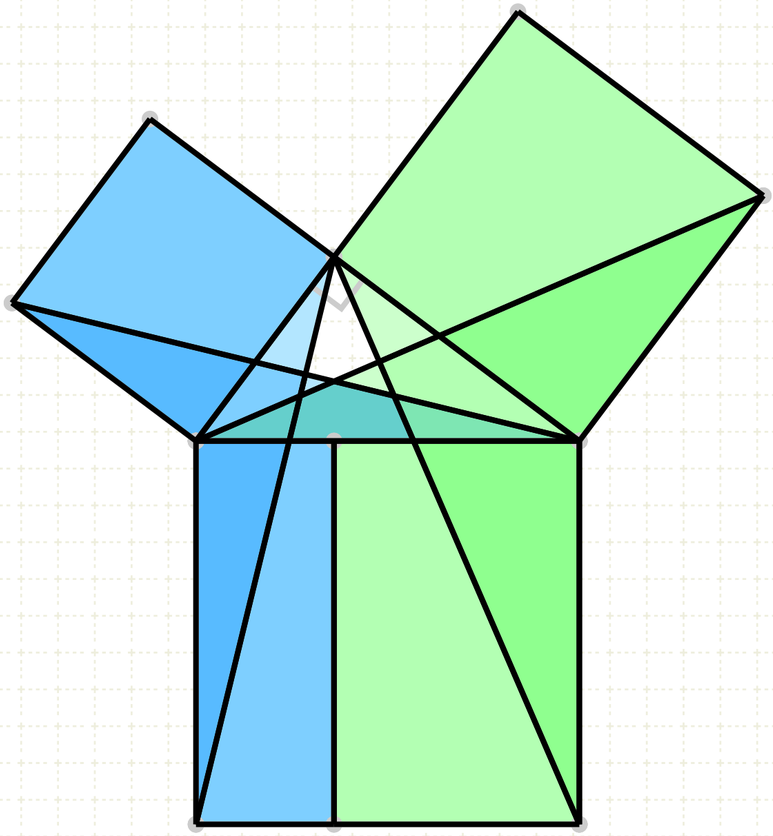
Euclid's Elements

Book I



If Euclid did not kindle your youthful enthusiasm, you were not born to be a scientific thinker.

Albert Einstein

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To describe a square on a given straight line.

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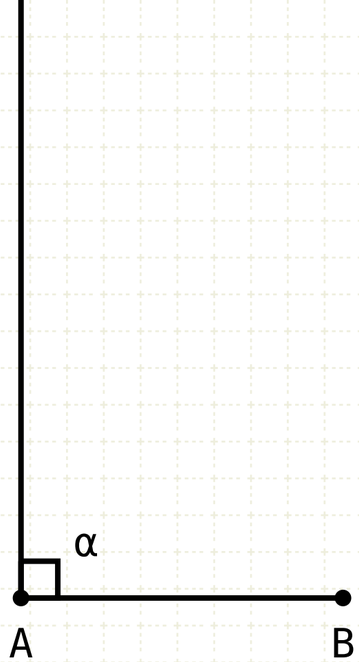
To describe a square on a given straight line.

Construction

Start with a given line AB



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟

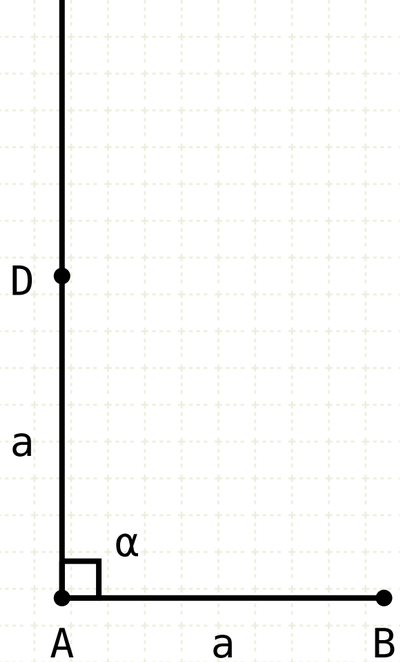
Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Proposition 46 of Book I

To describe a square on a given straight line.



α = ∟

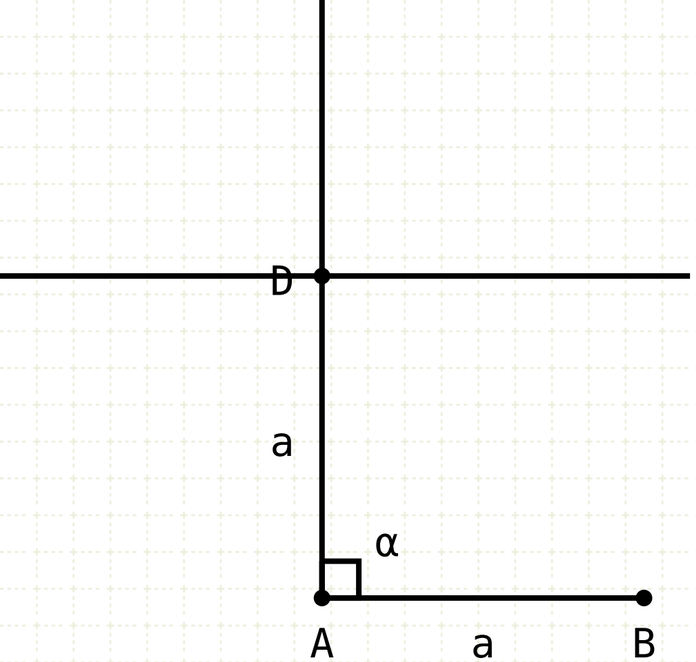
AD = AB

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟
AD = AB
AB || DE

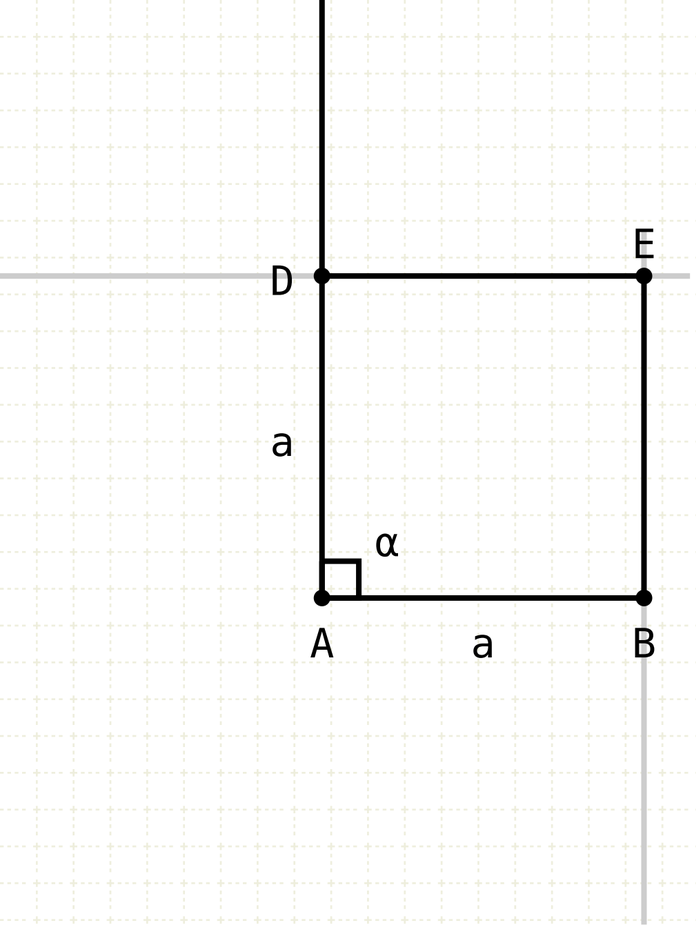
Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

Draw a line DE through D parallel to line AB (I·31)



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟
AD = AB
AB || DE
AD || BE

Construction

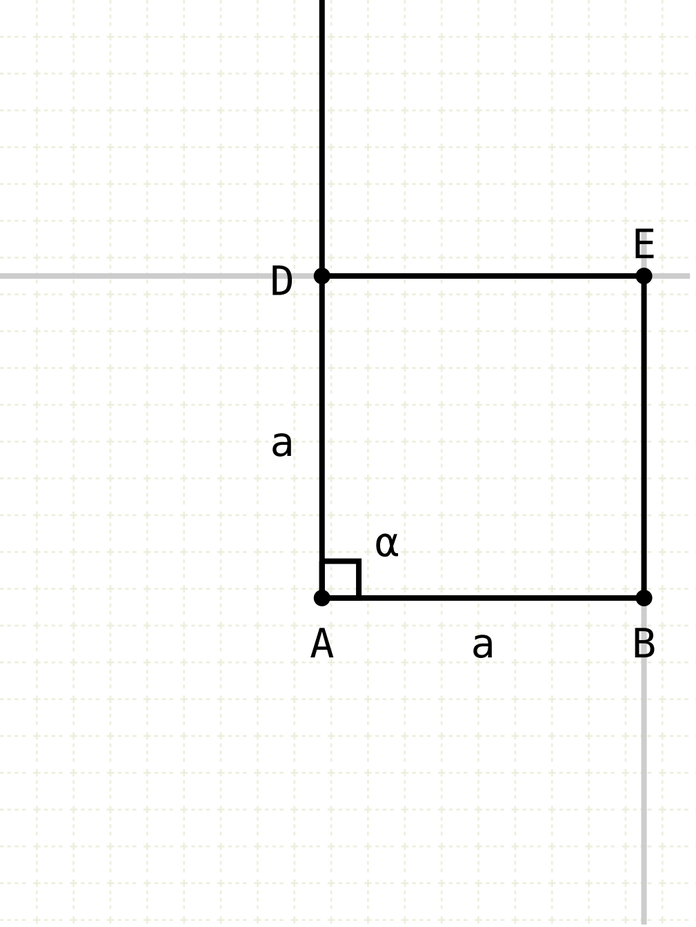
Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

Draw a line DE through D parallel to line AB (I·31)

Draw a line through B parallel to line AD (I·31) intersecting the previous line at point E



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟
AD = AB
AB || DE
AD || BE

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

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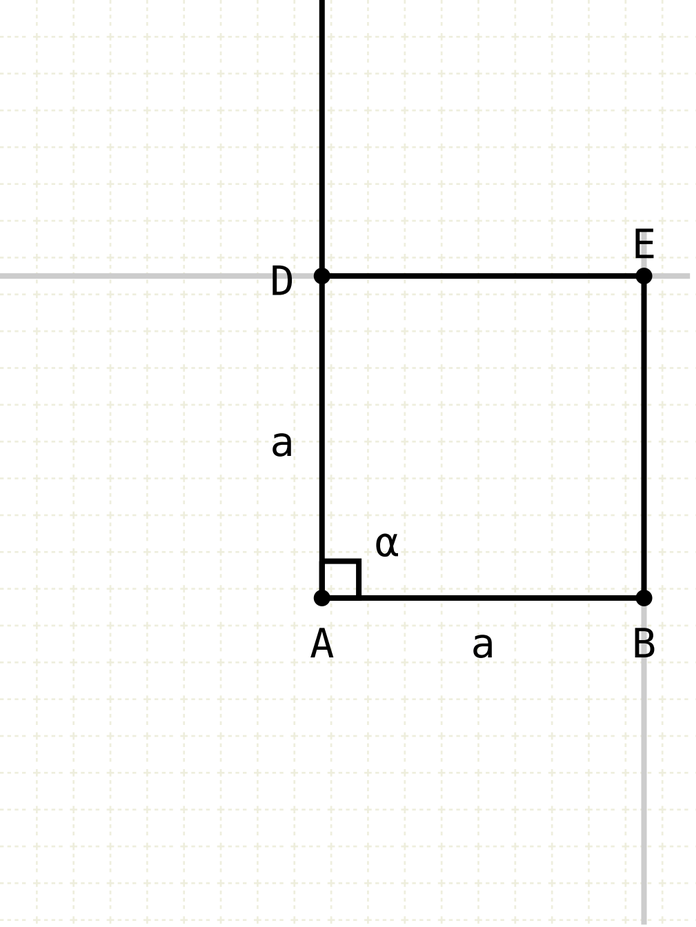
ABED is a square



Proposition 46 of Book I

To describe a square on a given straight line.

$\alpha = \llcorner$

$AD = AB$

$AB \parallel DE$

$AD \parallel BE$

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

Draw a line DE through D parallel to line AB (I·31)

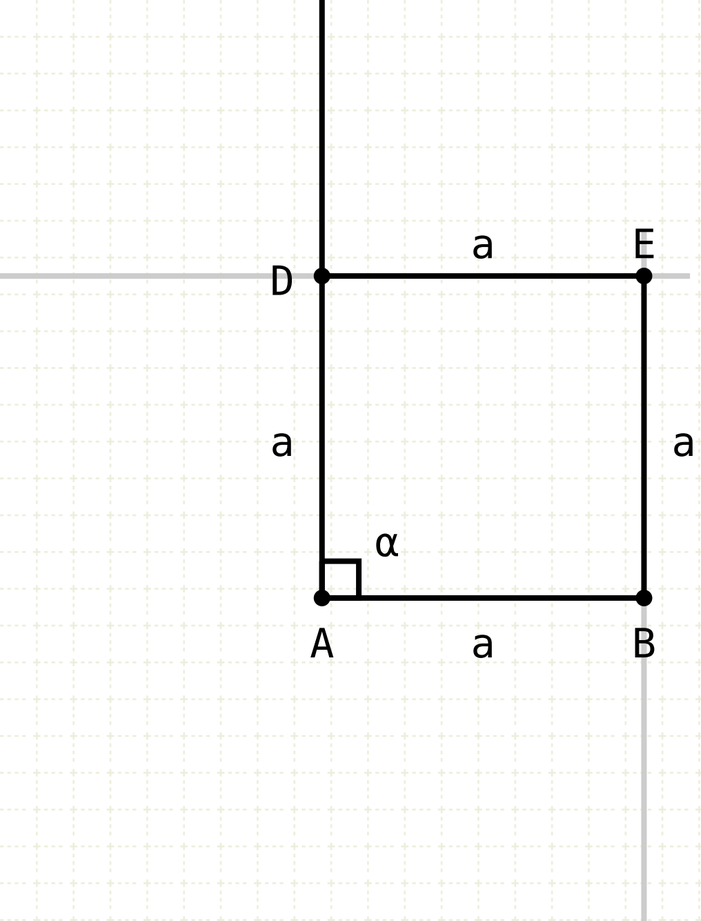
Draw a line through B parallel to line AD (I·31) intersecting the previous line at point E

ABED is a square

Proof:

Proposition 46 of Book I

To describe a square on a given straight line.



α = ∟
AD = AB
AB || DE
AD || BE
AB = DE
AD = BE

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

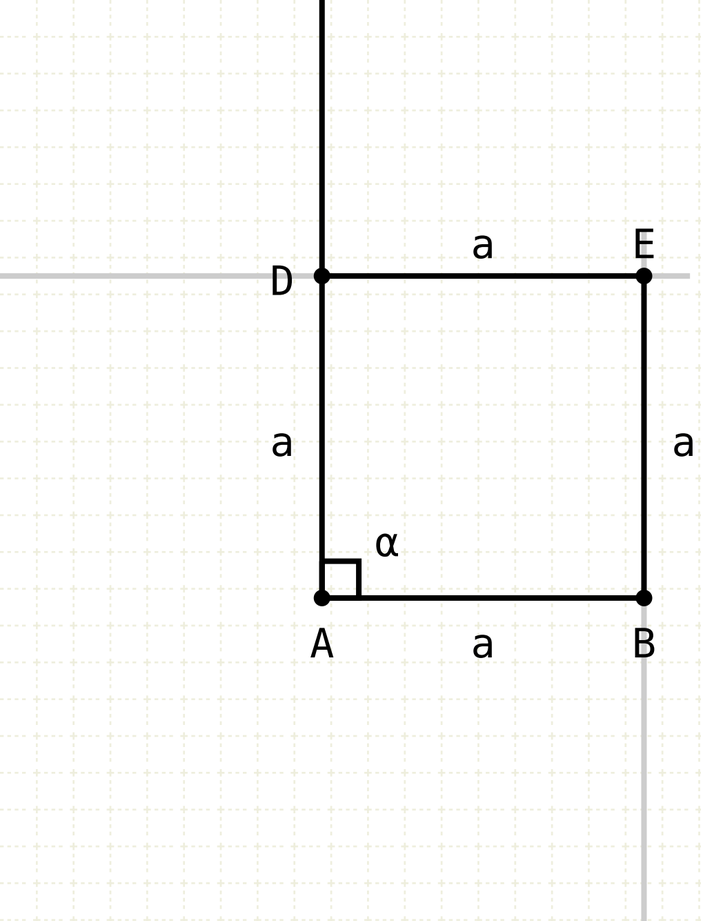
Draw a line DE through D parallel to line AB (I·31)

Draw a line through B parallel to line AD (I·31) intersecting the previous line at point E

ABED is a square

Proof:

Since AB is parallel to DE, and AD is parallel to BE, ABED is a parallelogram, and AB equals DE and AD equals BE (I·34)



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟
AD = AB
AB || DE
AD || BE
AB = DE
AD = BE

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

Draw a line DE through D parallel to line AB (I·31)

Draw a line through B parallel to line AD (I·31) intersecting the previous line at point E

ABED is a square

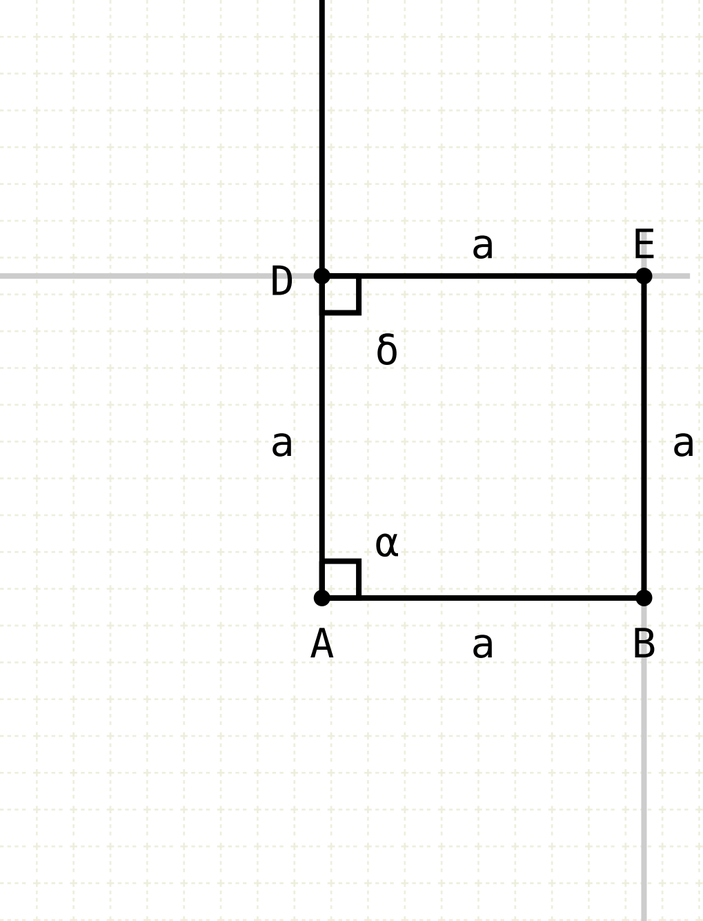
Proof:

Since AB is parallel to DE, and AD is parallel to BE, ABED is a parallelogram, and AB equals DE and AD equals BE (I·34)

But, AD equals AB, thus all the sides of the parallelogram are equal, so ABED is an equilateral

Proposition 46 of Book I

To describe a square on a given straight line.



α = ∟
AD = AB
AB || DE
AD || BE
AB = DE
AD = BE
α + δ = 2∟
δ = ∟

Construction

Start with a given line AB

Draw a line AC perpendicular to AB, from point A (I·11)

Define point D such that AD equals AB (I·3)

Draw a line DE through D parallel to line AB (I·31)

Draw a line through B parallel to line AD (I·31) intersecting the previous line at point E

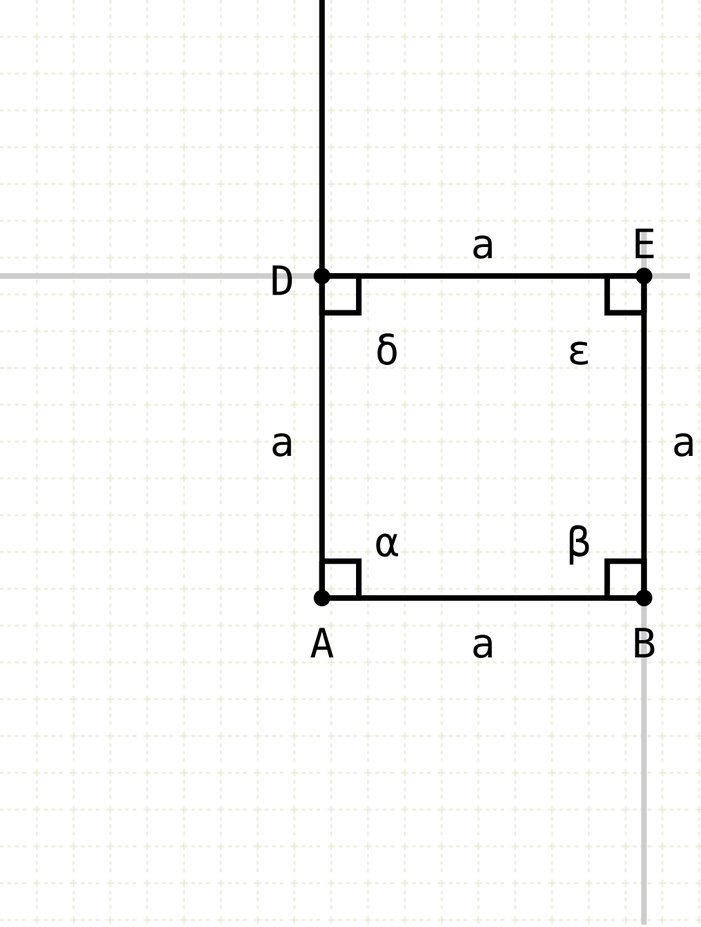
ABED is a square

Proof:

Since AB is parallel to DE, and AD is parallel to BE, ABED is a parallelogram, and AB equals DE and AD equals BE (I·34)

But, AD equals AB, thus all the sides of the parallelogram are equal, so ABED is an equilateral

Line DA intersects two parallel lines, thus the angles DAB and ADE equal two right angles (I·29)



Proposition 46 of Book I

To describe a square on a given straight line.

α = ∟
AD = AB
AB || DE
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AD = BE
α + δ = 2∟
δ = ∟
ε = ∟
β = ∟

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Line DA intersects two parallel lines, thus the angles DAB and ADE equal two right angles (I·29)

In a parallelogram, the opposite angles are equal to one another, so angles DEB and EBA are also right angles (I·34)

Proposition 46 of Book I

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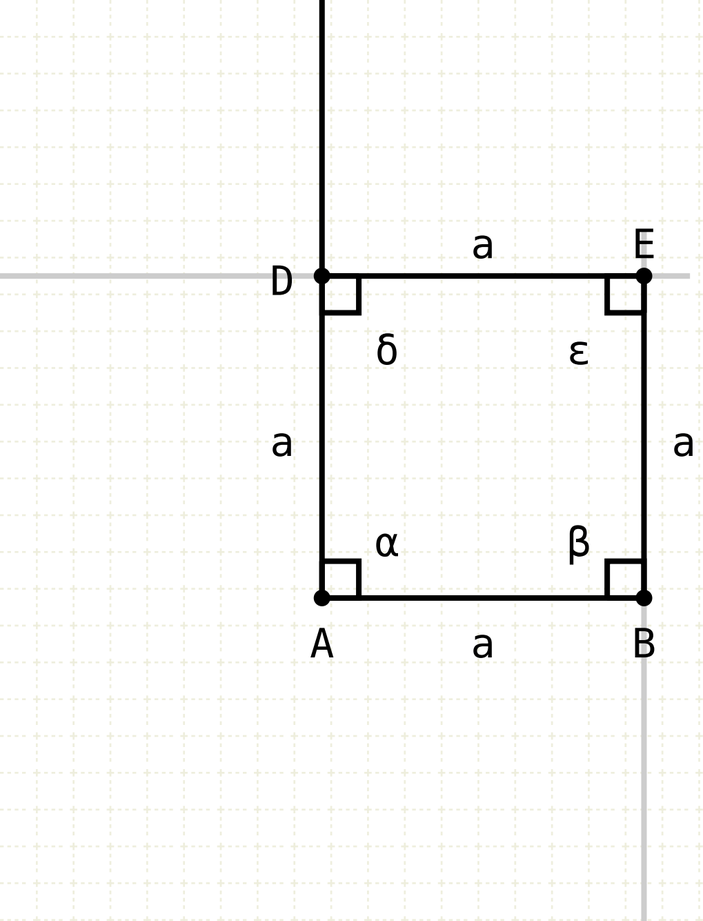

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In a parallelogram, the opposite angles are equal to one another, so angles DEB and EBA are also right angles (I·34)

An equilateral parallelogram with all right angles is a square

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