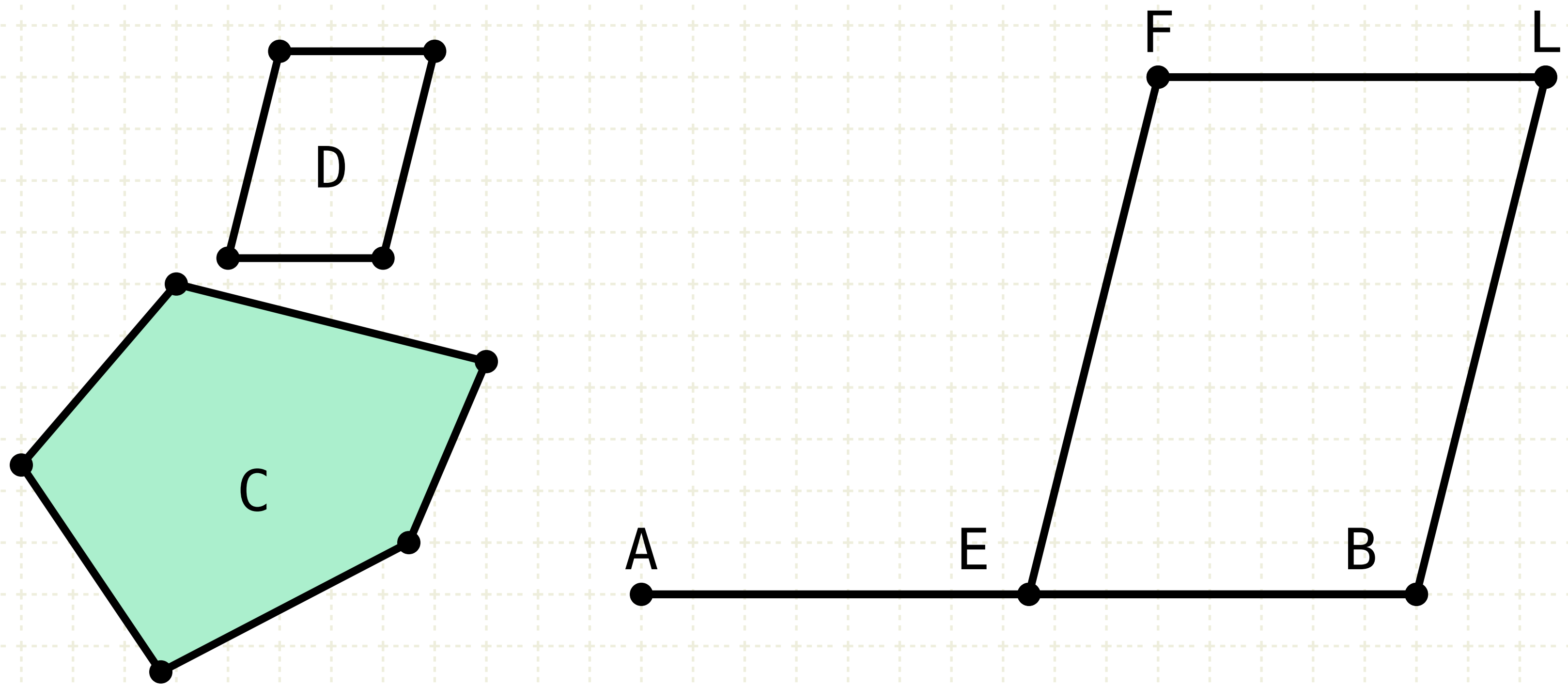

FB ~ D

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

Proposition 29 of Book VI

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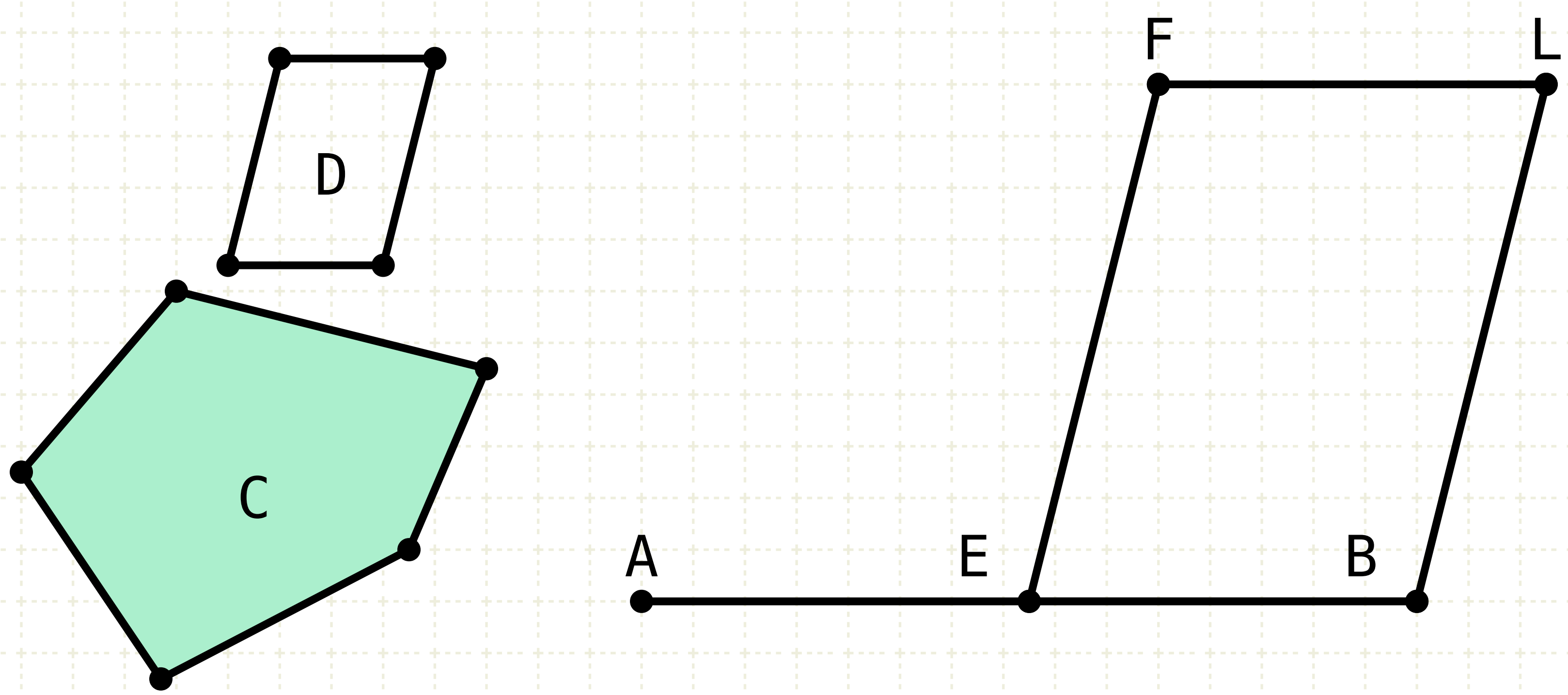

FB ~ D

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

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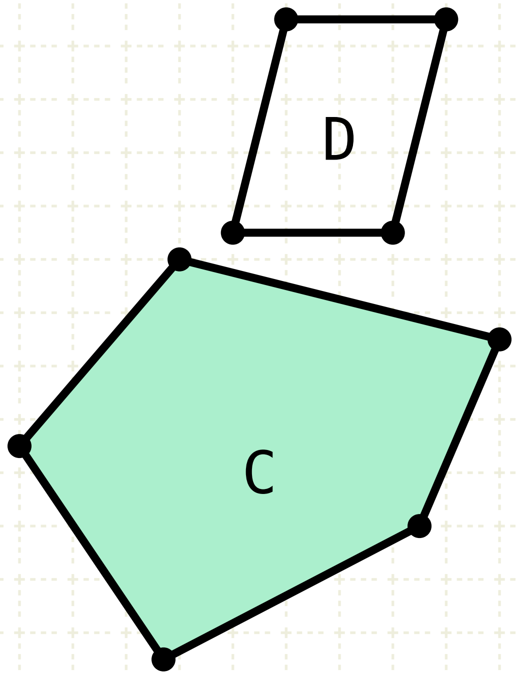

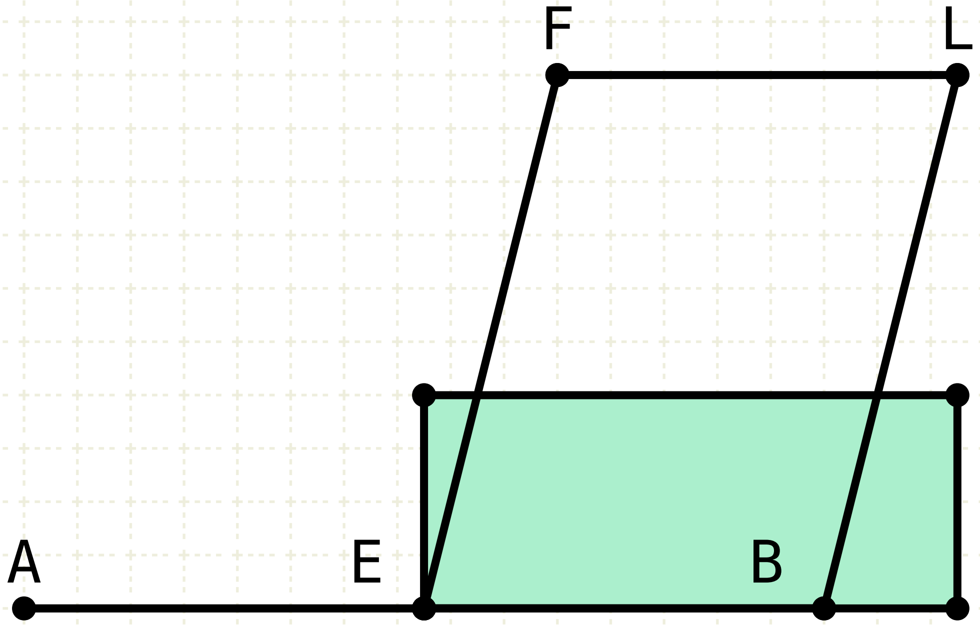

FB ~ D

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Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

* Copy the rectilineal figure C to a rectangle

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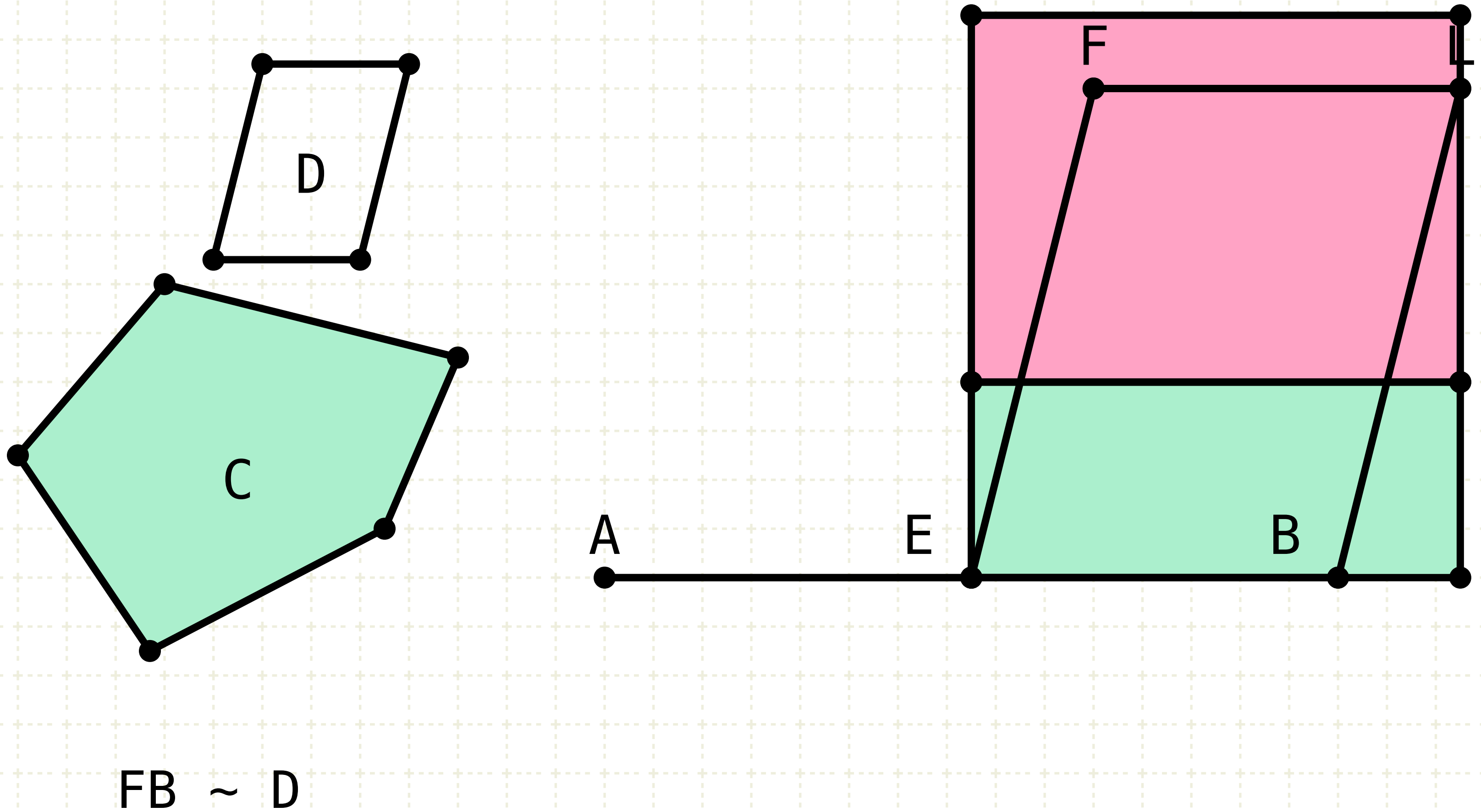

Construction

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Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

* Copy the rectilineal figure C to a rectangle
* Construct another rectangle on the top of the previous rectangle such that it is equal in area to the parallelogram FB (I·44)

Proposition 29 of Book VI

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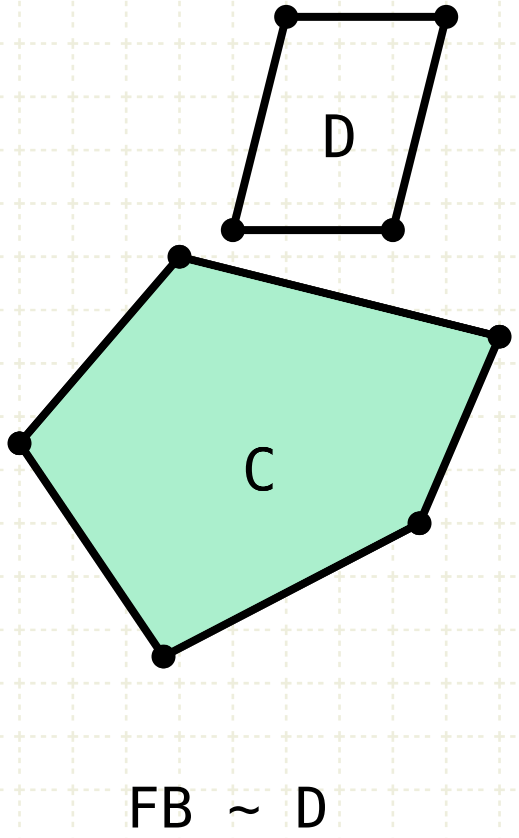

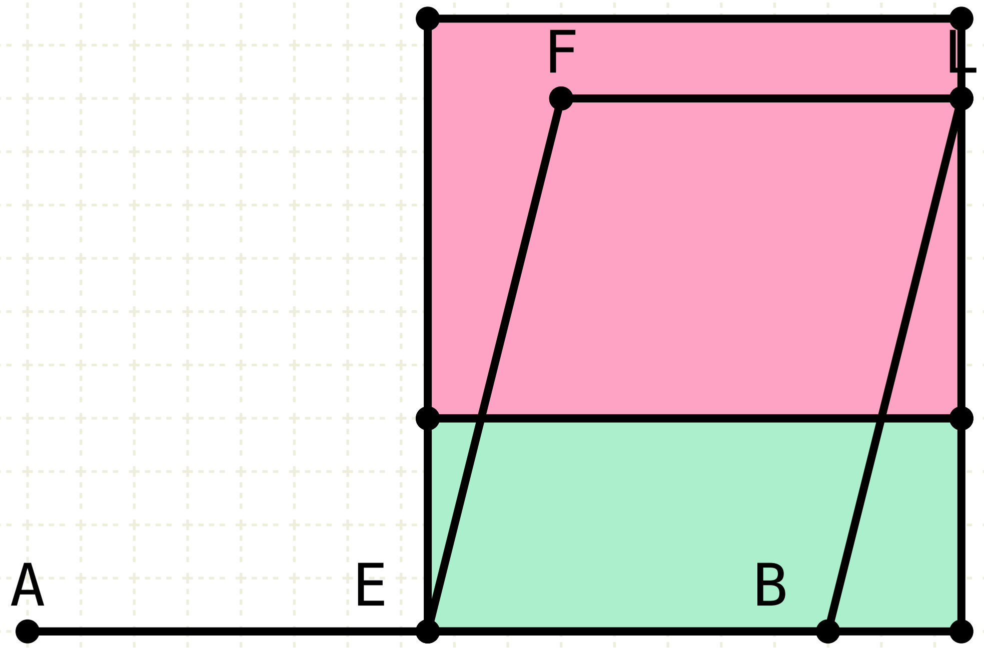

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Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

* Copy the rectilineal figure C to a rectangle
* Construct another rectangle on the top of the previous rectangle such that it is equal in area to the parallelogram FB (I·44)
* Copy the sum of these two rectangles to a polygon similar to D

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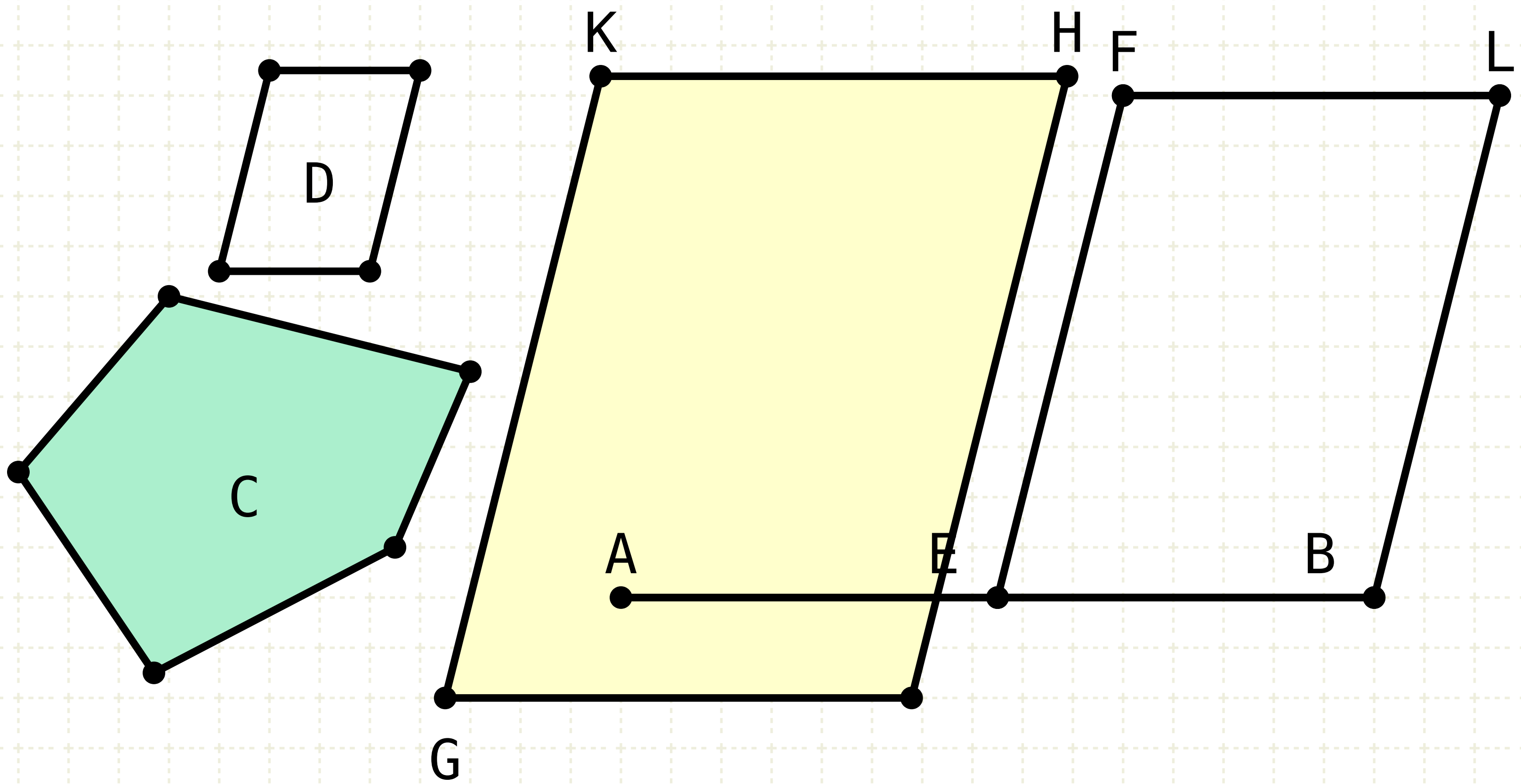

FB ~ D
GH = C + FB

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

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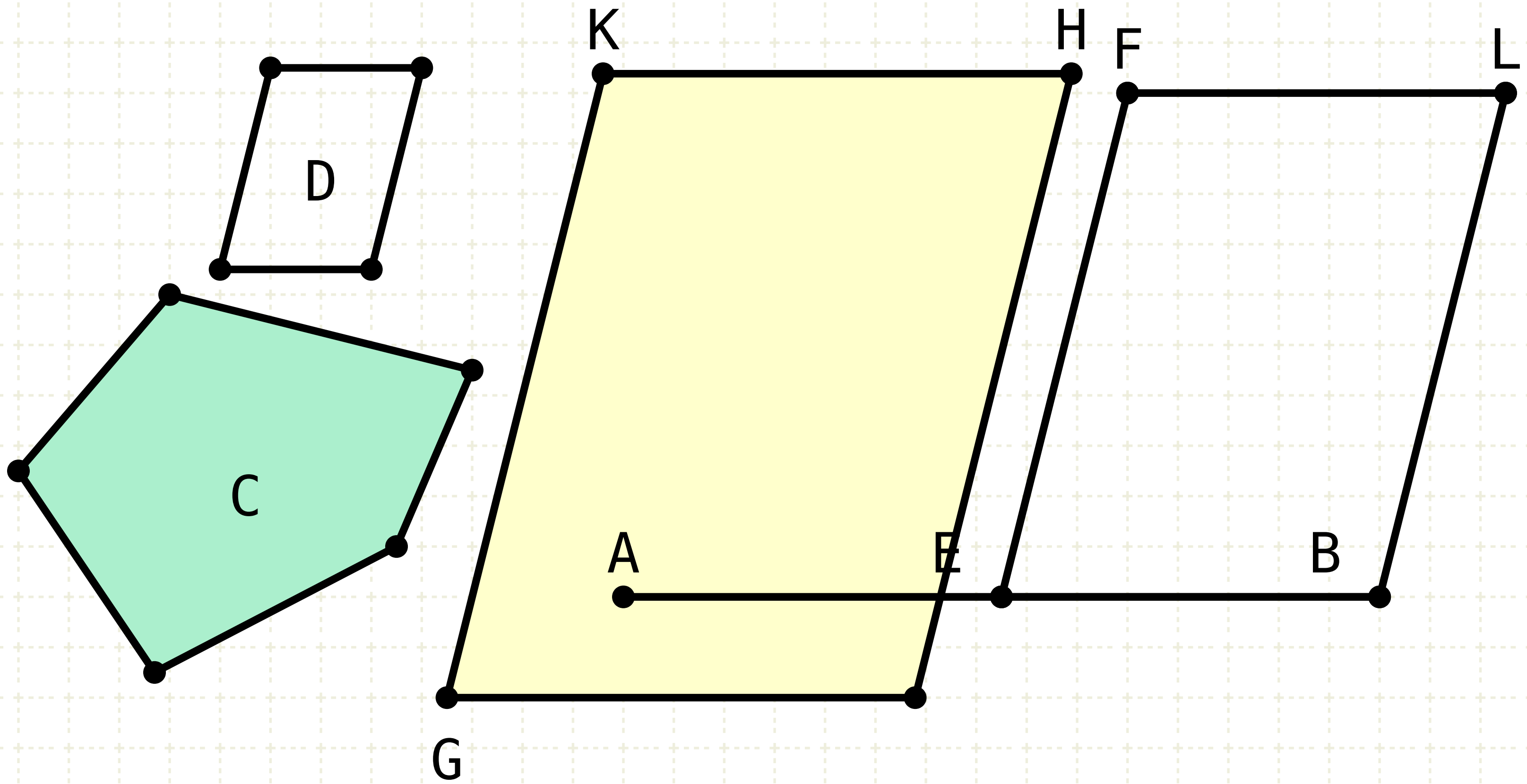


FB ~ D

GH = C + FB

GH ~ D

∴ GH ~ FB

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

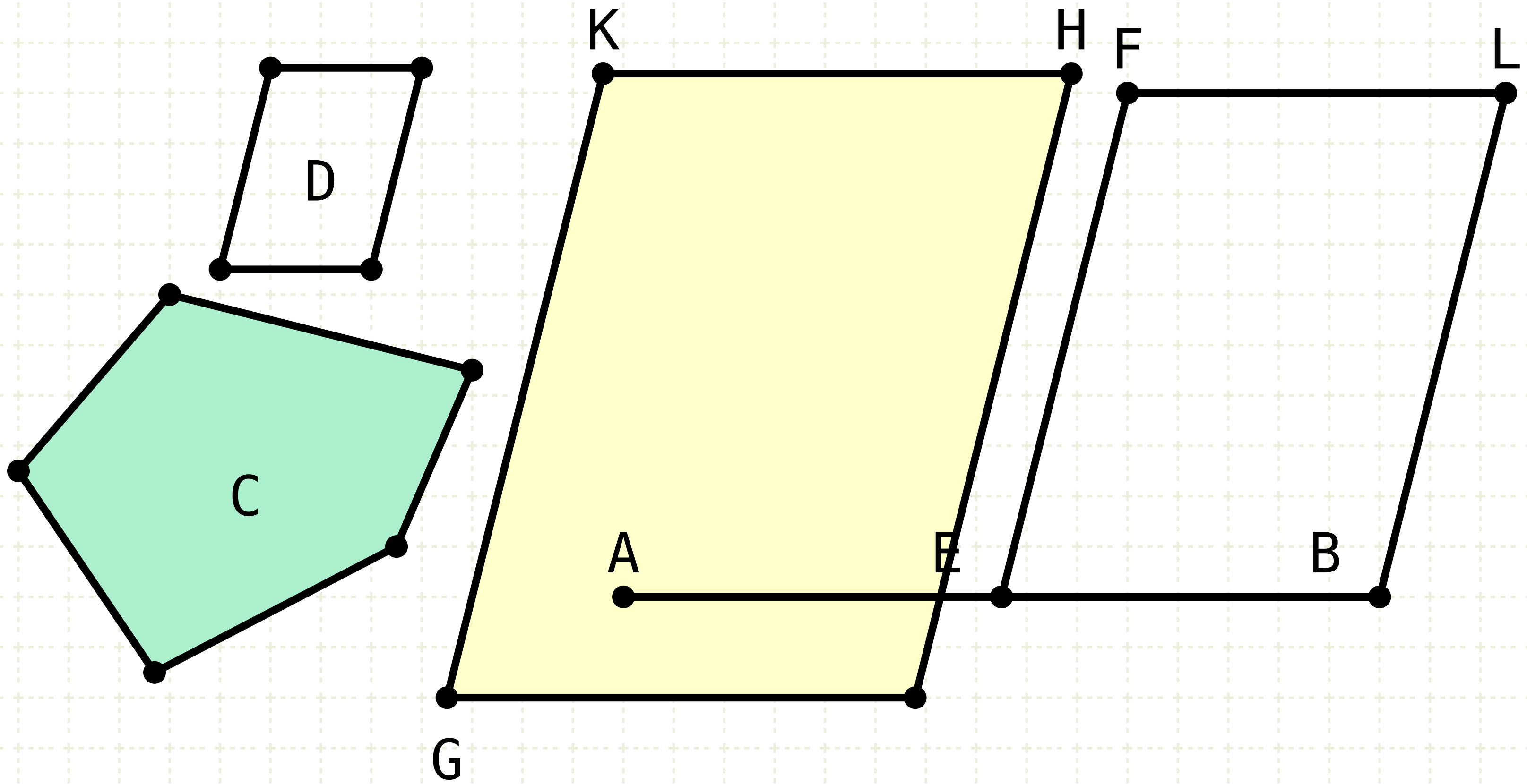
Let GH be constructed such that it is equal to the the area of FB plus the area of C, and is similar to D (VI·25)

* Copy the rectilineal figure C to a rectangle
* Construct another rectangle on the top of the previous rectangle such that it is equal in area to the parallelogram FB (I·44)
* Copy the sum of these two rectangles to a polygon similar to D

GH is similar to D, which is also similar to FB, therefore GH is similar to FB (VI·21)

Proposition 29 of Book VI

To a given straight line to apply a parallelogram equal to a given rectilineal figure and exceeding by a parallelogrammic figure similar to a given one



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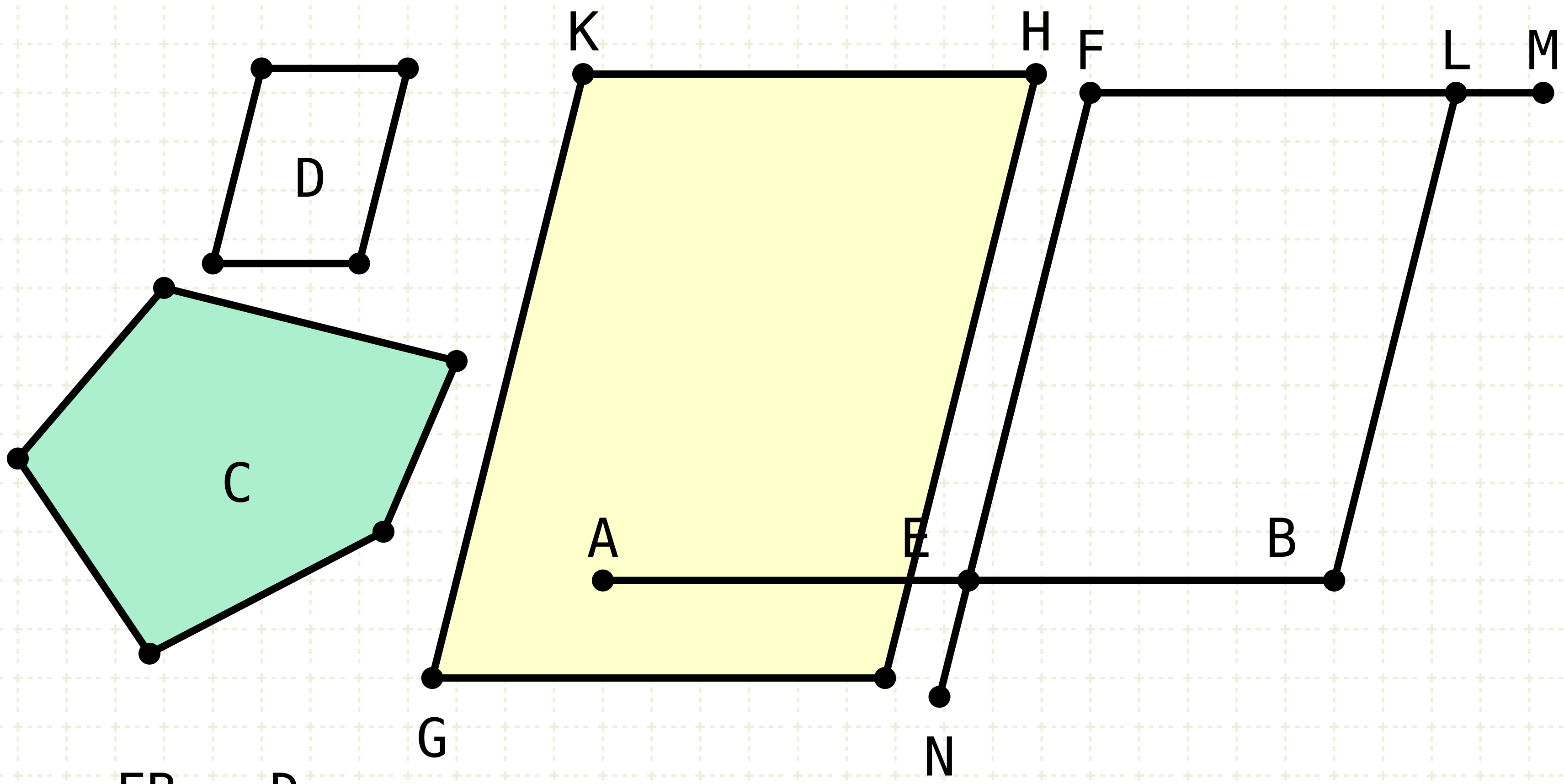
* Copy the sum of these two rectangles to a polygon similar to D

GH is similar to D, which is also similar to FB, therefore GH is similar to FB (VI·21)

GH is larger than FB, and since they are similar, GK is larger than FE and KH is larger than FL

Proposition 29 of Book VI

To a given straight line to apply a parallelogram equal to a given rectilineal figure and exceeding by a parallelogrammic figure similar to a given one



FB ~ D

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* Copy the sum of these two rectangles to a polygon similar to D

GH is similar to D, which is also similar to FB, therefore GH is similar to FB (VI·21)

GH is larger than FB, and since they are similar, GK is larger than FE and KH is larger than FL

Extend the line FL and FE such that FLM is equal to KH and FEN is equal to KG

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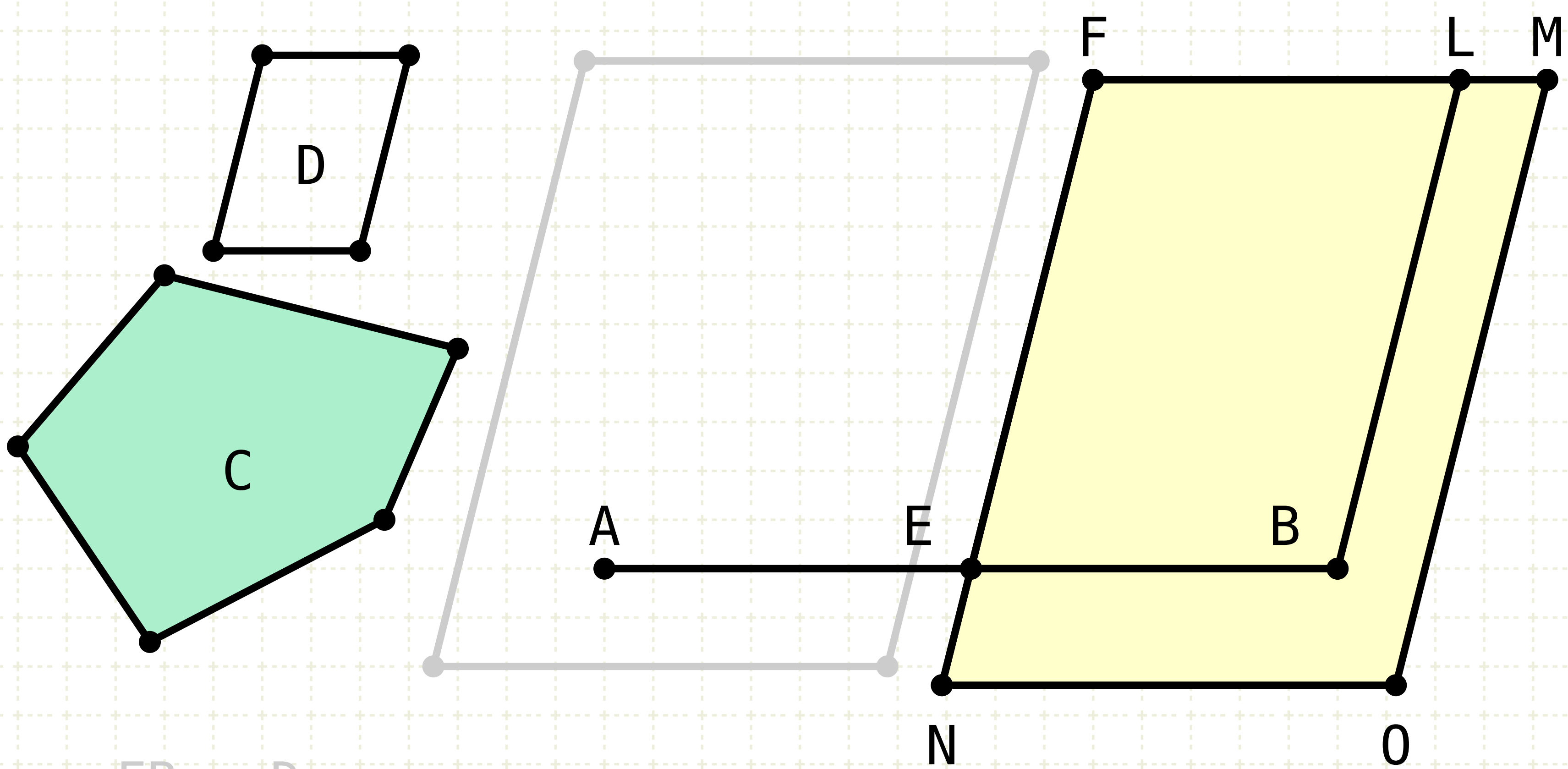

FB ~ D

GH = C + FB

GH ~ D

∴ GH ~ FB

MN = GH

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

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GH is larger than FB, and since they are similar, GK is larger than FE and KH is larger than FL

Extend the line FL and FE such that FLM is equal to KH and FEN is equal to KG

Complete the parallelogram MN

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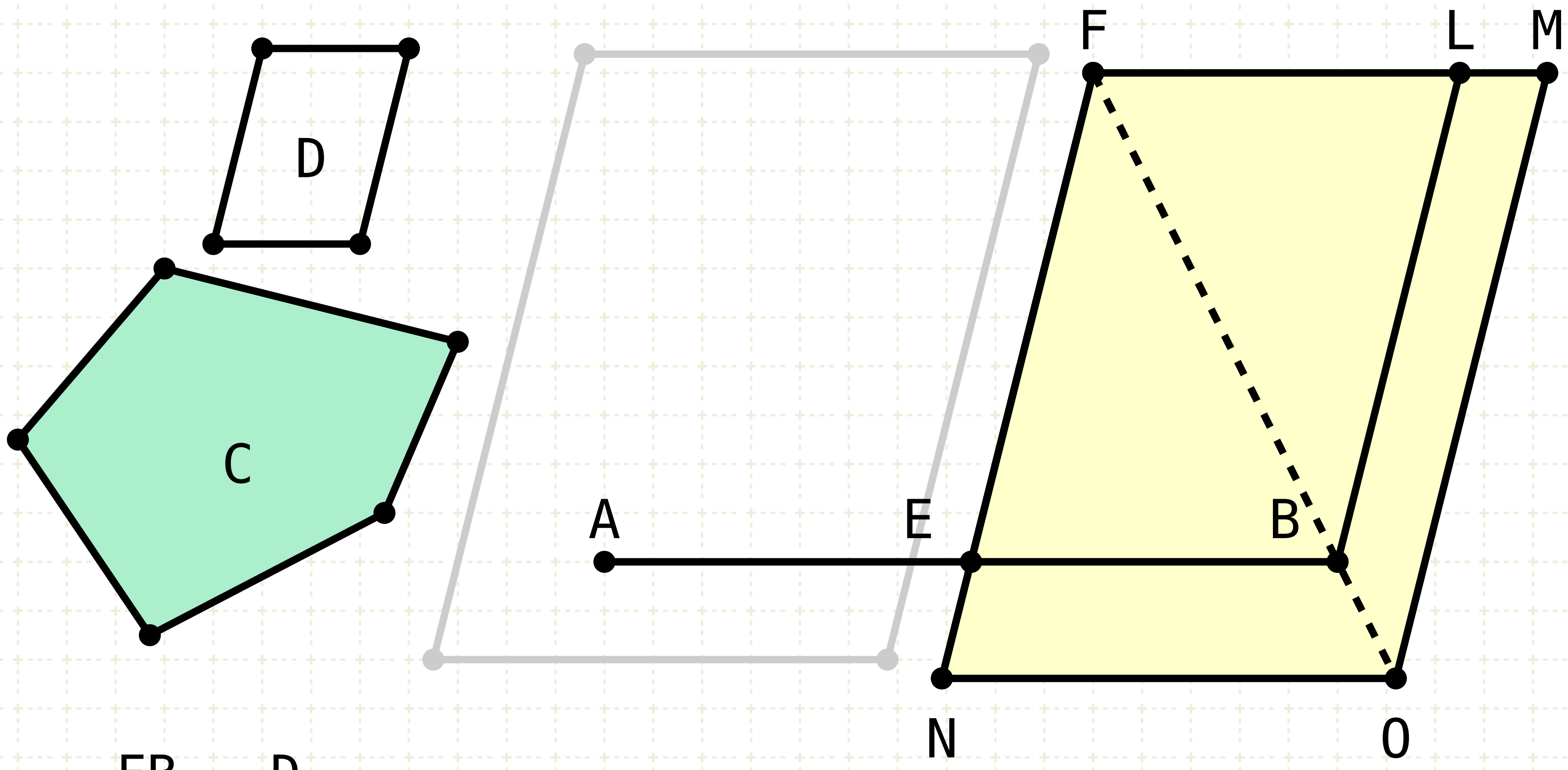

FB ~ D

GH = C + FB

GH ~ D

∴ GH ~ FB

MN = GH

MN ~ GH ~ D ~ FB

Construction

Bisect the line AB at point E

Create a parallelogram similar to D on line EB (VI·18)

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- Copy the sum of these two rectangles to a polygon similar to D

GH is similar to D, which is also similar to FB, therefore GH is similar to FB (VI·21)

GH is larger than FB, and since they are similar, GK is larger than FE and KH is larger than FL

Extend the line FL and FE such that FLM is equal to KH and FEN is equal to KG

Complete the parallelogram MN

Since MN is similar to GH, so is MN similar to FB (VI·21), thus the points F,B, and O lie on the same diagonal (VI·26)

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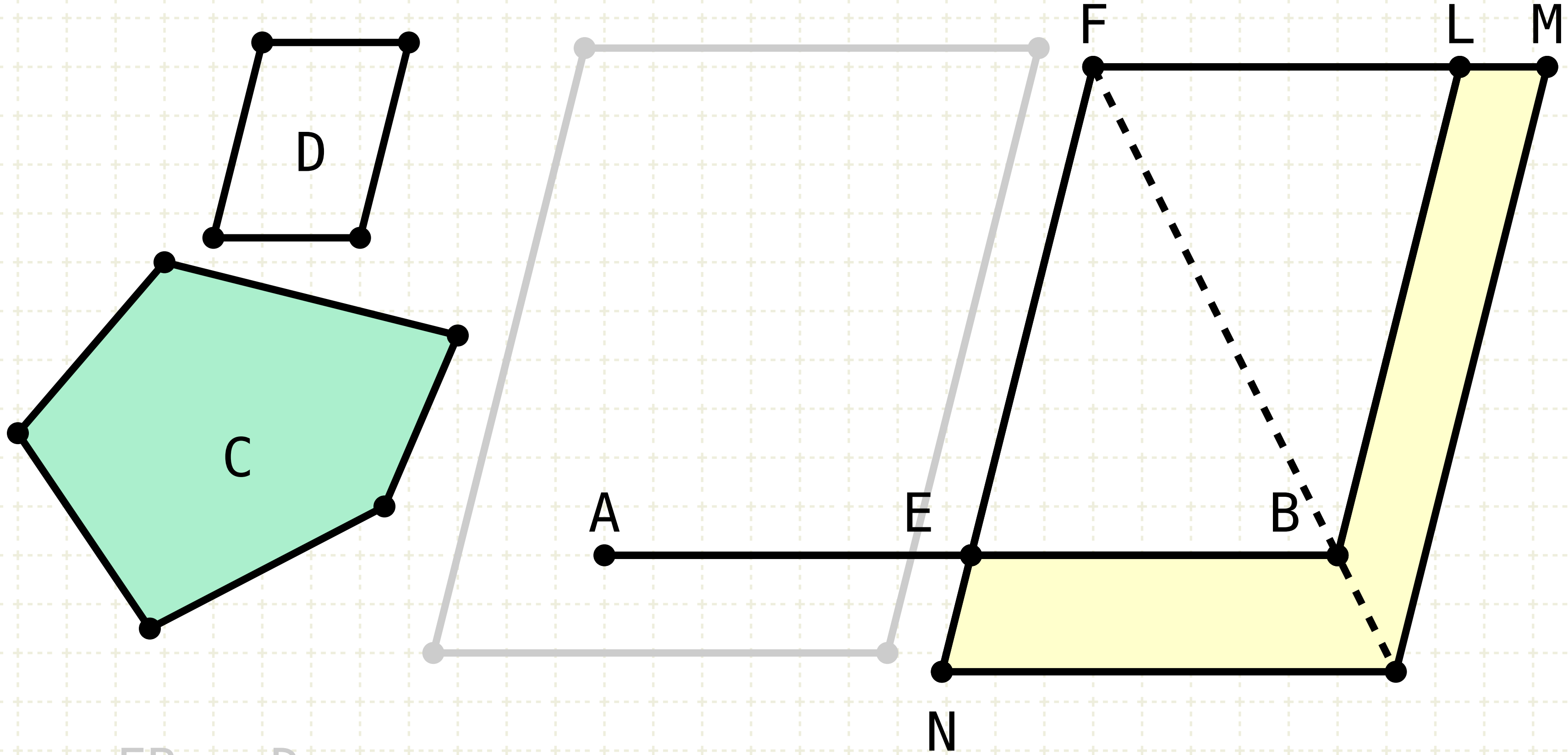

FB ~ D
GH = C + FB
GH ~ D
∴ GH ~ FB
MN = GH

MN ~ GH ~ D ~ FB
NOMLBE = C

Construction (cont.)

GH is equal to sum of FB and C, and since MN is equal to GH, the remaining gnomon (NOMLBE) is equal in area to C

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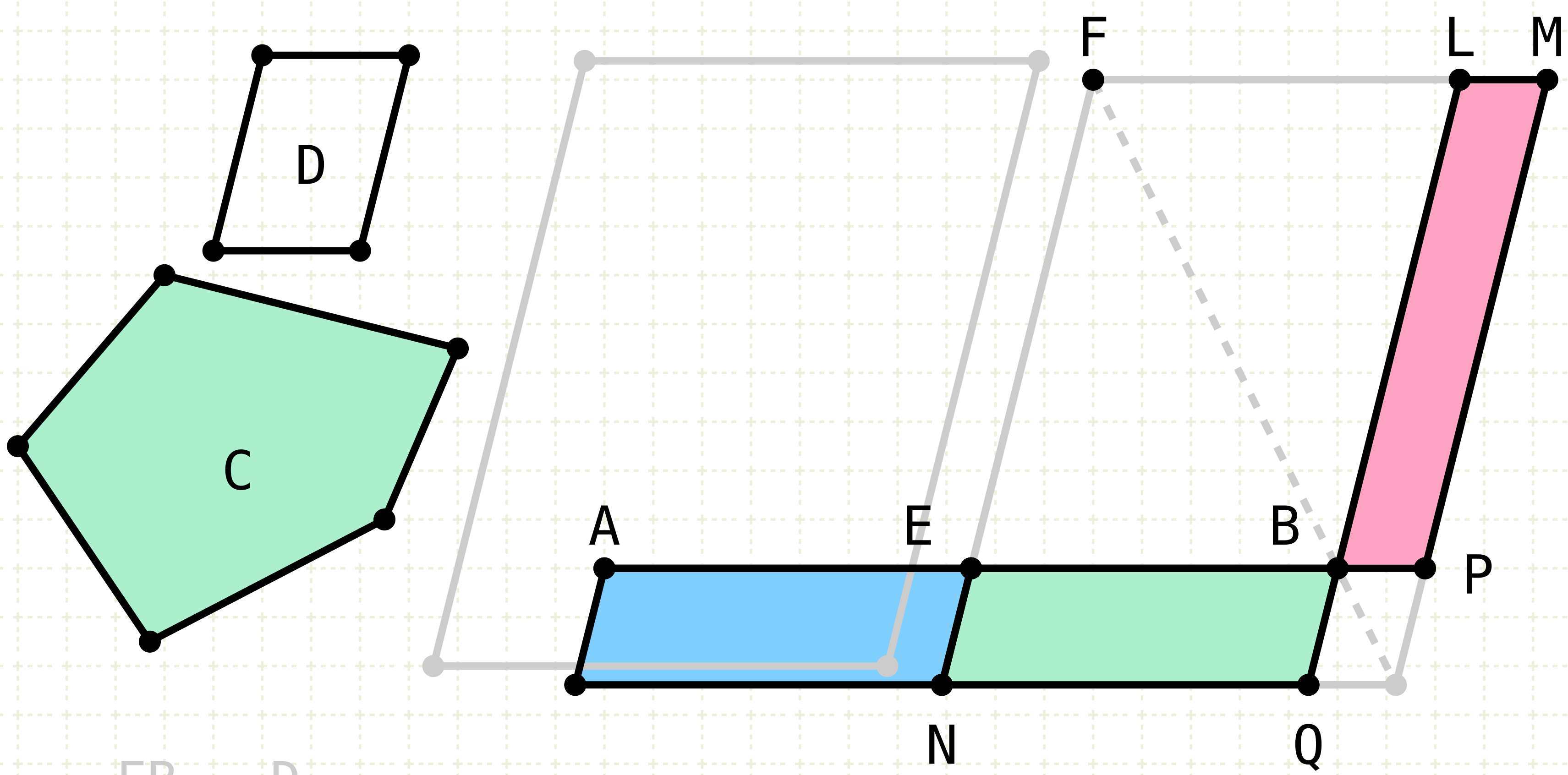
To a given straight line to apply a parallelogram equal to a given rectilineal figure and exceeding by a parallelogrammic figure similar to a given one



FB ~ D
GH = C + FB
GH ~ D
∴ GH ~ FB
MN = GH

MN ~ GH ~ D ~ FB
NOMLBE = C
AN = NB = LP

Construction (cont.)

GH is equal to sum of FB and C, and since MN is equal to GH, the remaining gnomon (NOMLBE) is equal in area to C

Since AE equals EB, the parallelogram AN equals NB (VI·21) and LP (VI·26)

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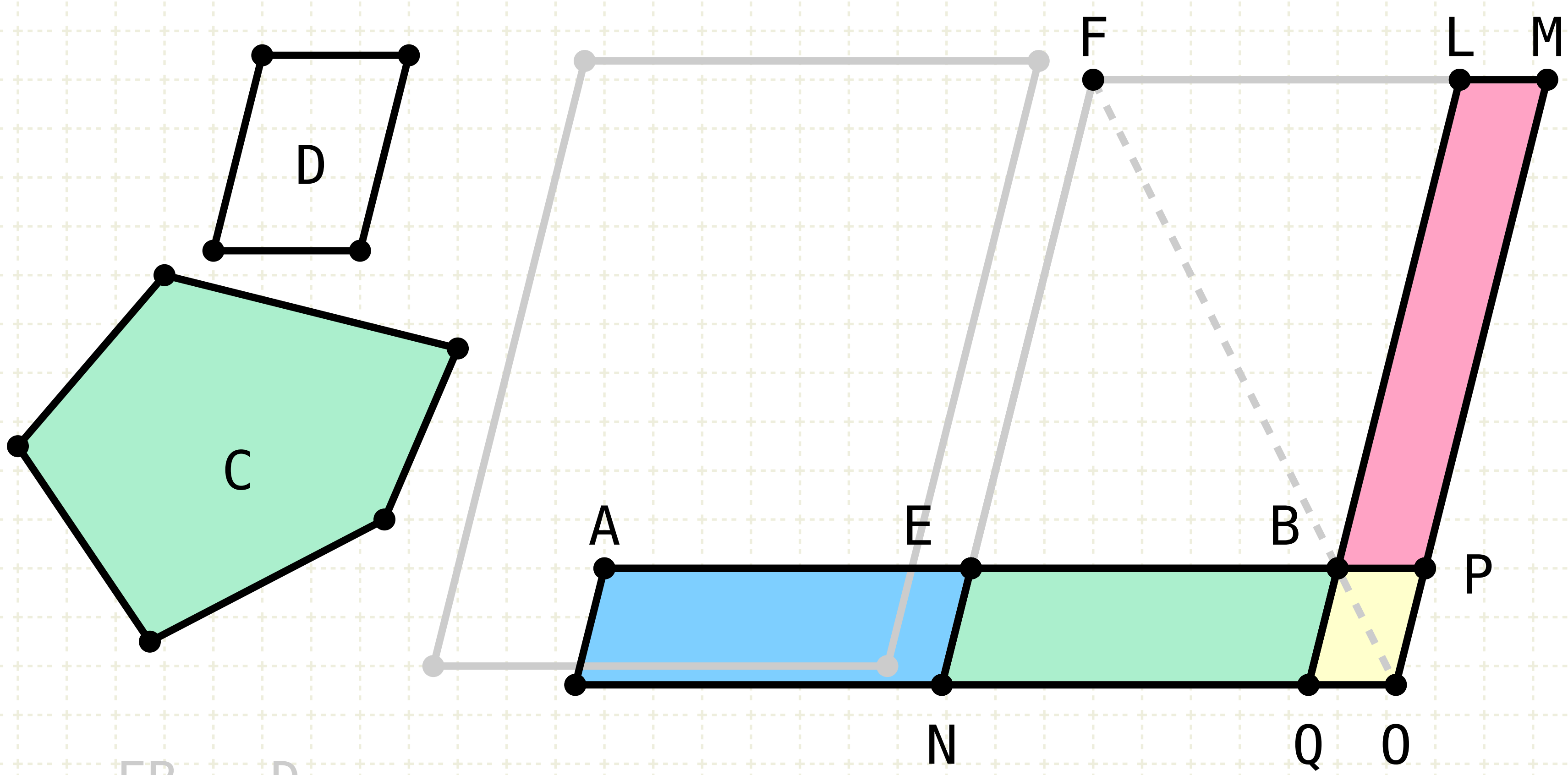

FB ~ D
GH = C + FB
GH ~ D
∴ GH ~ FB
MN = GH

MN ~ GH ~ D ~ FB
NOMLBE = C
AN = NB = LP
AO = AN + EO
AO = LP + EO = NOMLBE

Construction (cont.)

GH is equal to sum of FB and C, and since MN is equal to GH, the remaining gnomon (NOMLBE) is equal in area to C

Since AE equals EB, the parallelogram AN equals NB (VI·21) and LP (VI·26)

Add EO to AN and LP, thus AO is equal to the gnomon (NOMLBE)

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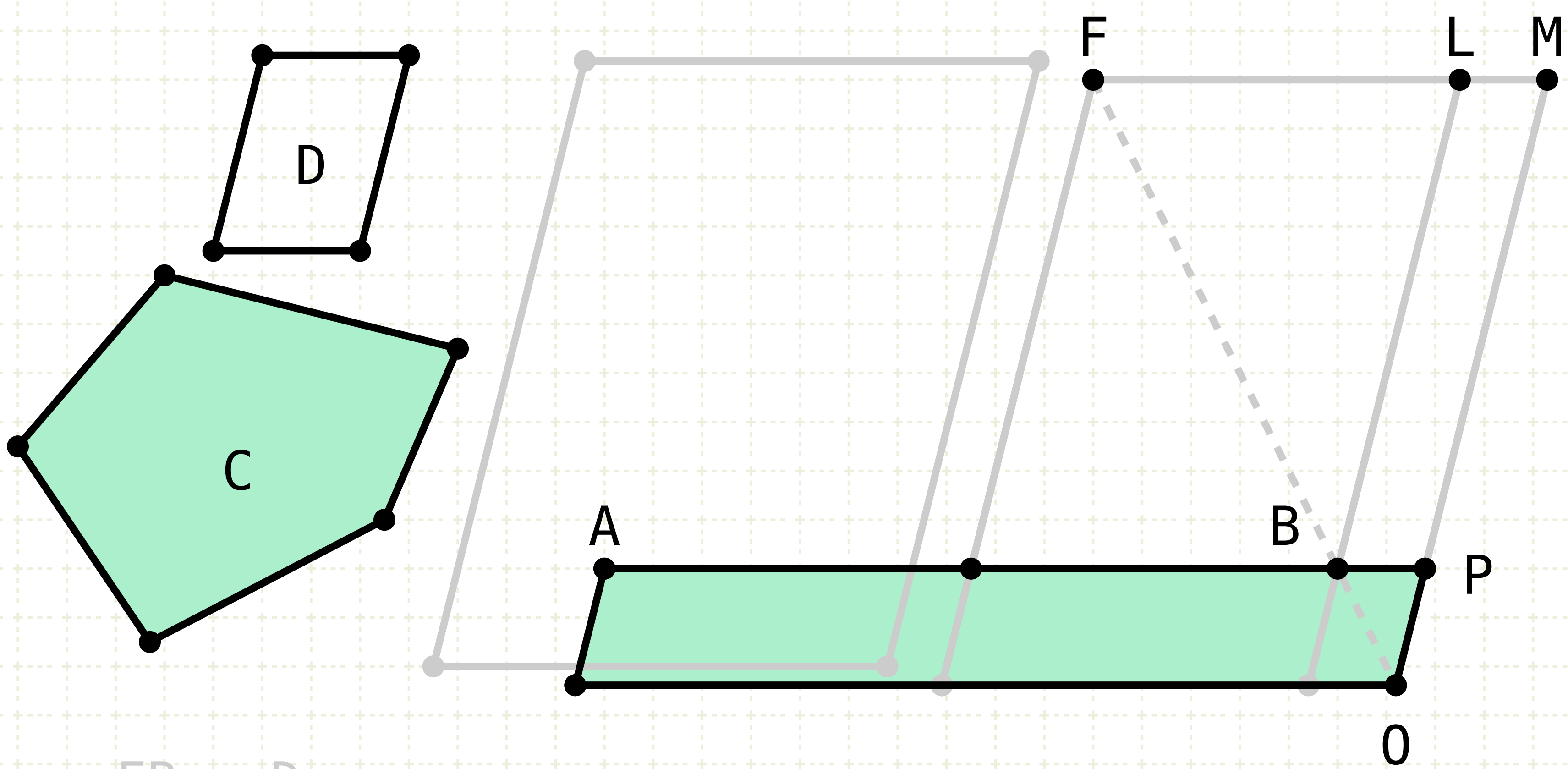

FB ~ D
GH = C + FB
GH ~ D
∴ GH ~ FB
MN = GH

MN ~ GH ~ D ~ FB
NOMLBE = C
AN = NB = LP
AO = AN + EO
AO = LP + EO = NOMLBE
AO = C

Construction (cont.)

GH is equal to sum of FB and C, and since MN is equal to GH, the remaining gnomon (NOMLBE) is equal in area to C

Since AE equals EB, the parallelogram AN equals NB (VI·21) and LP (VI·26)

Add EO to AN and LP, thus AO is equal to the gnomon (NOMLBE)

It has already been shown that the gnomon is equal to C, hence AO is equal to C

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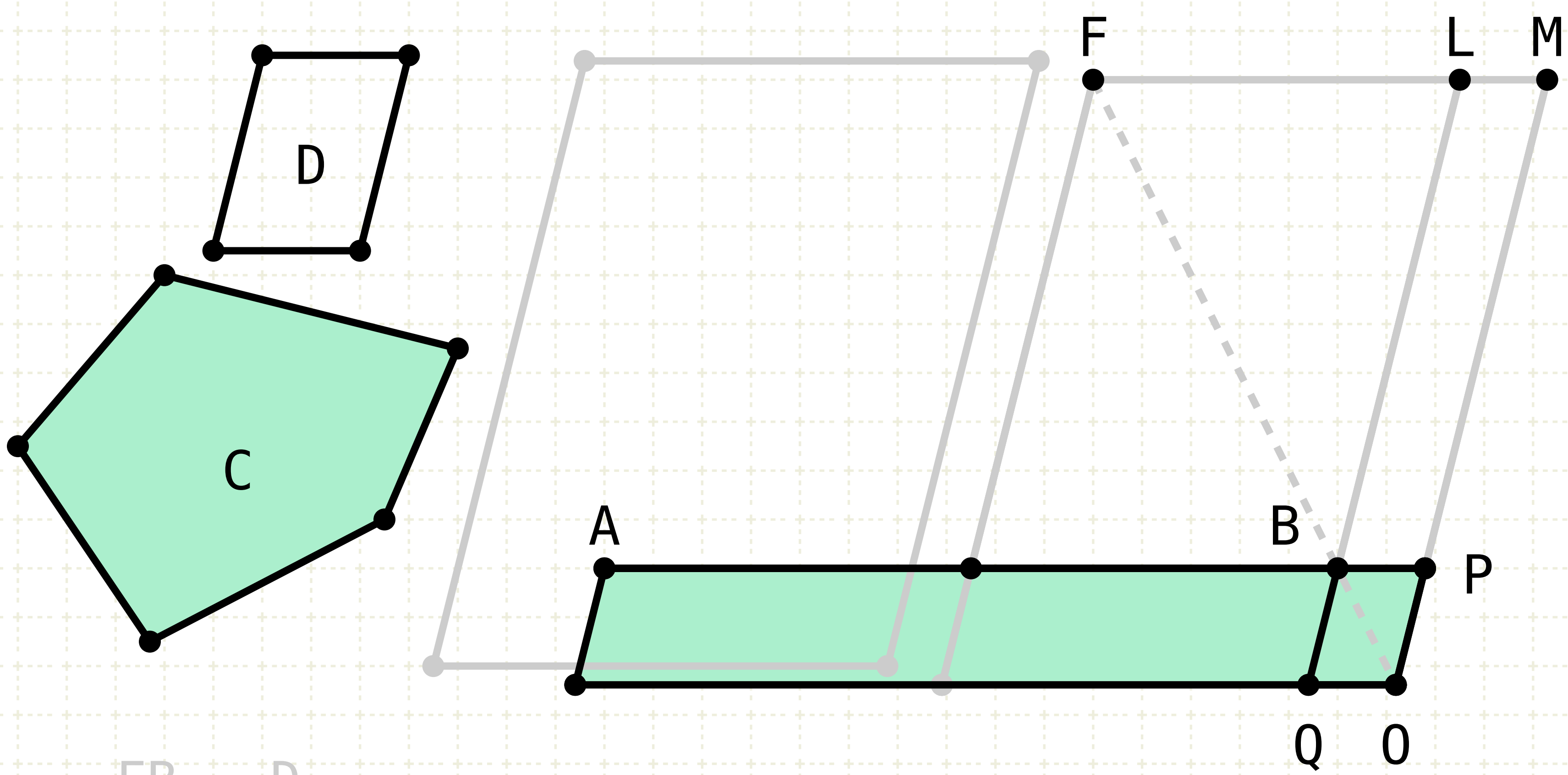

FB ~ D
GH = C + FB
GH ~ D
∴ GH ~ FB
MN = GH

MN ~ GH ~ D ~ FB
NOMLBE = C
AN = NB = LP
AO = AN + EO
AO = LP + EO = NOMLBE
AO = C

Construction (cont.)

GH is equal to sum of FB and C, and since MN is equal to GH, the remaining gnomon (NOMLBE) is equal in area to C

Since AE equals EB, the parallelogram AN equals NB (VI·21) and LP (VI·26)

Add EO to AN and LP, thus AO is equal to the gnomon (NOMLBE)

It has already been shown that the gnomon is equal to C, hence AO is equal to C

Thus, AO is a parallelogram drawn on AB, equal in size to C, exceeding AB by a parallelogram figure (QP) similar to D

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