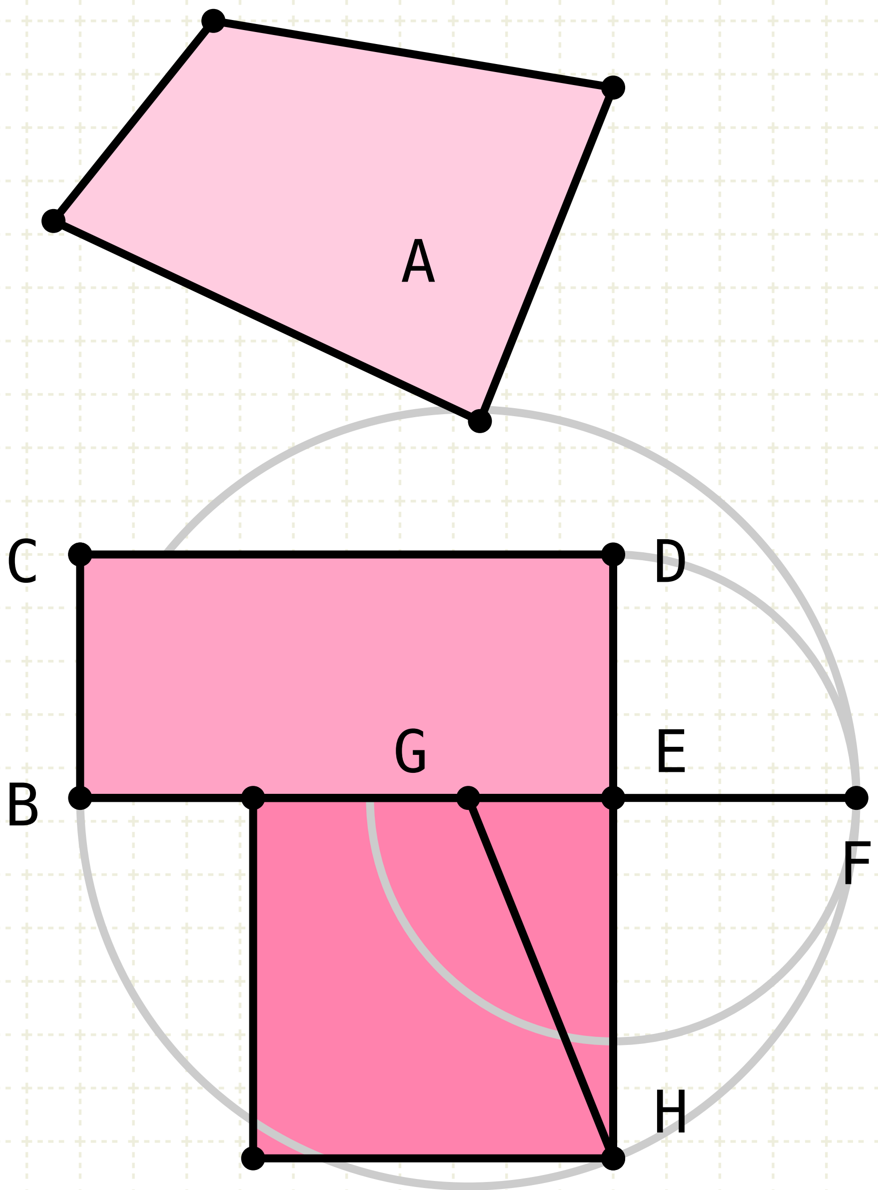
Euclid's Elements

Book II



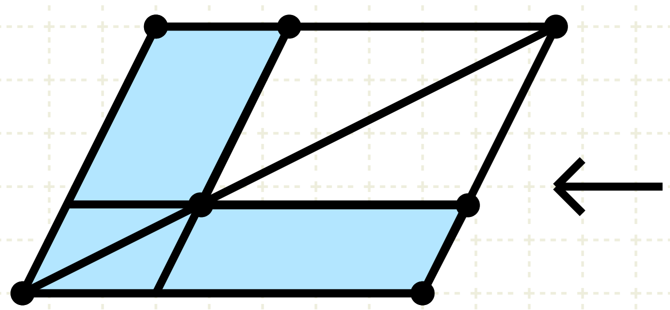
It is a remarkable fact in the history of geometry, that the Elements of Euclid, written two thousand years ago, are still regarded by many as the best introduction to the mathematical sciences.

Florian Cajori,

A History of Mathematics (1893)

Definitions:

Any rectangular parallelogram is said to be contained by the two straight lines containing the right angle.



And in any parallelogrammic area let any one whatever of the parallelograms about its diameter with the two complements be called a gnomon.

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Proposition 6 of Book II

If a straight line be bisected and a straight line be added to it in a straight line, the rectangle contained by the whole with the added straight line and the added straight line together with the square on the half is equal to the square on the straight line made up of the half and the added straight line.

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In other words

Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

$AD=AB+BD$, $CB=\frac{1}{2}AB$, $CD=CB+BD$

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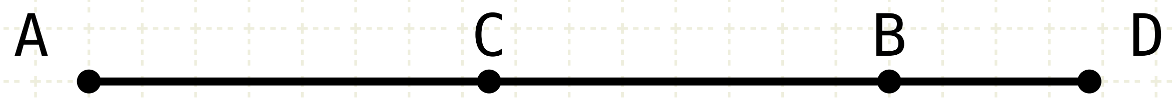

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Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

The rectangle formed by the extended line AD, and the extension BD plus the square on CB is equal to the square on CD

$AD=AB+BD, \quad CB=\frac{1}{2}AB, \quad CD=CB+BD$

$AD \cdot DB + CB \cdot CB = CD \cdot CD$

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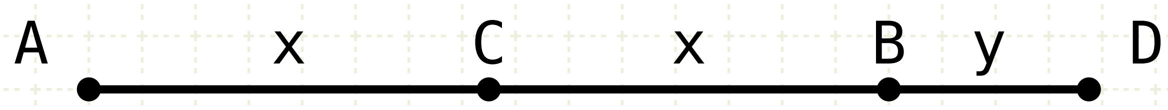

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$(2x+y)y + x^2 = (x+y)^2$

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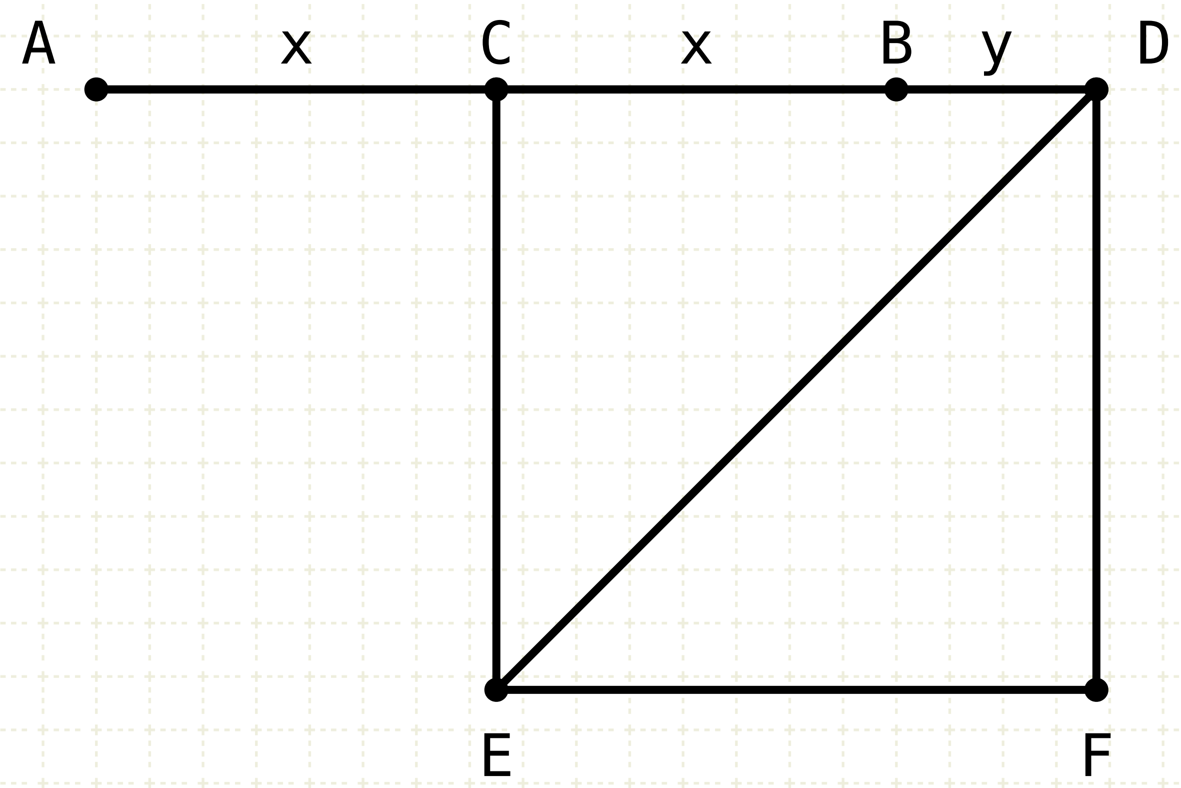

AD=AB+BD, CB=½AB, CD=CB+BD

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Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

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Construction:

Draw a square CEFB on the line CD (I·46) and draw the diagonal DE

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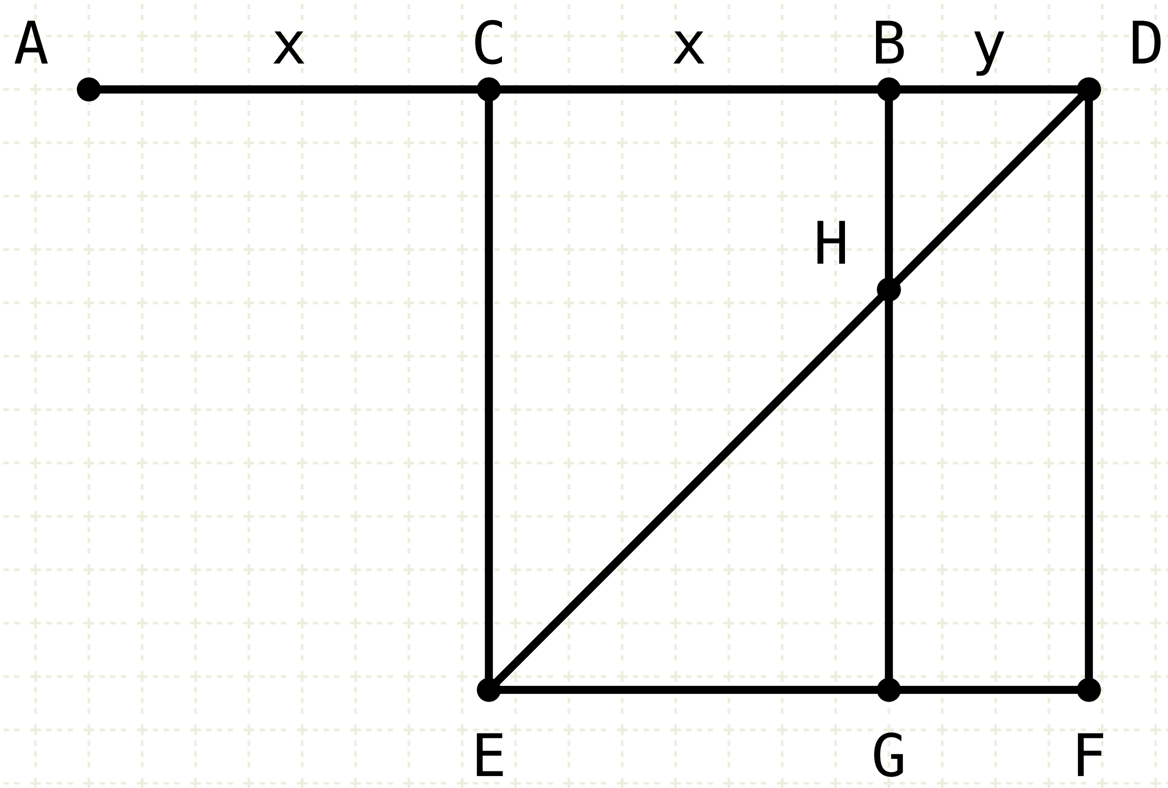

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Construction:

Draw a square CEFB on the line CD (I·46) and draw the diagonal DE

From point B, draw a line parallel to either CE or DF (I·31)

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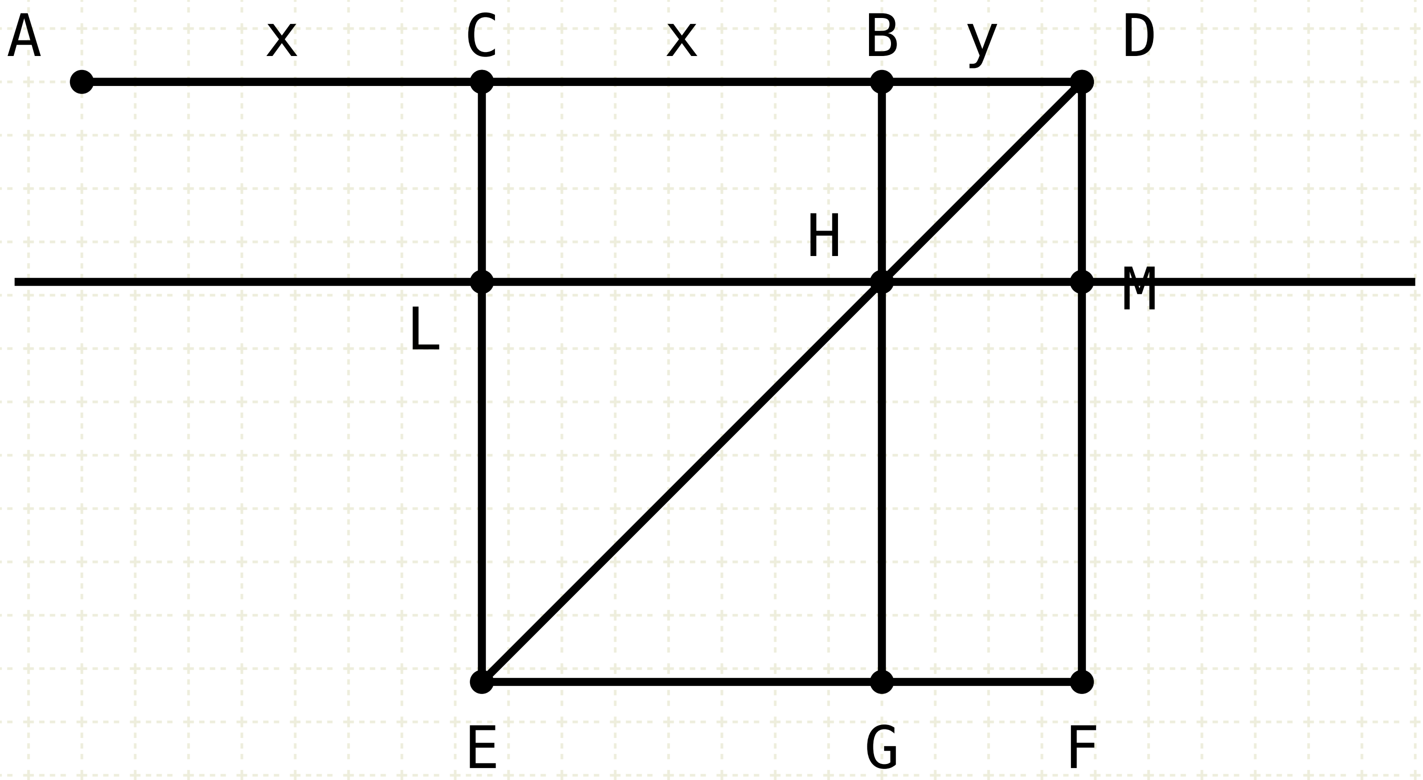

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Construction:

Draw a square CEFB on the line CD (I·46) and draw the diagonal DE

From point B, draw a line parallel to either CE or DF (I·31)

From point H, draw a line parallel to either AB or EF (I·31)

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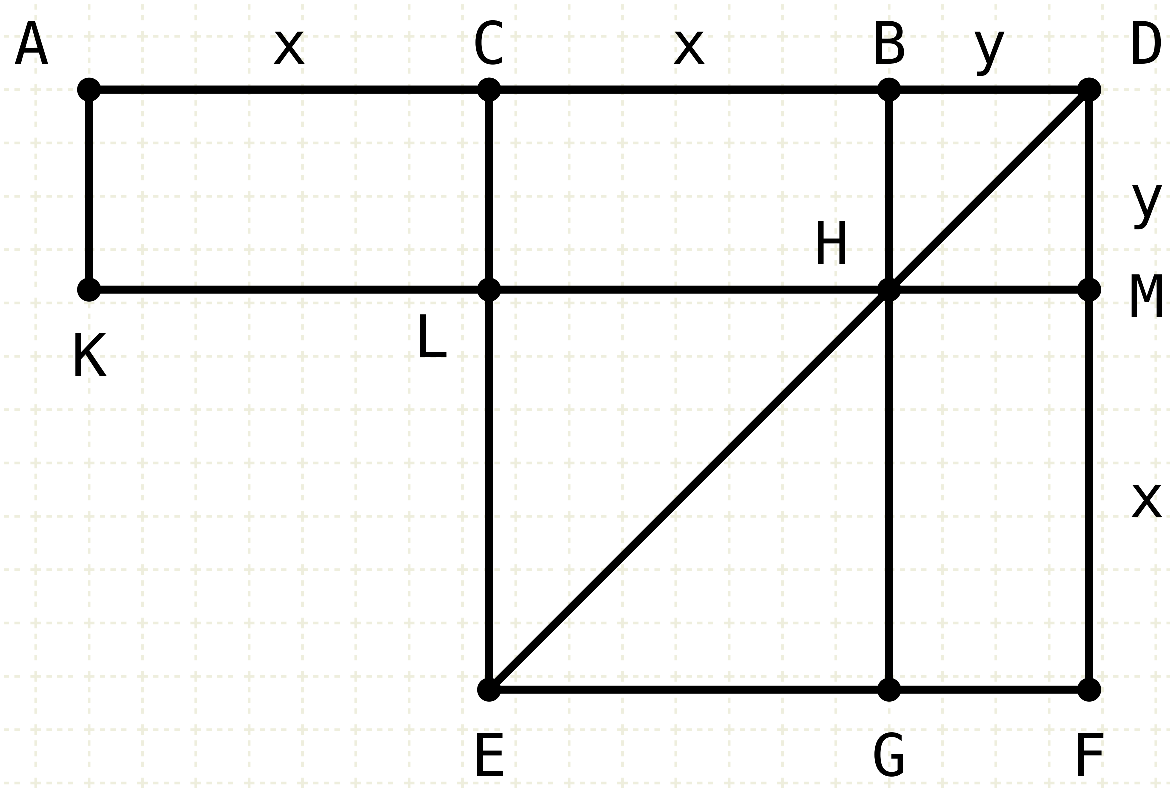
If a straight line be bisected and a straight line be added to it in a straight line, the rectangle contained by the whole with the added straight line and the added straight line together with the square on the half is equal to the square on the straight line made up of the half and the added straight line.



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Construction:

Draw a square CEFB on the line CD (I·46) and draw the diagonal DE

From point B, draw a line parallel to either CE or DF (I·31)

From point H, draw a line parallel to either AB or EF (I·31)

From point A, draw a line parallel to either CL or BH (I·31)

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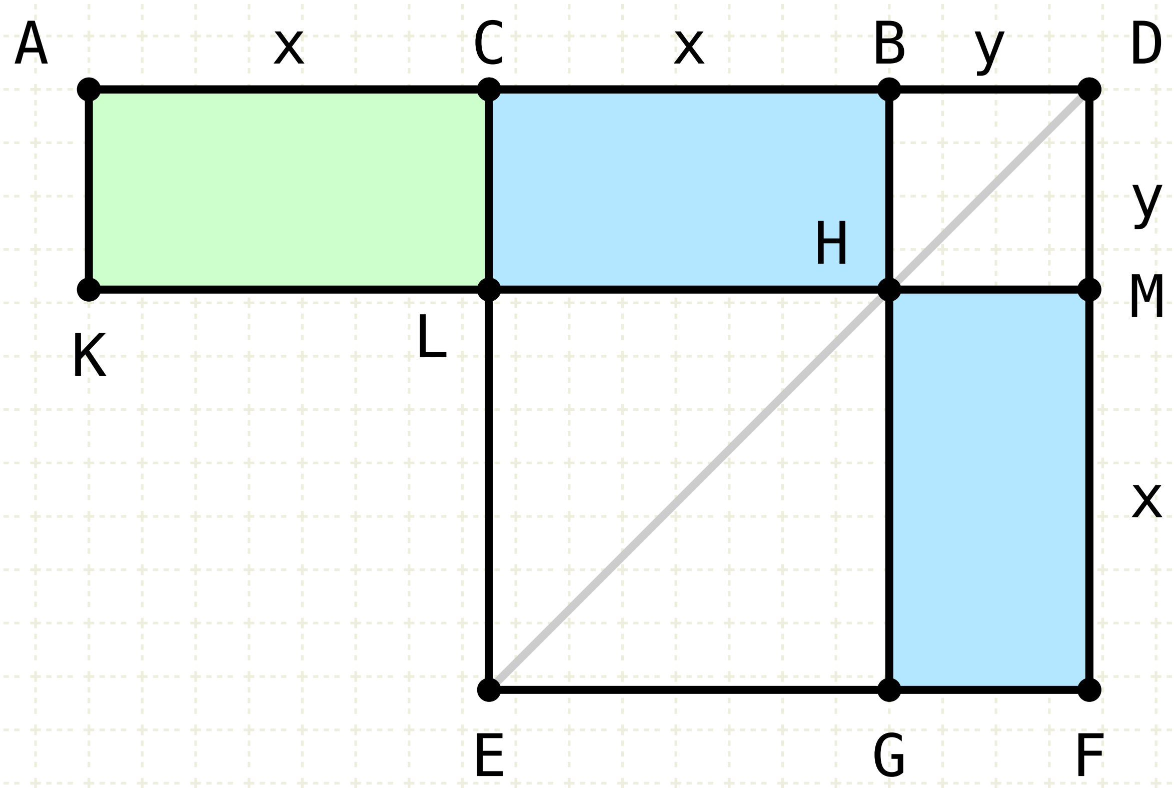

AD=AB+BD, CB=½AB, CD=CB+BD

AC=CB ∴ □AL=□CH=□HF ∴ □AL=□HF

In other words

Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

The rectangle formed by the extended line AD, and the extension BD plus the square on CB is equal to the square on CD

Proof:

Since AC equals CB, then AL equals CH (I·36), and CH equals HF (I·43), then AL = HF

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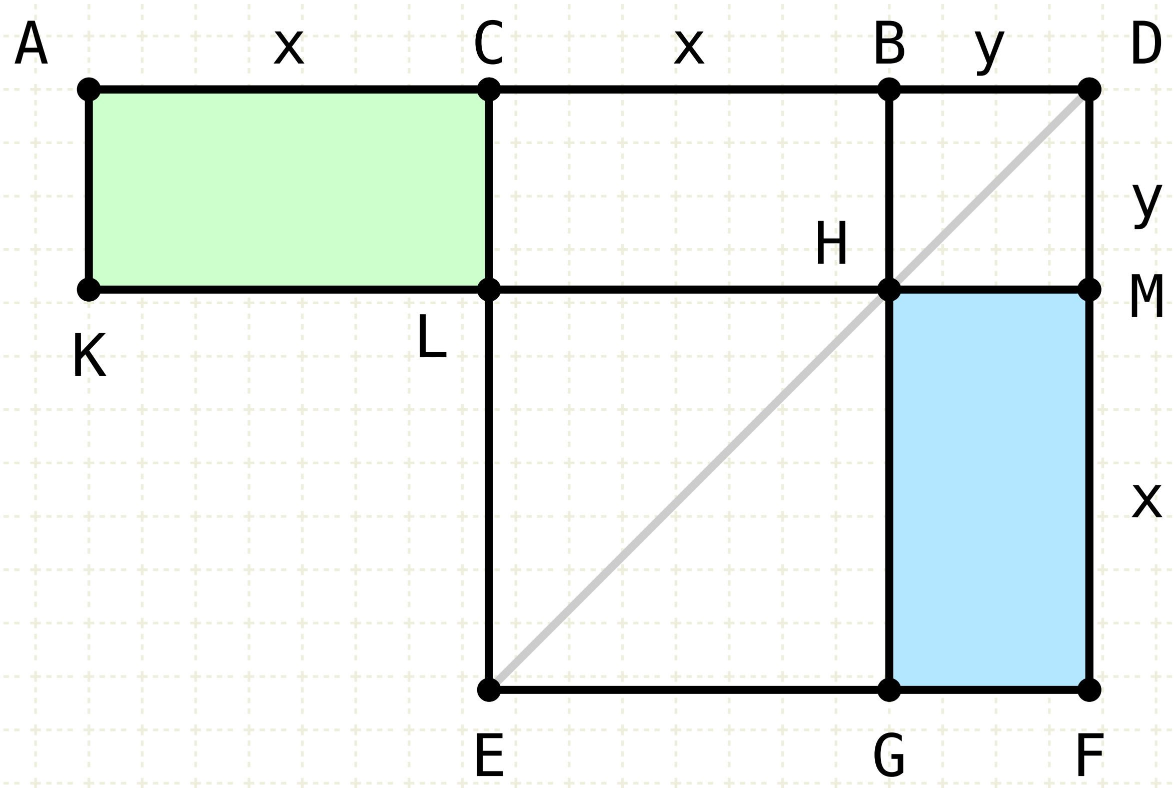

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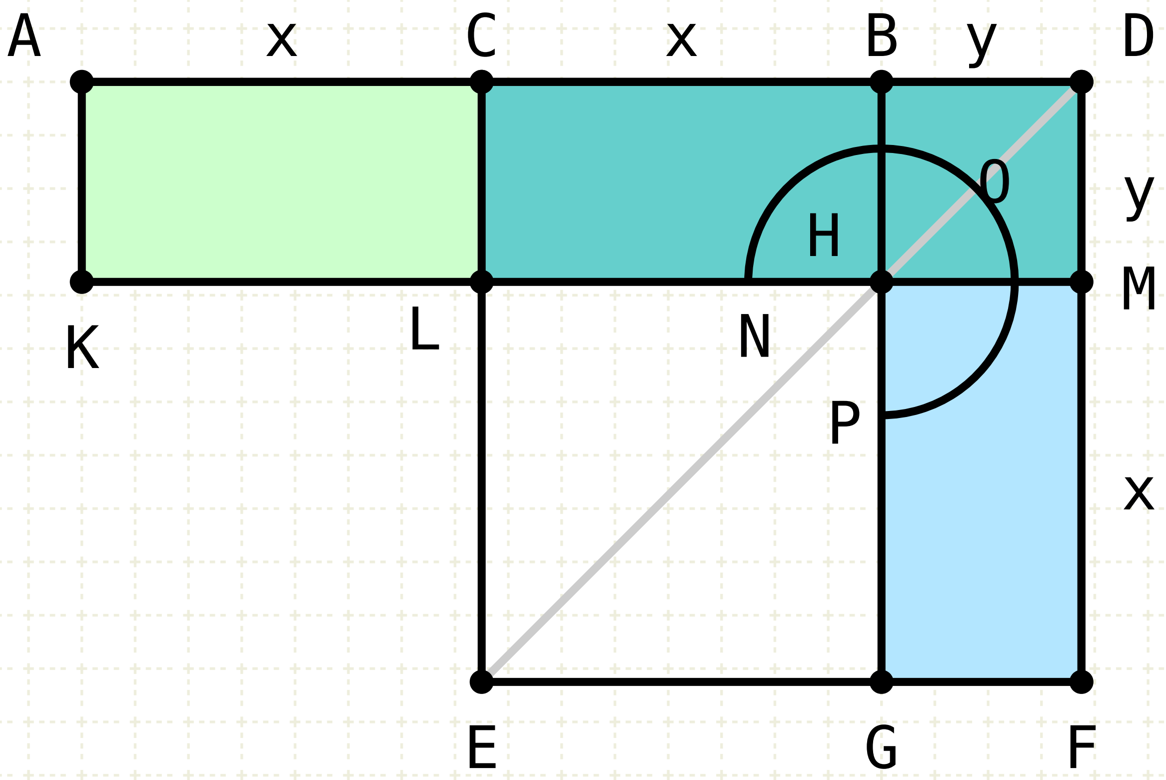

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AC=CB ∴ □AL=□CH=□HF ∴ □AL=□HF

□AL + □CM = □AM = □HF + □CM

□AM = NOP

In other words

Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

The rectangle formed by the extended line AD, and the extension BD plus the square on CB is equal to the square on CD

Proof:

Since AC equals CB, then AL equals CH (I·36), and CH equals HF (I·43), then AL = HF

Add CM to both

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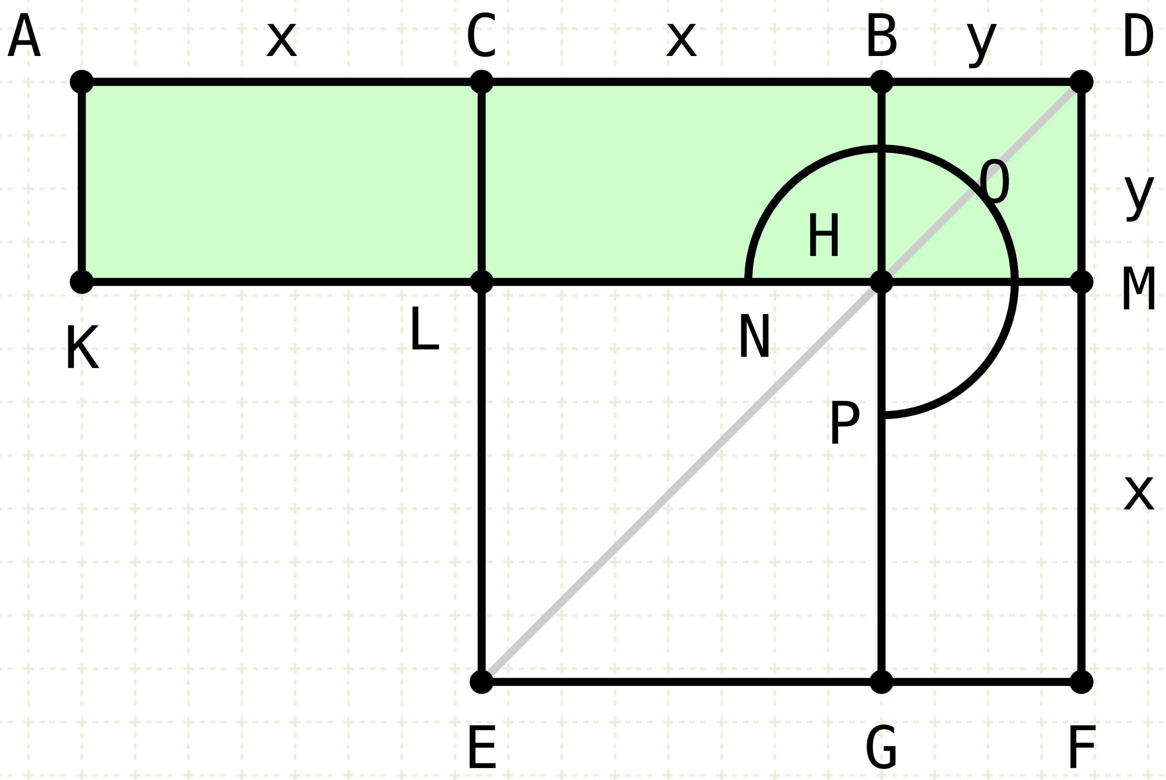
If a straight line be bisected and a straight line be added to it in a straight line, the rectangle contained by the whole with the added straight line and the added straight line together with the square on the half is equal to the square on the straight line made up of the half and the added straight line.



$AD=AB+BD, \quad CB=\frac{1}{2}AB, \quad CD=CB+BD$

$AC=CB \therefore \square AL=\square CH=\square HF \therefore \square AL=\square HF$

$\square AL + \square CM = \square AM = \square HF + \square CM$

$\square AM = NOP$

$\square AM = AD \cdot DB$

In other words

Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

The rectangle formed by the extended line AD, and the extension BD plus the square on CB is equal to the square on CD

Proof:

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Add CM to both

Since DB equals DM, AM is the rectangle formed from AD and DB

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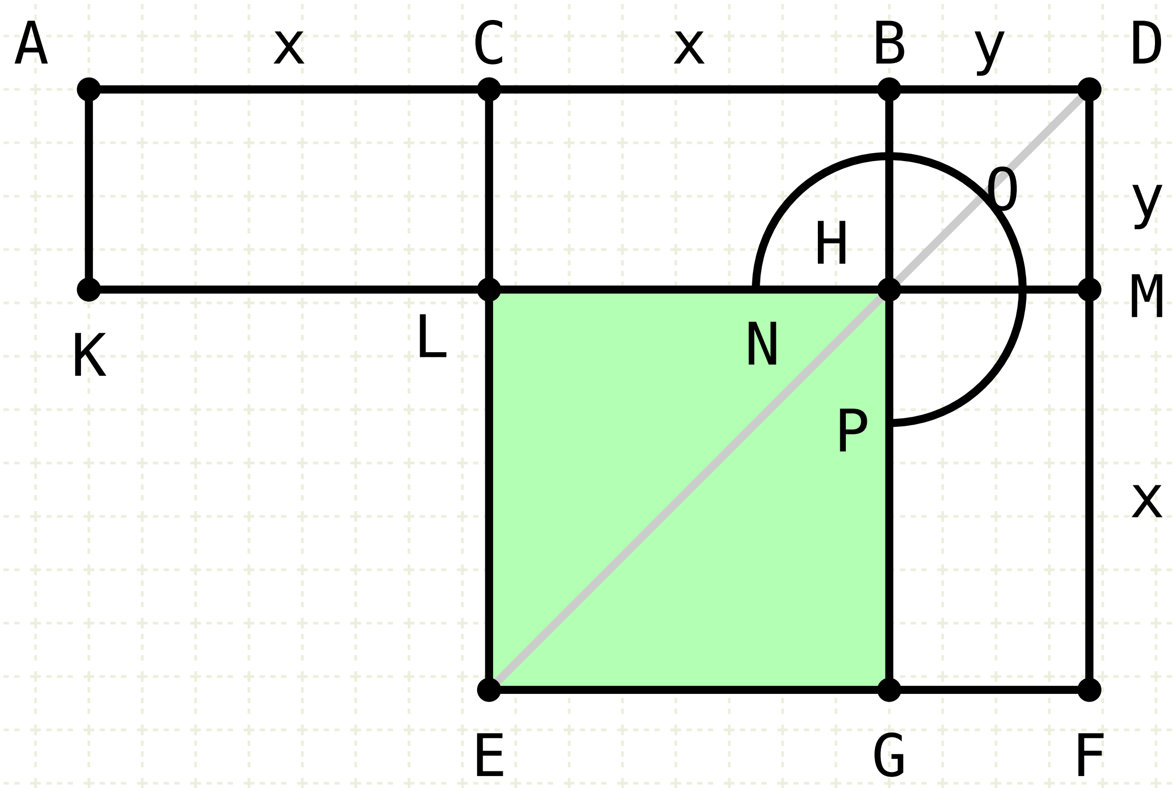

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□AM = AD·DB

□LG = CB·CB

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Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

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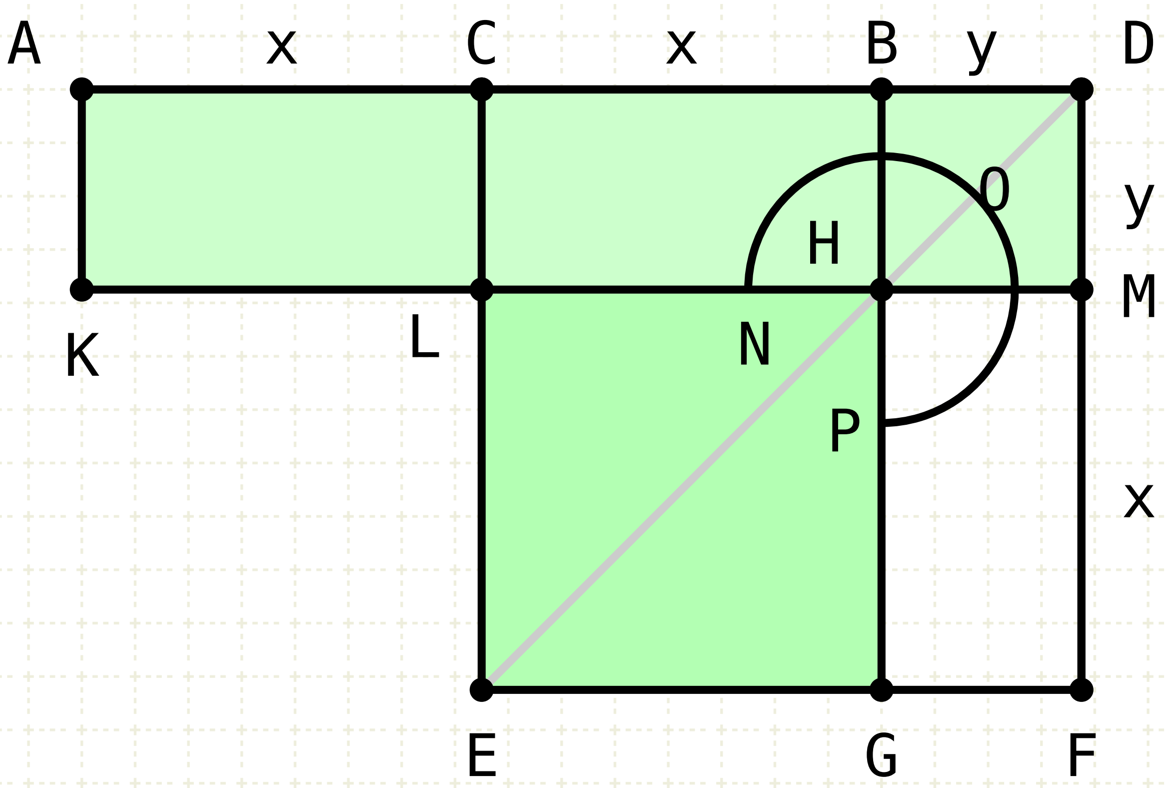

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AD·DB + CB·CB = NOP + CB·CB

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Let AB be a straight line, bisected at point C, and extend the line AB to an arbitrary point D

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LG is the square of CB

Add LG to AM and the gnomon NOP

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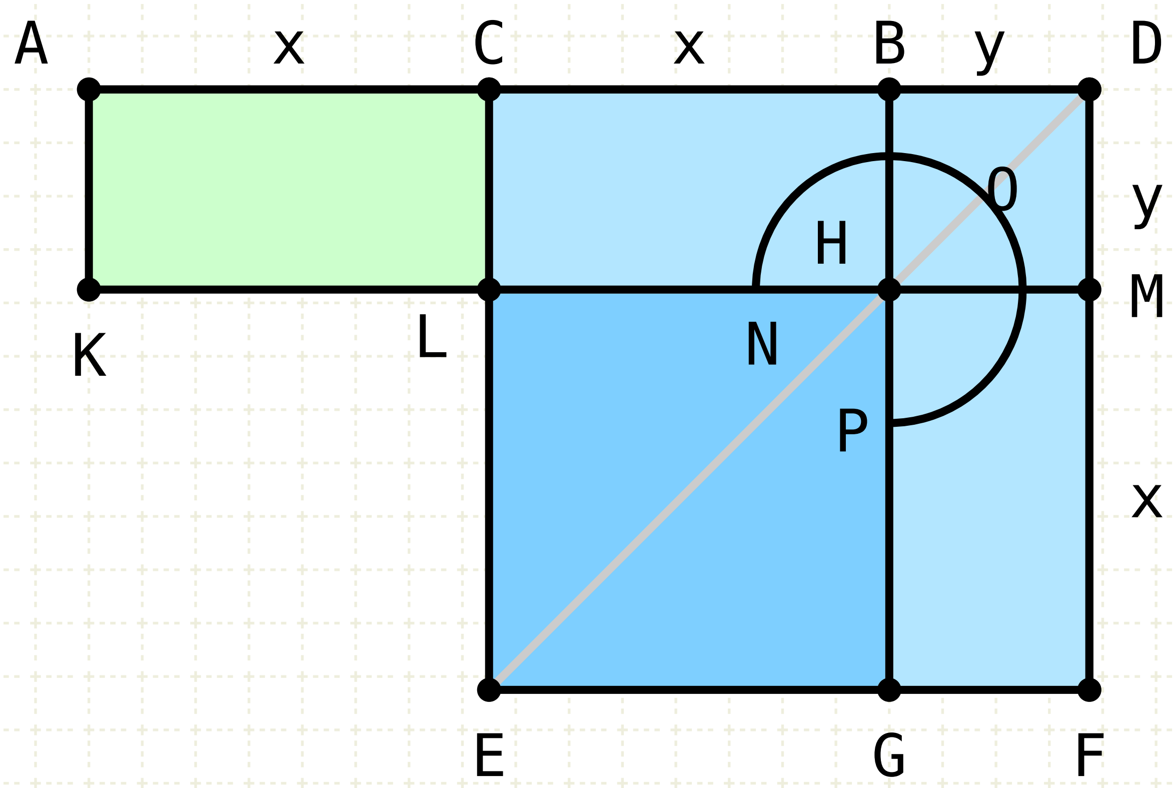

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Add CM to both

Since DB equals DM, AM is the rectangle formed from AD and DB

LG is the square of CB

Add LG to AM and the gnomon NOP

But LG added to the gnomon NOP is also equal to the square on CD, therefore AM plus LG is equal to CF

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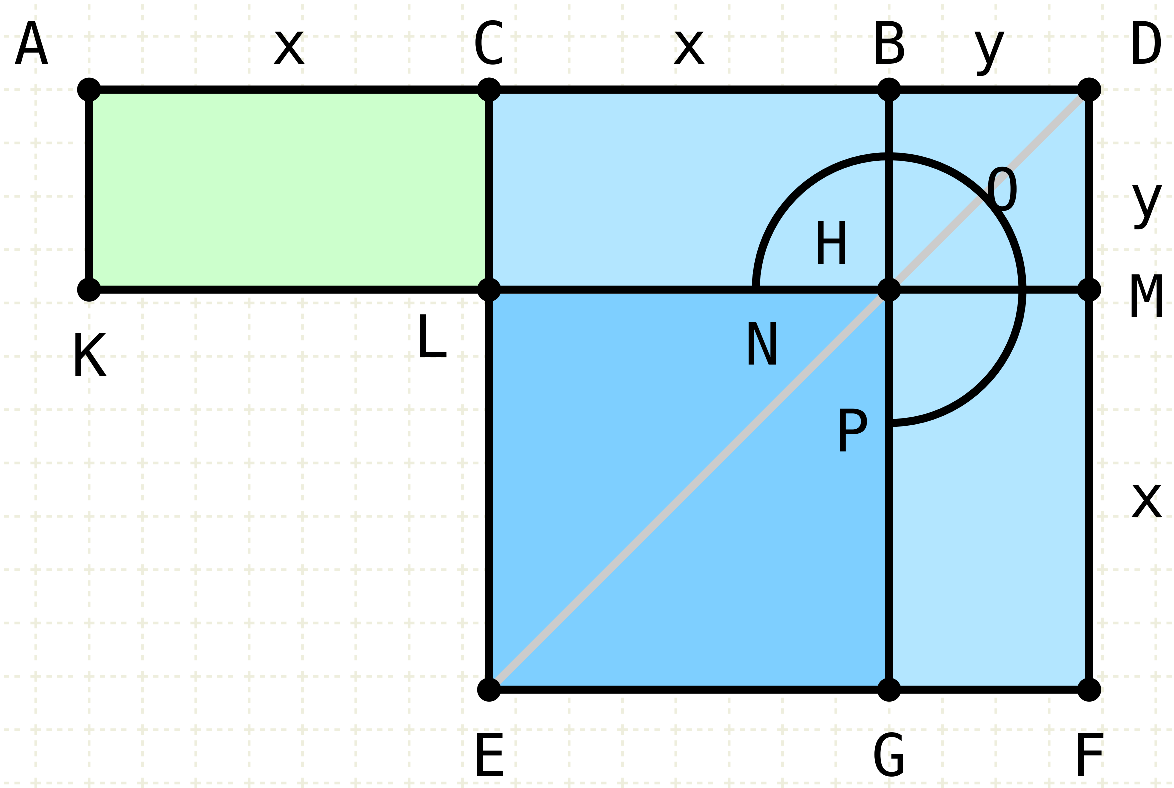

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$\square LG = CB \cdot CB$

$AD \cdot DB + CB \cdot CB = NOP + CB \cdot CB$

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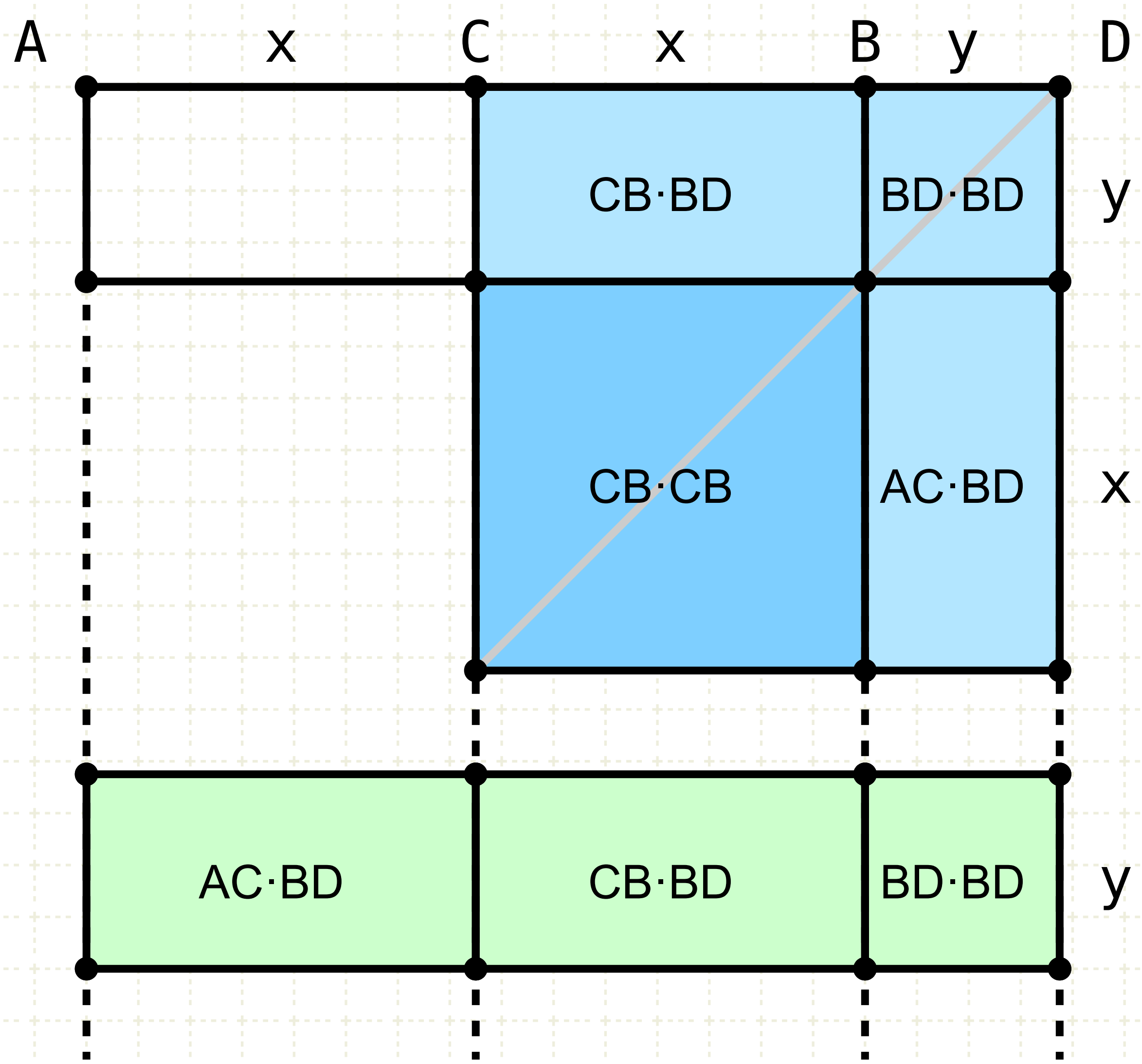

AC·BD + CB·BD + BD·BD = AD·BD

AD·BD + CB·CB = CD·CD

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