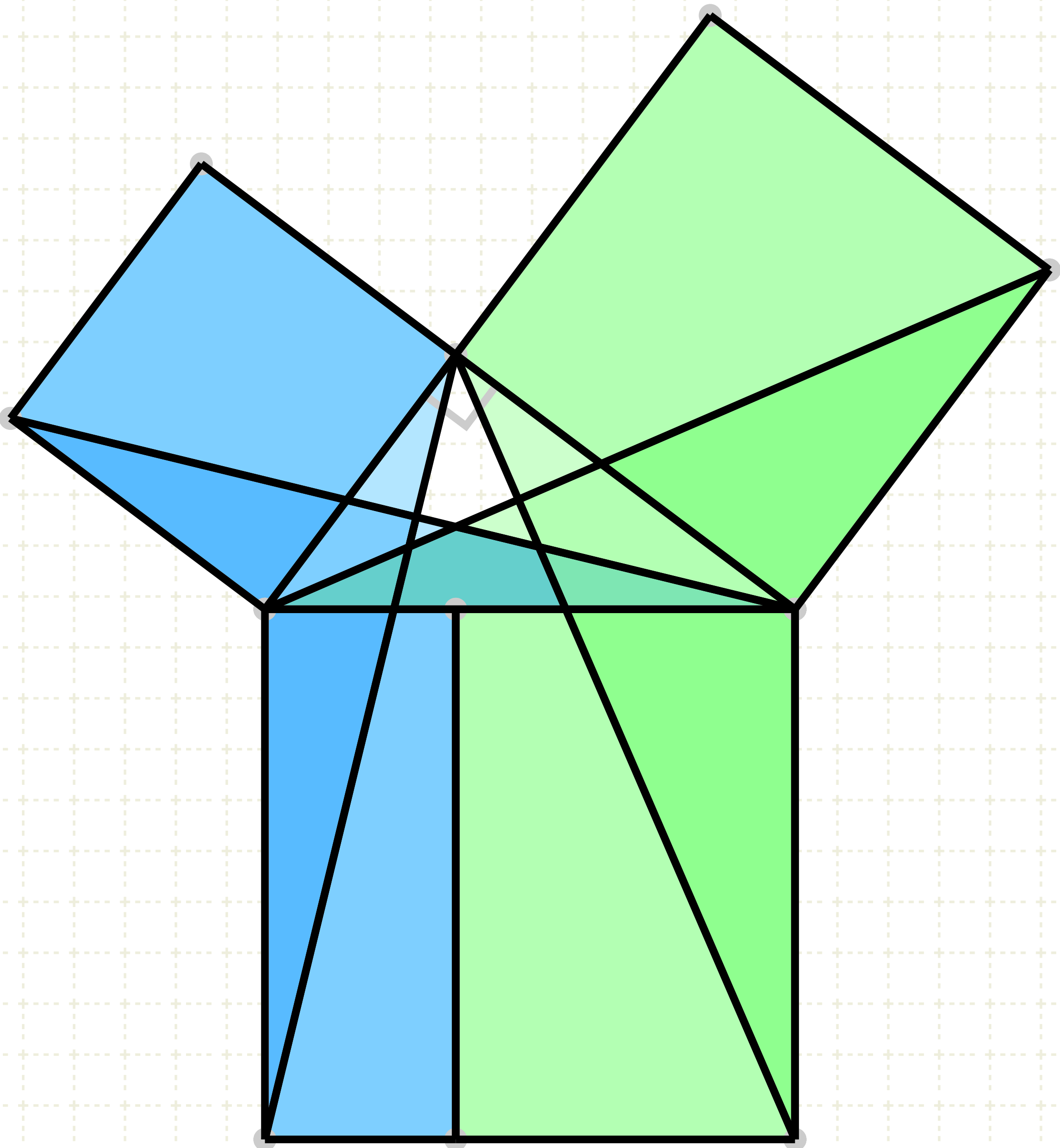

Euclid's Elements

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 20 of Book I

Any two sides of a triangle are together greater than the third side.

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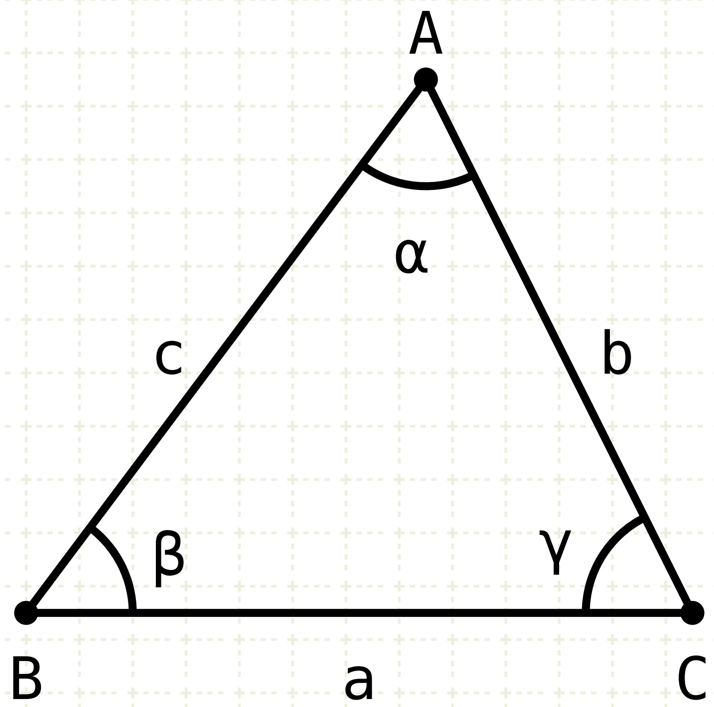
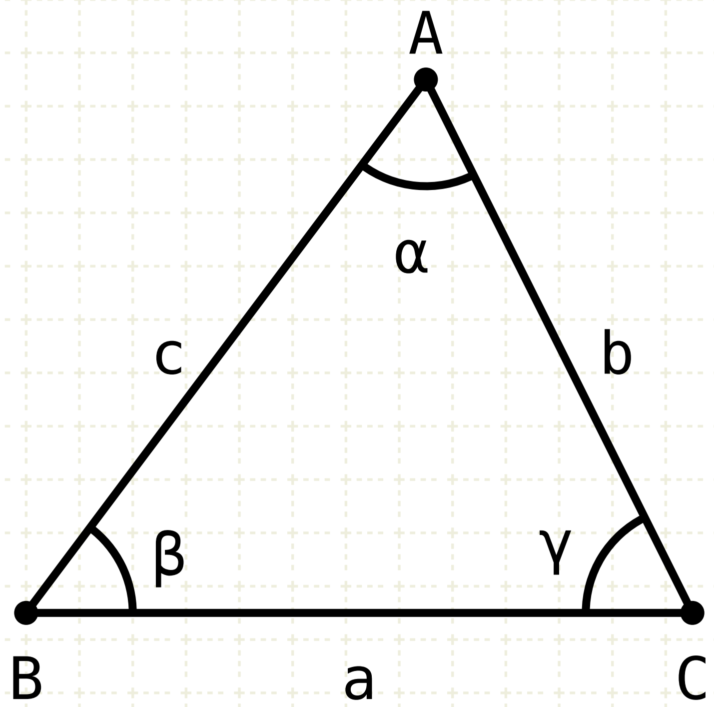


In other words

Given a triangle ABC

Proposition 20 of Book I

Any two sides of a triangle are together greater than the third side.



In other words

Given a triangle ABC

The sum of any two sides of the triangle is greater than the third

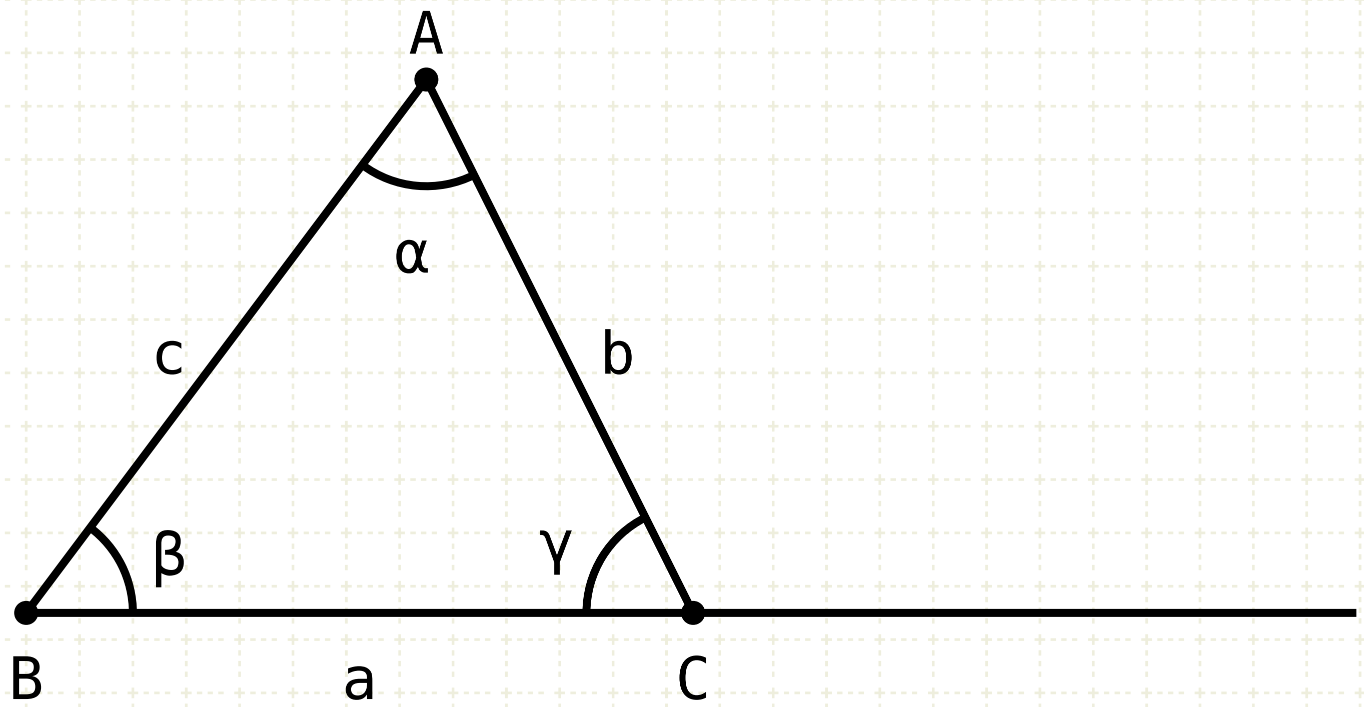
$AC + AB > BC \quad (b + c > a)$

$BC + AC > AB \quad (a + b > c)$

$AB + BC > AC \quad (c + a > b)$

Proposition 20 of Book I

Any two sides of a triangle are together greater than the third side.



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Proof

Extend BC

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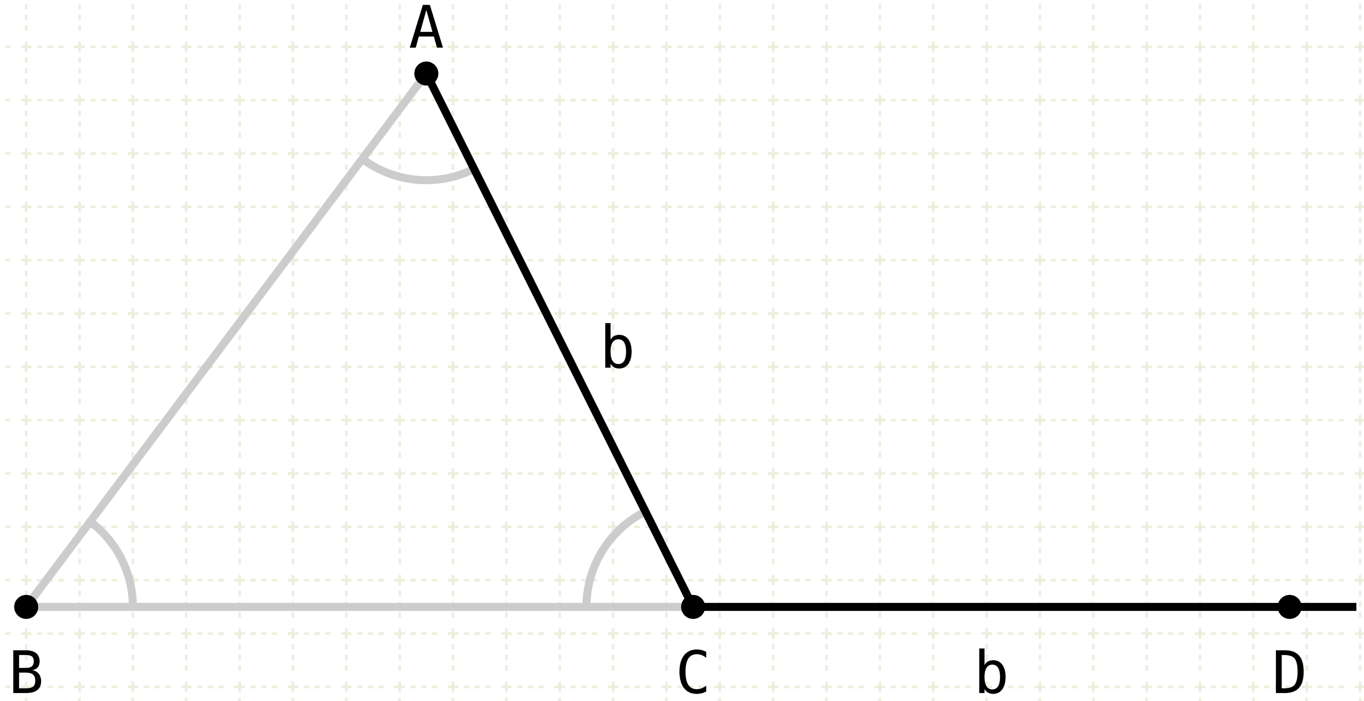


CD = AC

BD = BC + CD

BD = BC + AC

In other words

Given a triangle ABC

The sum of any two sides of the triangle is greater than the third

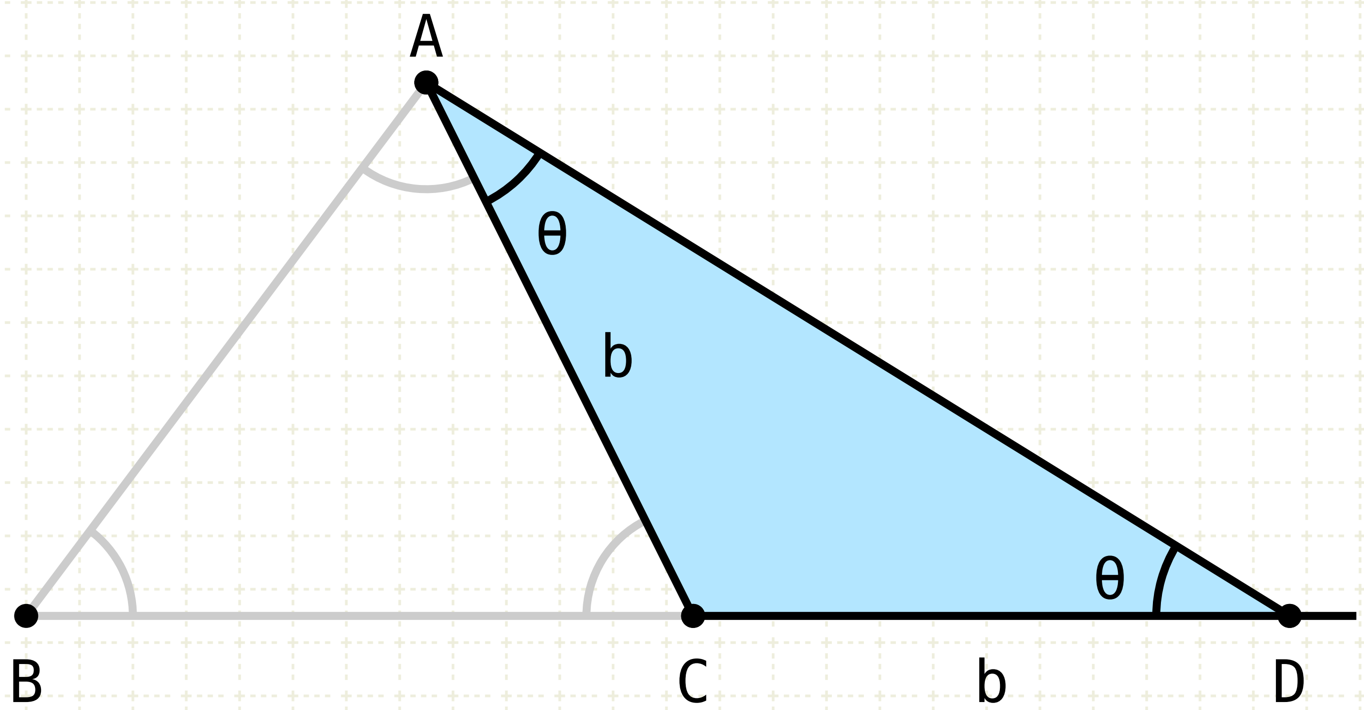
Proof

Extend BC

Define point D, such that CD equals AC

Proposition 20 of Book I

Any two sides of a triangle are together greater than the third side.



$CD = AC$
$BD = BC + CD$
$BD = BC + AC$

$\angle CAD = \angle CDA = \theta$

In other words

Given a triangle ABC

The sum of any two sides of the triangle is greater than the third

Proof

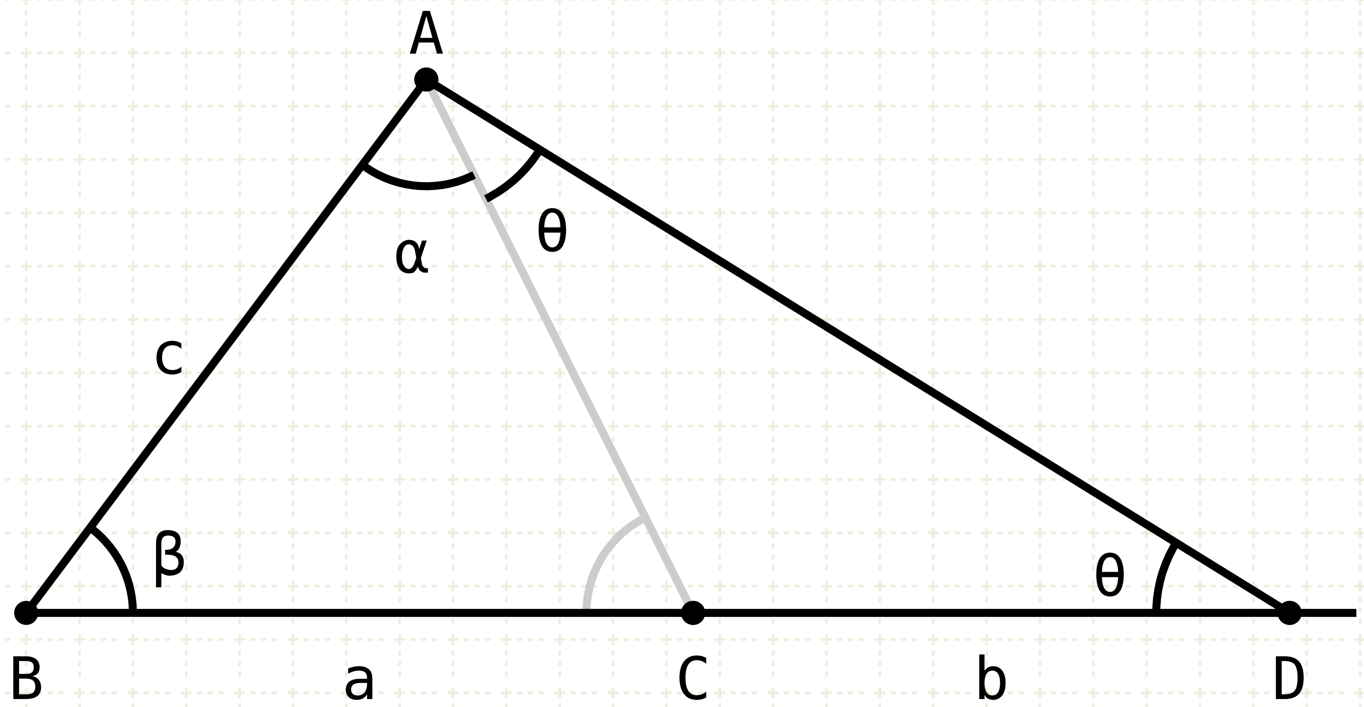
Extend BC

Define point D, such that CD equals AC

Create line AD, making the triangle ACD an isosceles triangle, thus the angles CAD and CDA are equal (I·5)

Proposition 20 of Book I

Any two sides of a triangle are together greater than the third side.



$$CD = AC$$
$$BD = BC + CD$$
$$BD = BC + AC$$

$$\angle CAD = \angle CDA = \theta$$

$$\alpha + \theta > \theta$$
$$\angle BAD > \angle BDA$$
$$\therefore BD > AB$$

In other words

Given a triangle ABC

The sum of any two sides of the triangle is greater than the third

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Extend BC

Define point D, such that CD equals AC

Create line AD, making the triangle ACD an isosceles triangle, thus the angles CAD and CDA are equal (I·5)

Consider triangle ABD

Angle BAD is obviously larger than angle BDA, thus length BD is larger than AB (I·18)

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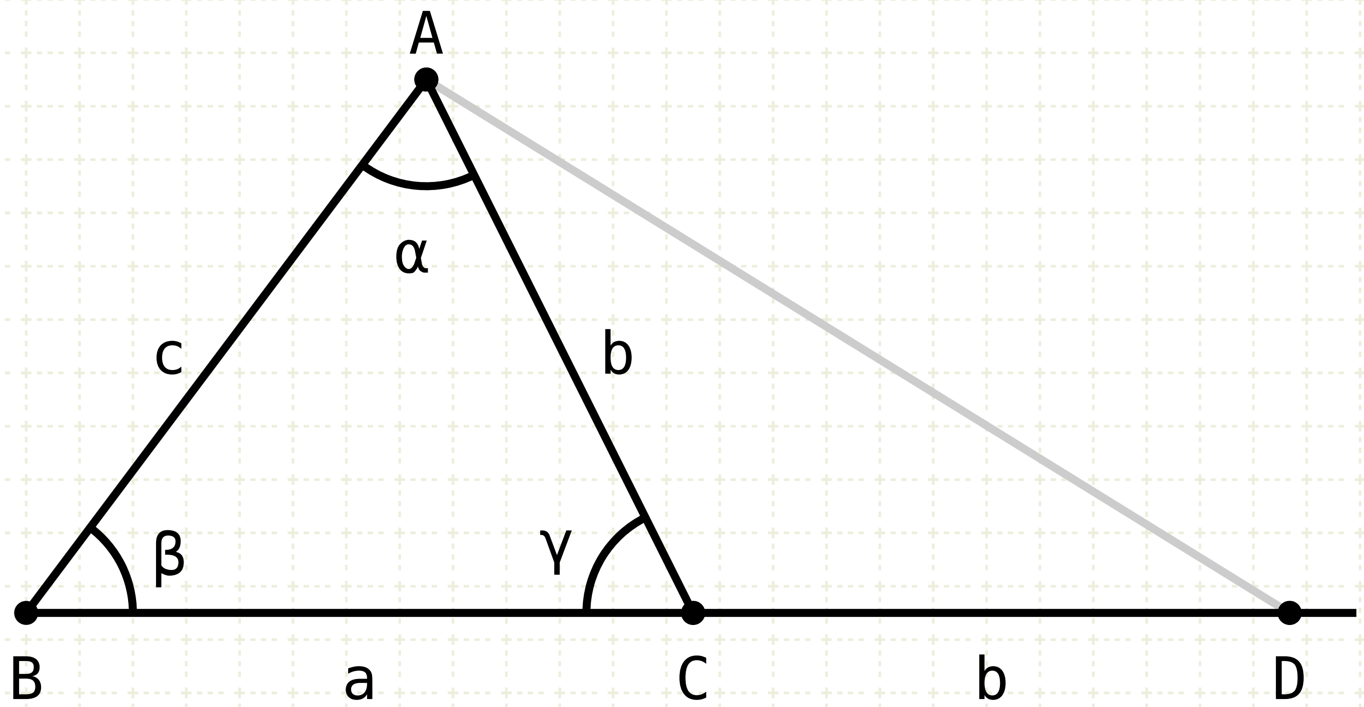

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But BD is the sum of BC and AC

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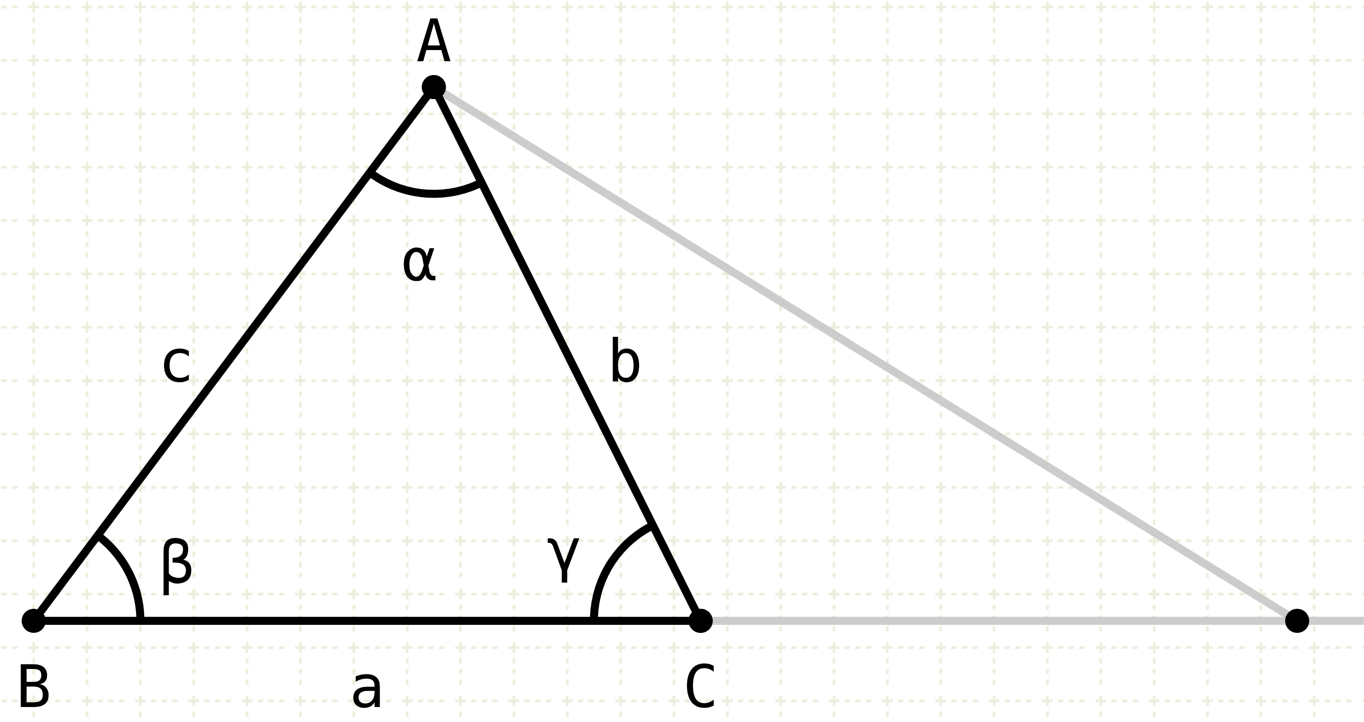

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But BD is the sum of BC and AC

Thus BD, one side of a triangle, is less than the sum of the other two sides

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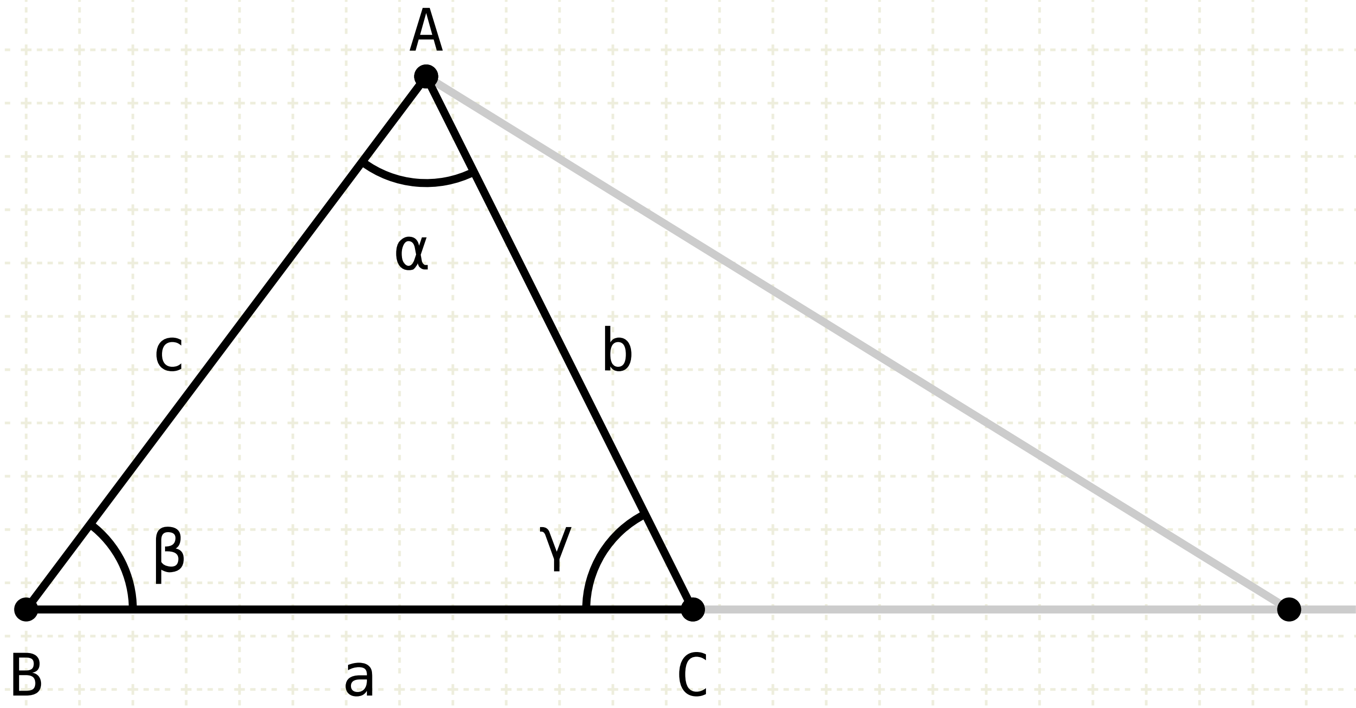

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Consider triangle ABD

Angle BAD is obviously larger than angle BDA, thus length BD is larger than AB (I·18)

But BD is the sum of BC and AC

Thus BD, one side of a triangle, is less than the sum of the other two sides

This procedure can be used on any side of the triangle, hence the sum of two sides is always greater than the third

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