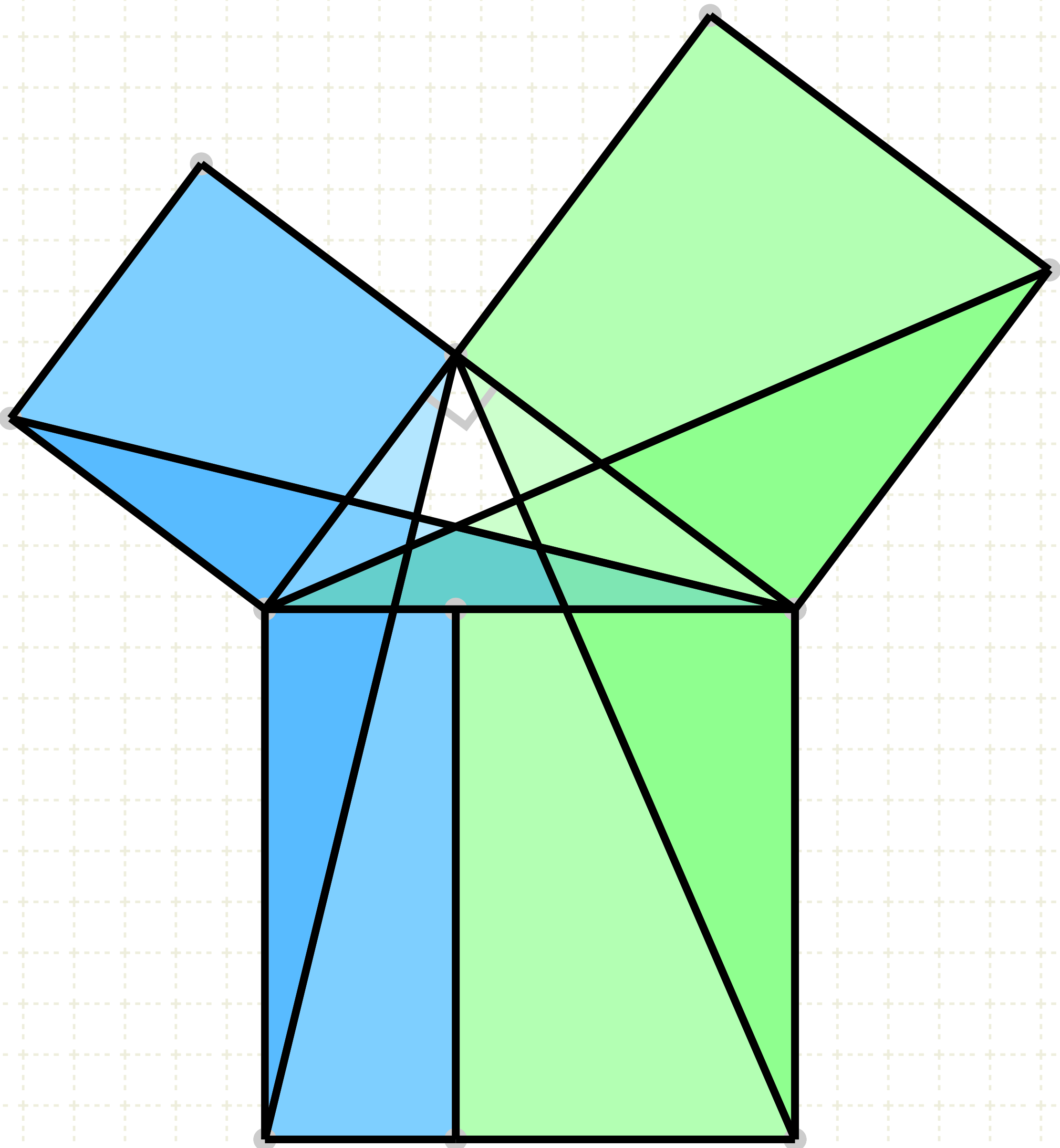
Euclid's Elements

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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Proposition 48 of Book I

If in a triangle the square on one of the sides equals the sum of the squares on the remaining two sides of the triangle, then the angle contained by the remaining two sides of the triangle is right.

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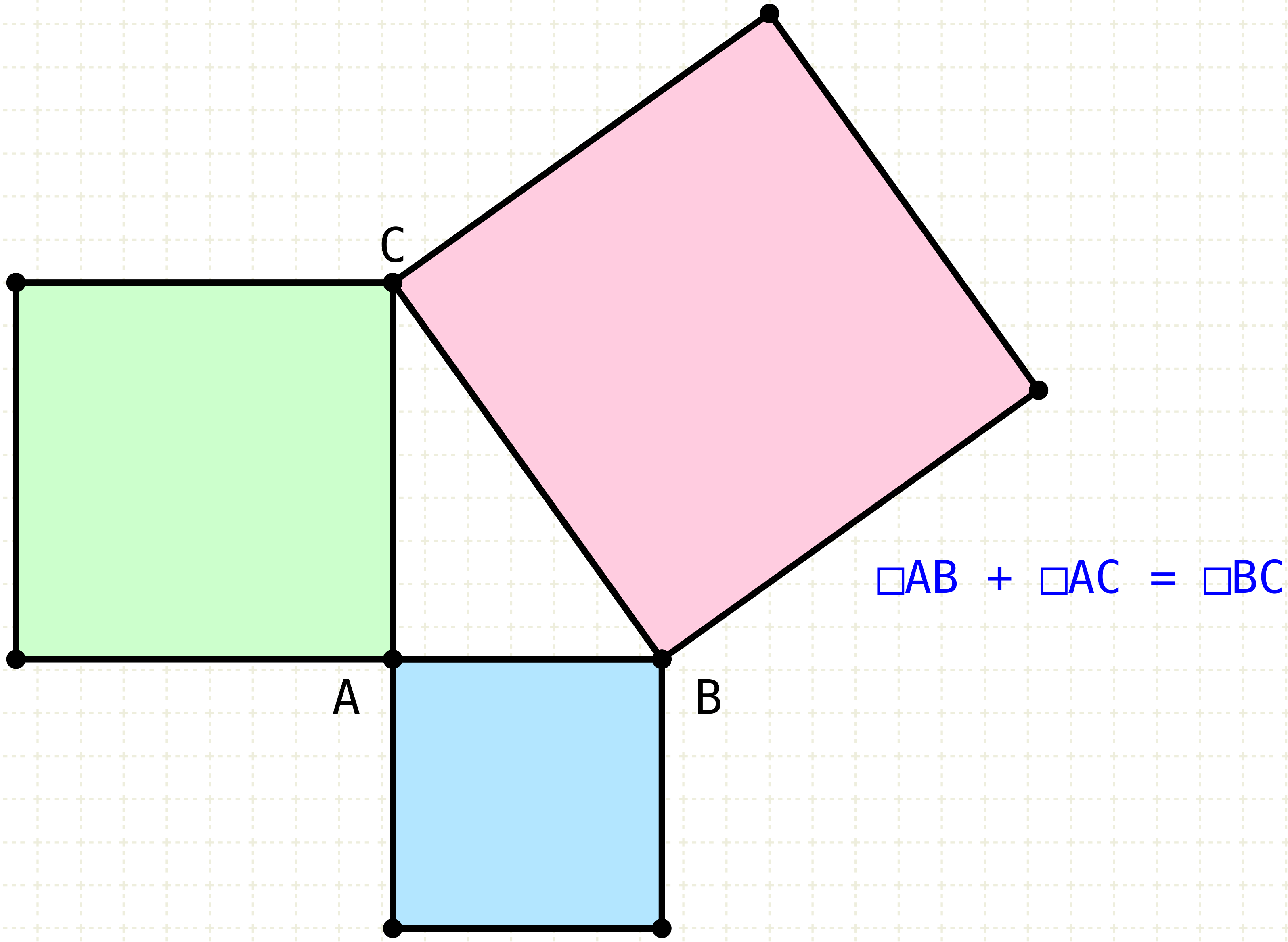

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

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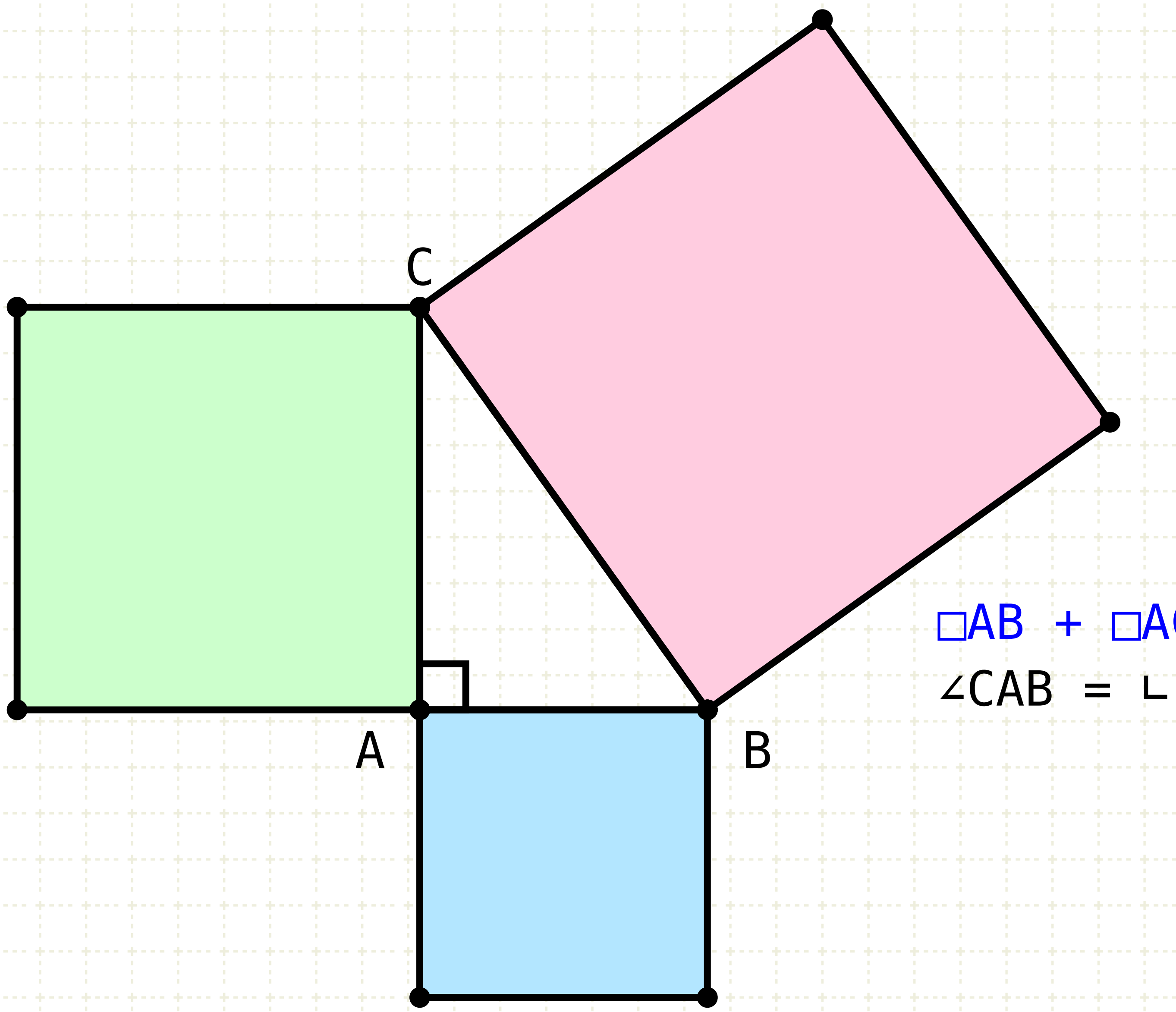

□AB + □AC = □BC

∠CAB = ∟

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

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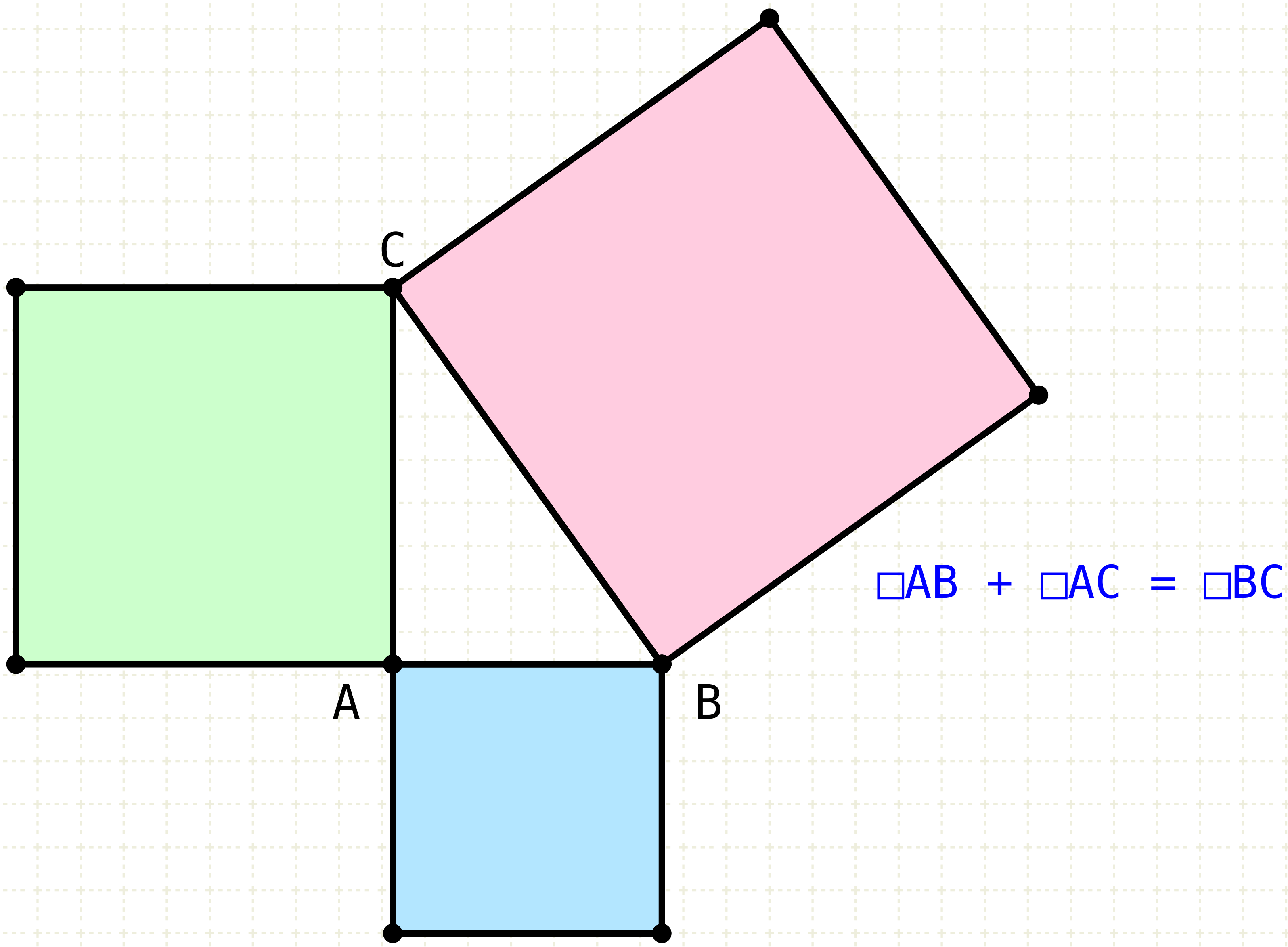

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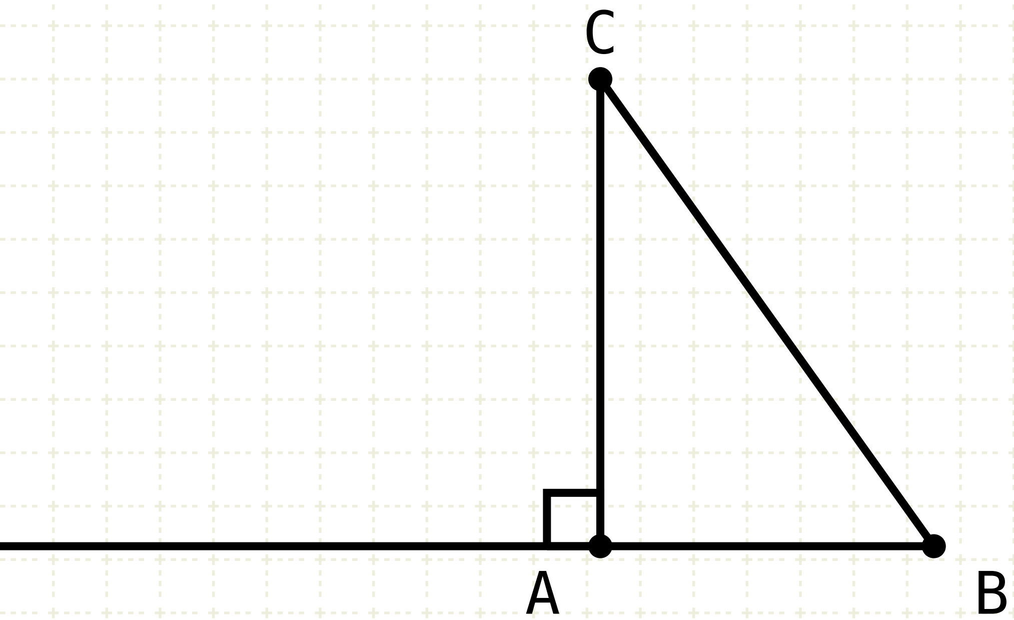

□AB + □AC = □BC

AC ⌙ AD

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

Proof:

Draw a line perpendicular to AC, from point A

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If in a triangle the square on one of the sides equals the sum of the squares on the remaining two sides of the triangle, then the angle contained by the remaining two sides of the triangle is right.

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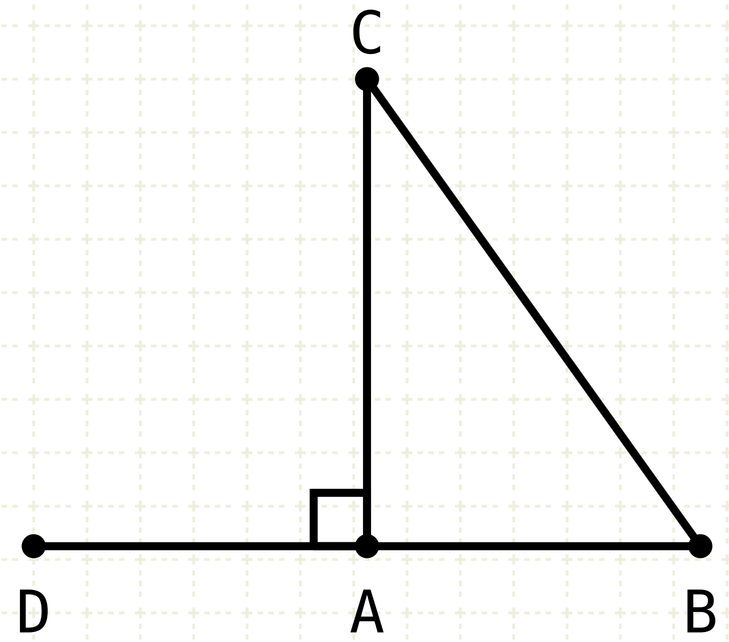
Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

Proof:

Draw a line perpendicular to AC, from point A

Define a point D such that AD equals AB



□AB + □AC = □BC

AC ∟ AD

AD = AB

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If in a triangle the square on one of the sides equals the sum of the squares on the remaining two sides of the triangle, then the angle contained by the remaining two sides of the triangle is right.

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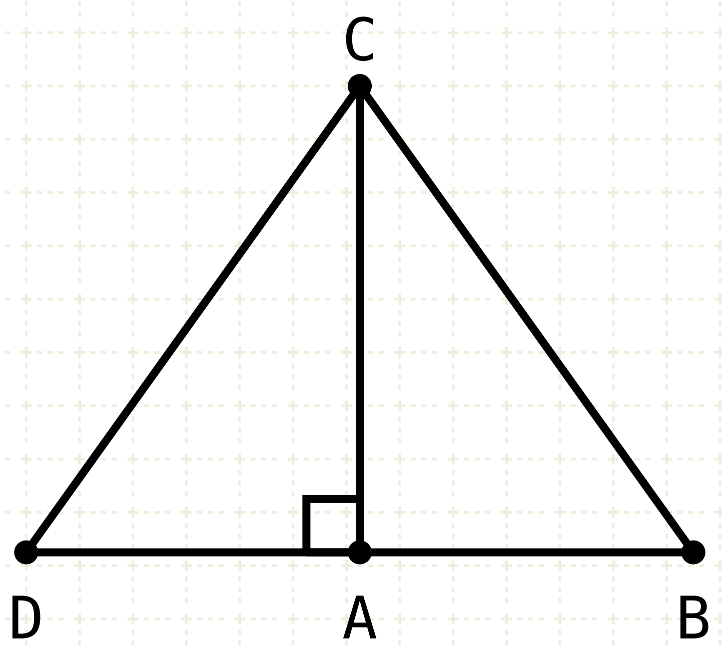

□AB + □AC = □BC

AC ∟ AD

AD = AB

Proof:

Draw a line perpendicular to AC, from point A

Define a point D such that AD equals AB

Draw line CD

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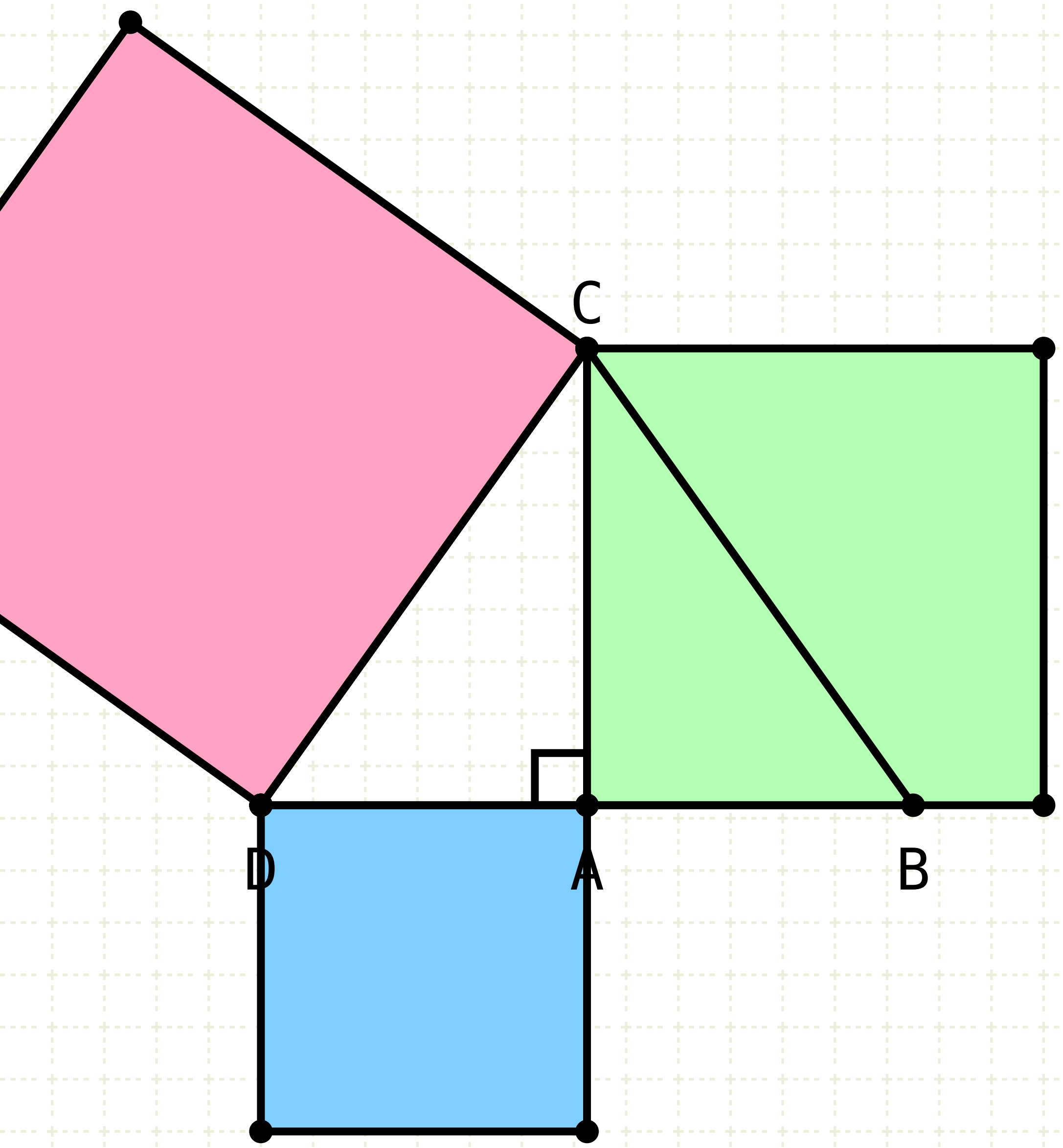

□AB + □AC = □BC

AC ∟ AD

AD = AB

□AD + □AC = □CD

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

Proof:

Draw a line perpendicular to AC, from point A

Define a point D such that AD equals AB

Draw line CD

Since the triangle CDA is a right angle triangle, the square of line CD equals the squares of AD and AC (I·47)

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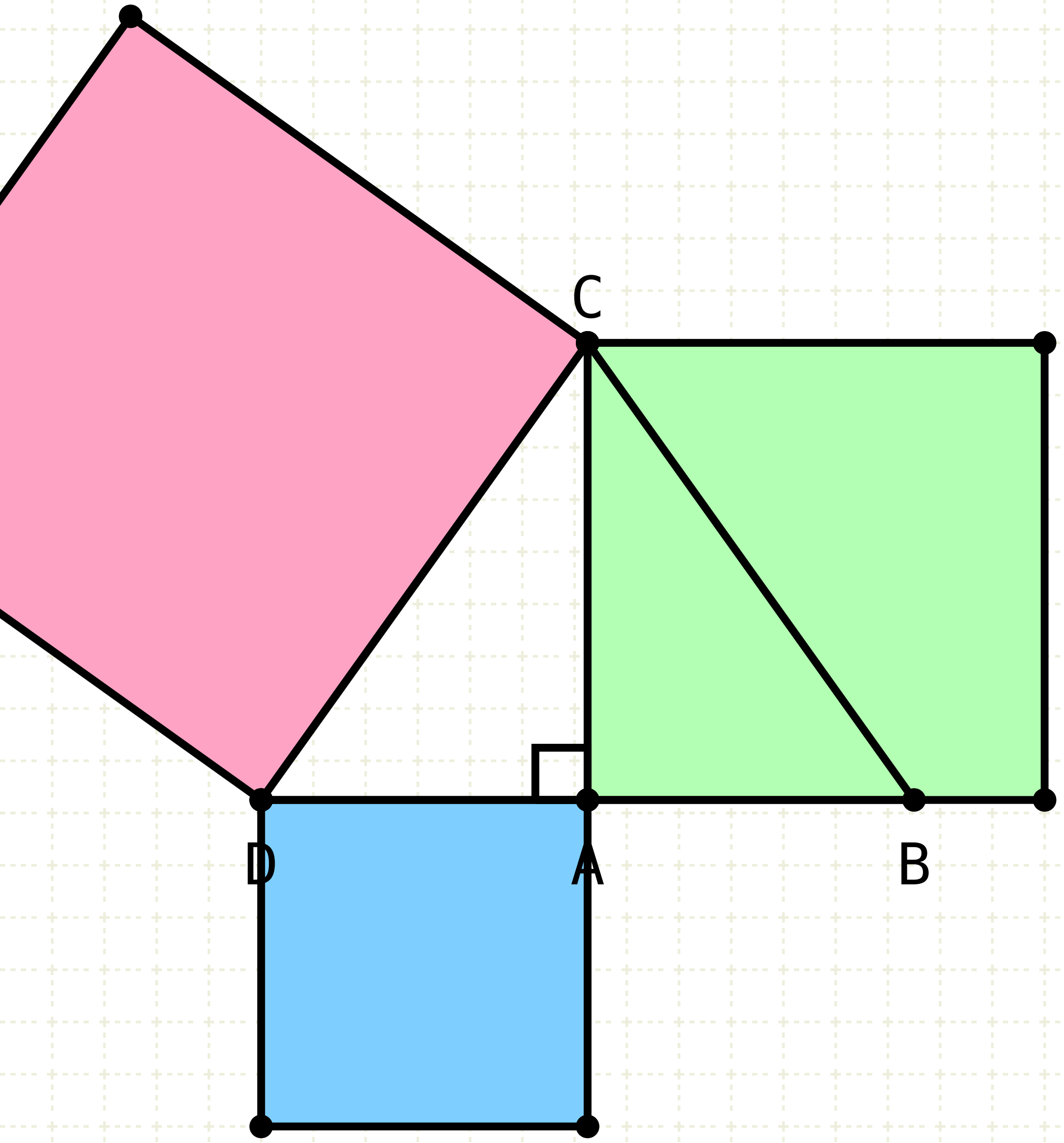

□AB + □AC = □BC

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□AD + □AC = □CD

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

Proof:

Draw a line perpendicular to AC, from point A

Define a point D such that AD equals AB

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Since the triangle CDA is a right angle triangle, the square of line CD equals the squares of AD and AC (I·47)

But since AD equals AB,

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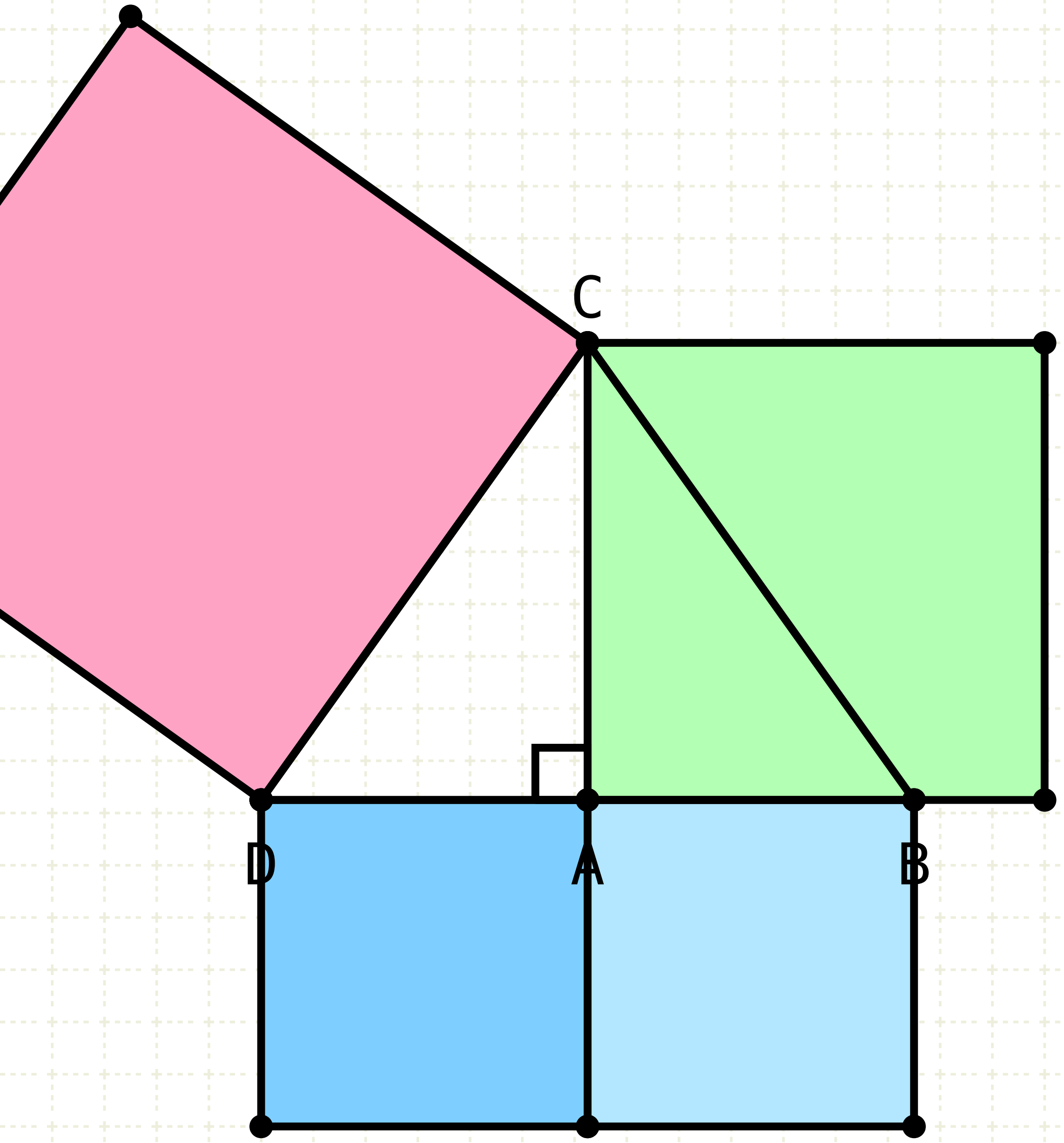

□AB + □AC = □BC

AC ⟂ AD

AD = AB

□AD + □AC = □CD

□AD = □AB

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

Then the angle CAB is a right angle

Proof:

Draw a line perpendicular to AC, from point A

Define a point D such that AD equals AB

Draw line CD

Since the triangle CDA is a right angle triangle, the square of line CD equals the squares of AD and AC (I·47)

But since AD equals AB,

Then the square on AD equals the square on AB

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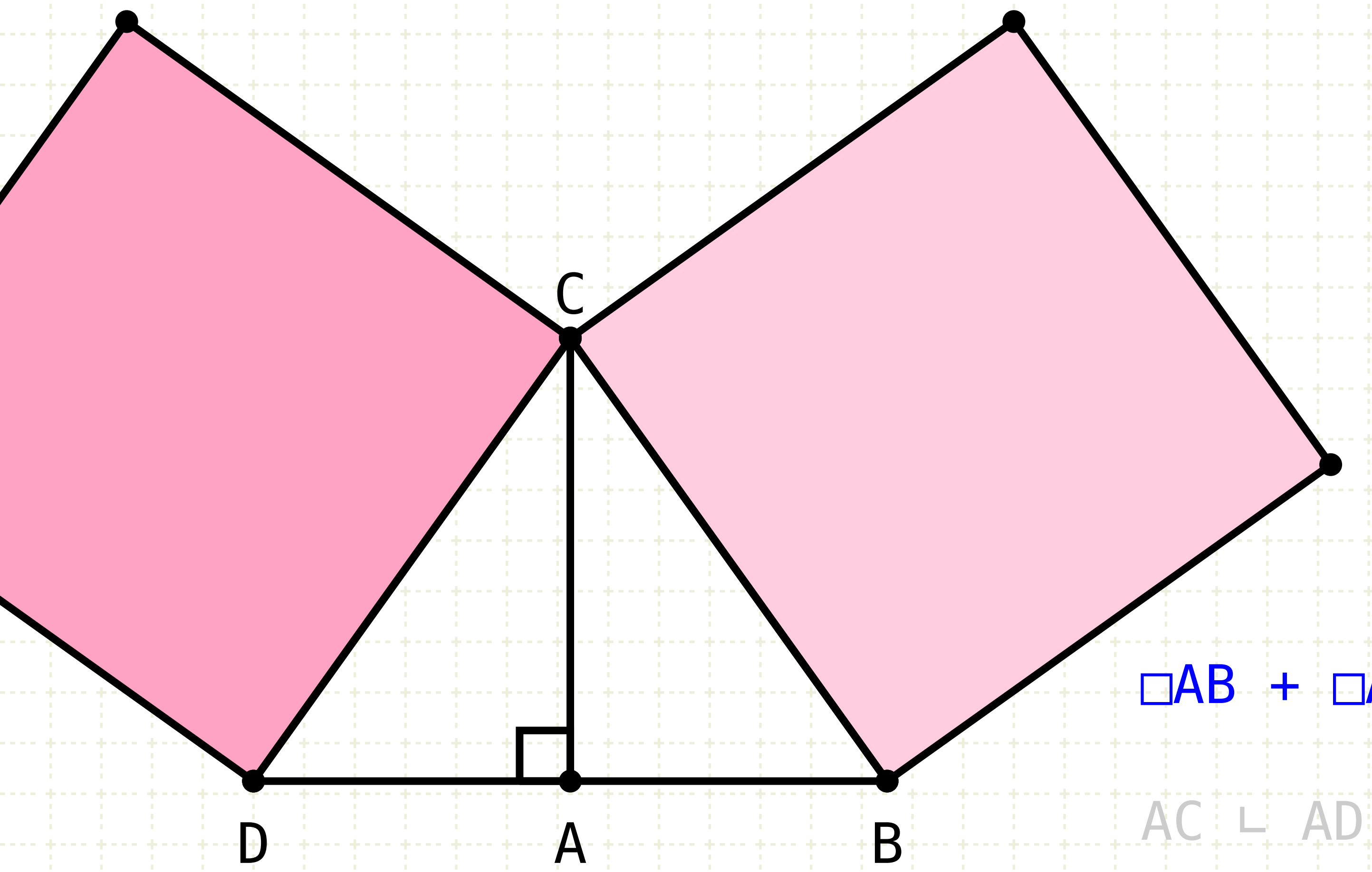

$\square AB + \square AC = \square BC$

$AC \perp AD$

$AD = AB$

$\square AD + \square AC = \square CD$

$\square AD = \square AB$

$\square CD = \square CB$

In other words

Given a triangle ABC, where the square of AB and AC equals the square of BC

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Draw a line perpendicular to AC, from point A

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Since the triangle CDA is a right angle triangle, the square of line CD equals the squares of AD and AC (I·47)

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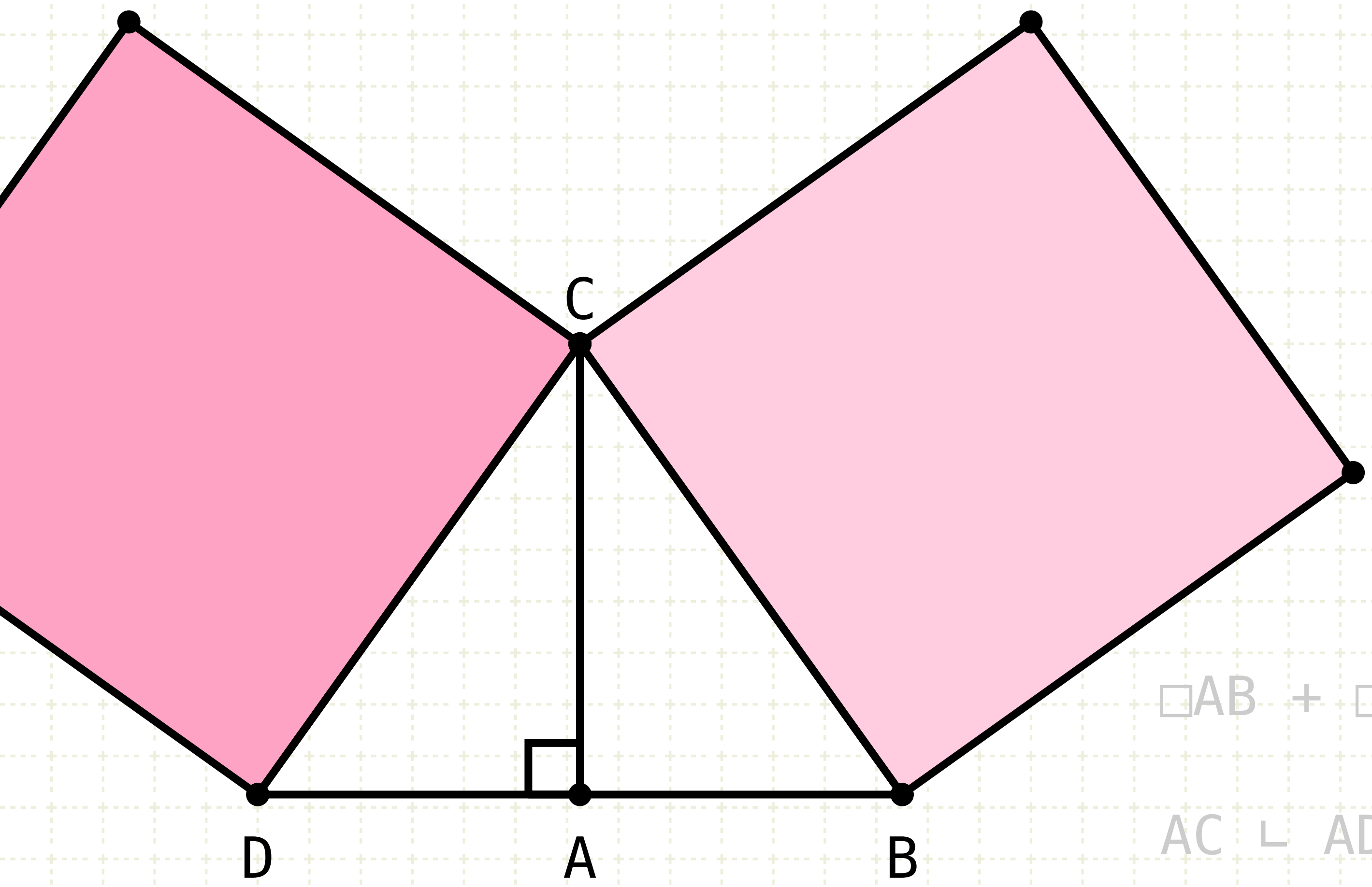

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□AD + □AC = □CD

□AD = □AB

□CD = □CB

CD = CB

In other words

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If the squares are equal, so are the lines

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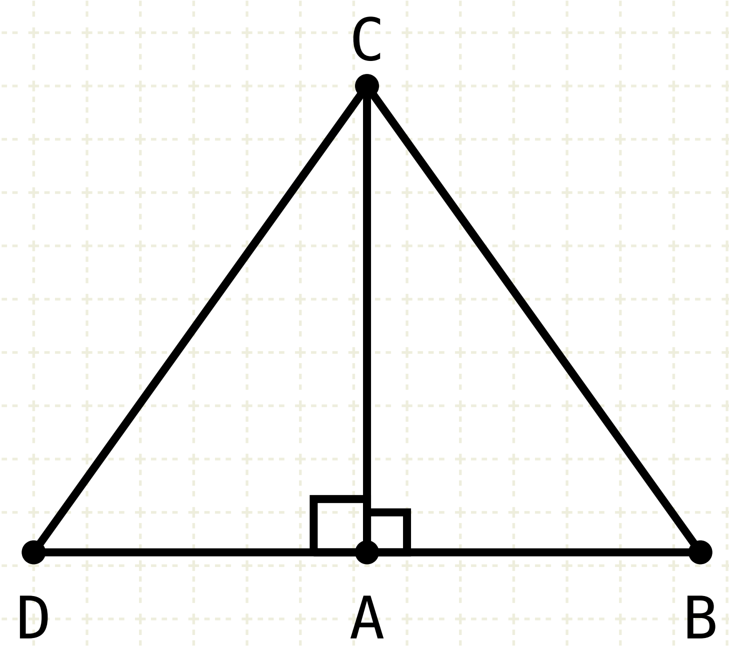

□AB + □AC = □BC

AC ⊾ AD

AD = AB

□AD + □AC = □CD

□AD = □AB

□CD = □CB

CD = CB

ΔCAD ≡ ΔCAB

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Given a triangle ABC, where the square of AB and AC equals the square of BC

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Triangle ABC and ADC have three equal sides

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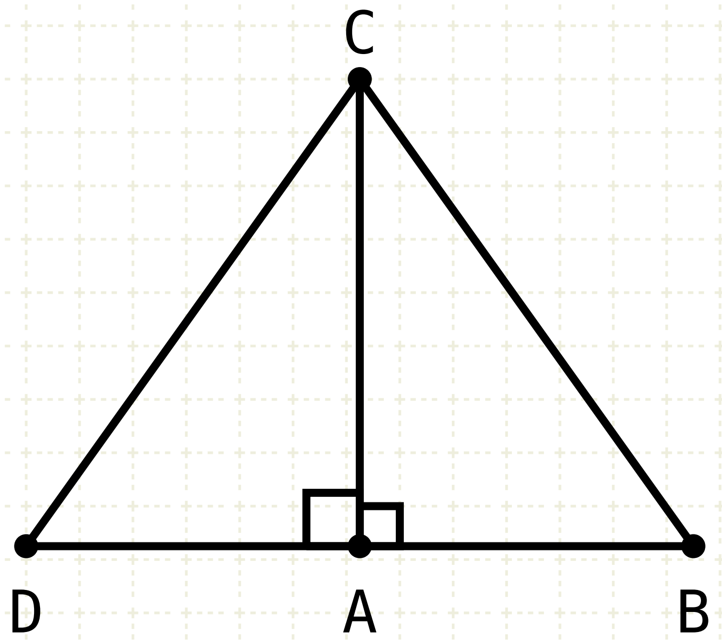

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Triangle ABC and ADC have three equal sides

Thus their angles are also equal (I·8)

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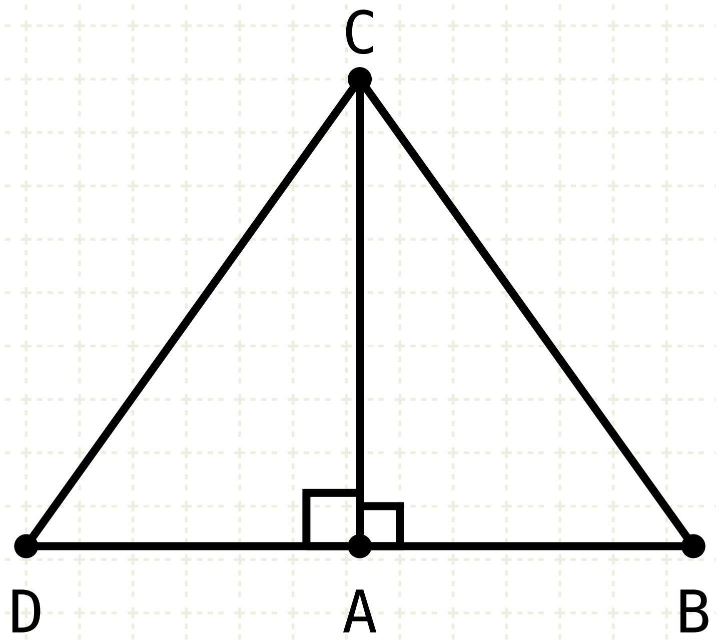

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