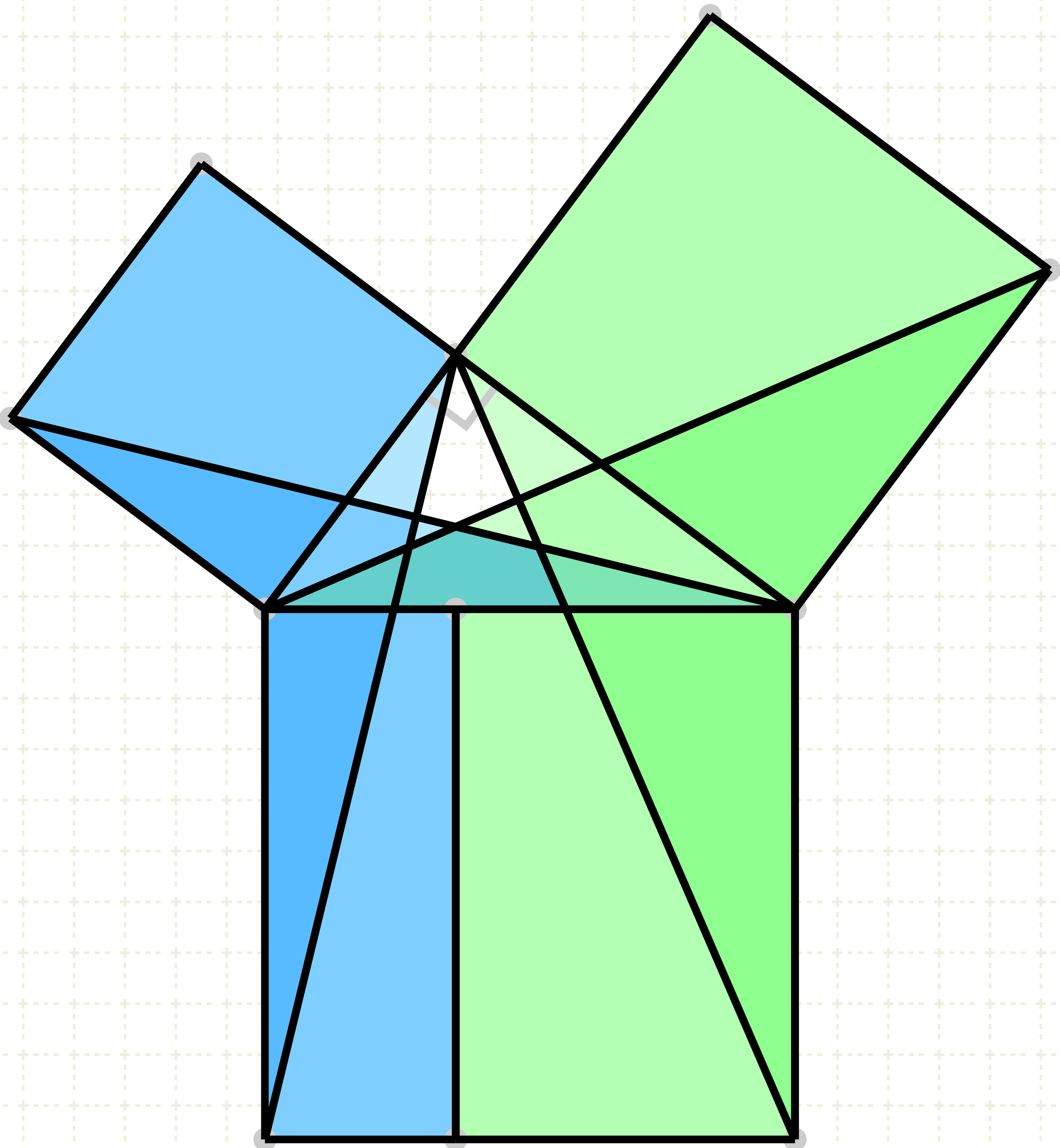
Euclid's Elements

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 19 of Book I

A greater angle of a triangle is opposite a greater side.

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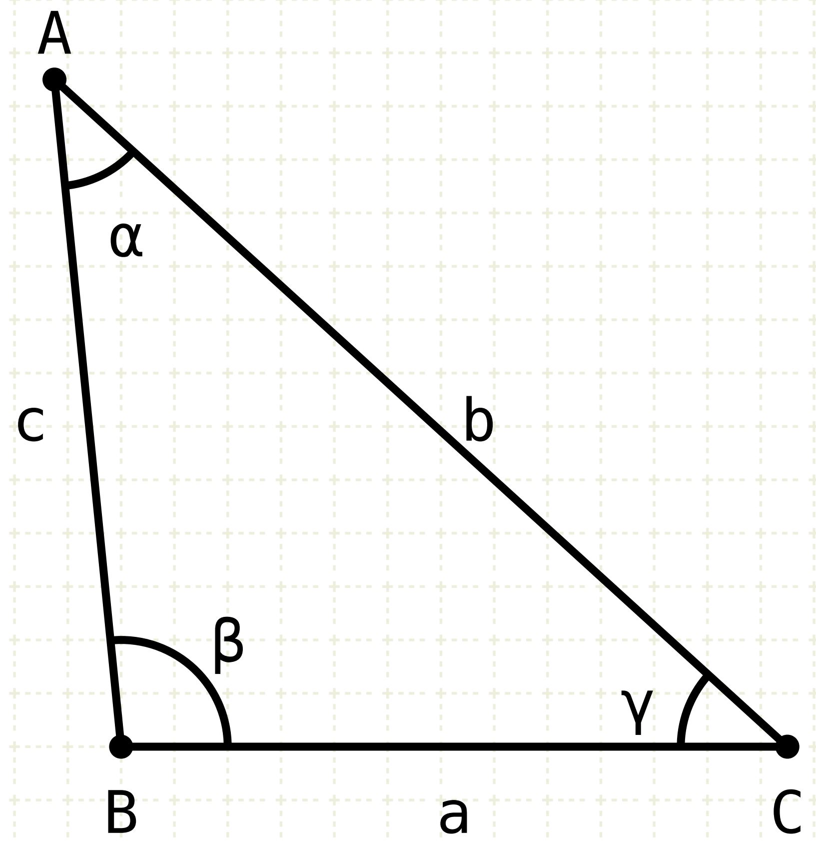


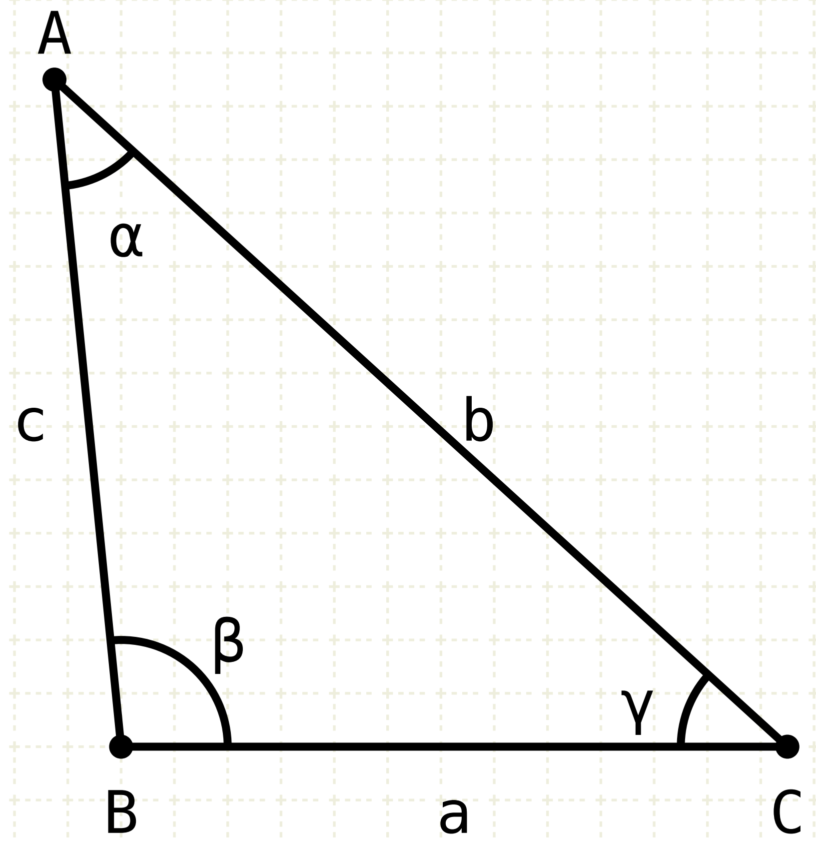
In other words

Given a triangle ABC

$\beta > \alpha \qquad \beta > \gamma$

Proposition 19 of Book I

A greater angle of a triangle is opposite a greater side.



In other words

Given a triangle ABC

If angle ABC is greater than angle BCA and CAB, then the side AC is greater than the other two sides of the triangle

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$b > a$ $\quad$ $b > c$

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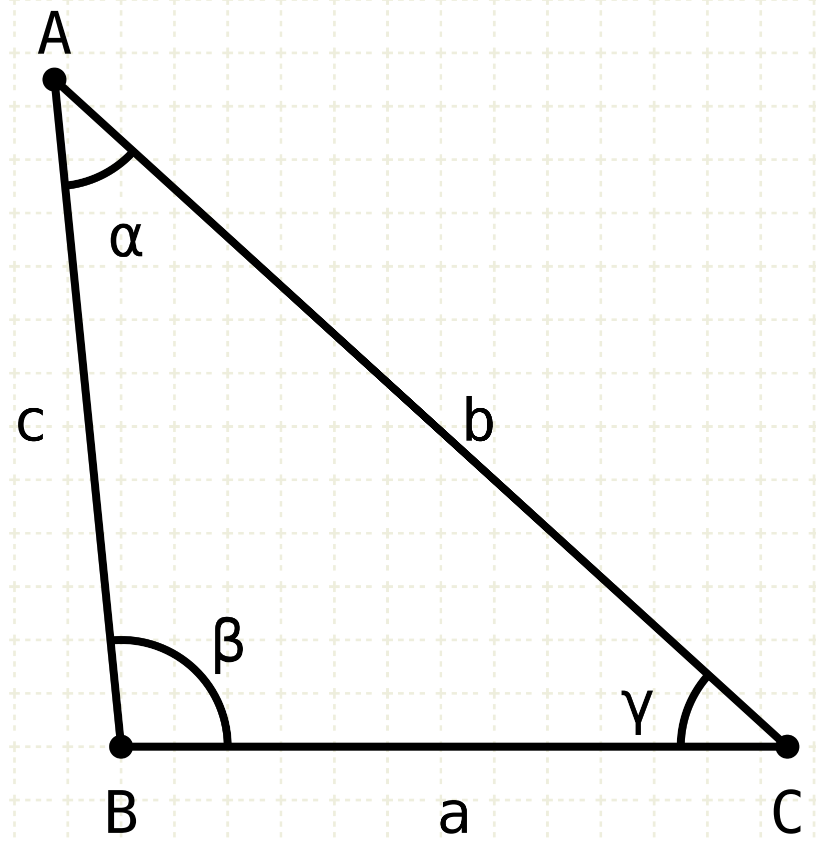

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Proof by contradiction

If AC is not greater than AB, then it must be less than or equal to AB

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$AC \leq AB$

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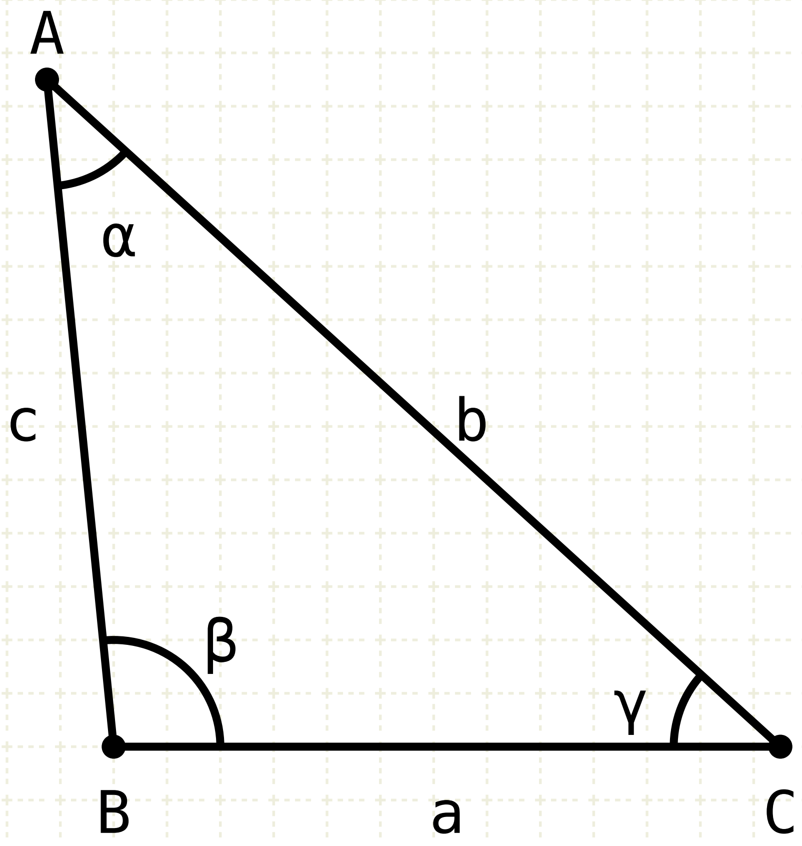

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If line AC equals AB, then the triangle would be an isosceles triangle, where angle ABC equals angle ACB (I·5)

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$AC \leq AB$

$AC = AB$

$\beta = \gamma$

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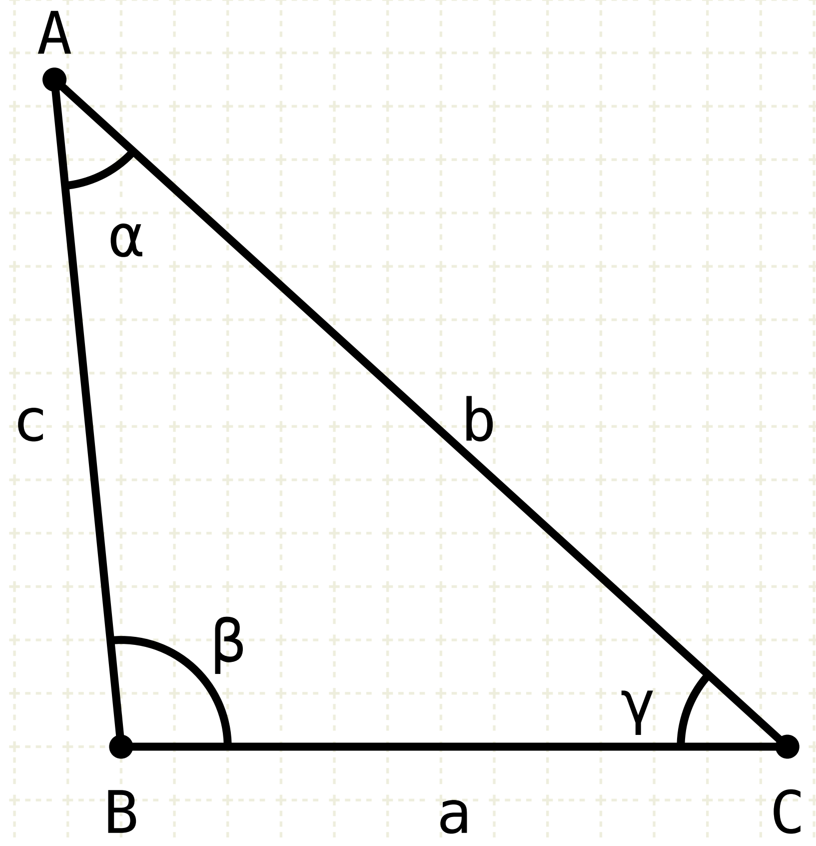

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But we have already stated that angle ABC is greater than angle BCA, so we have a contradiction

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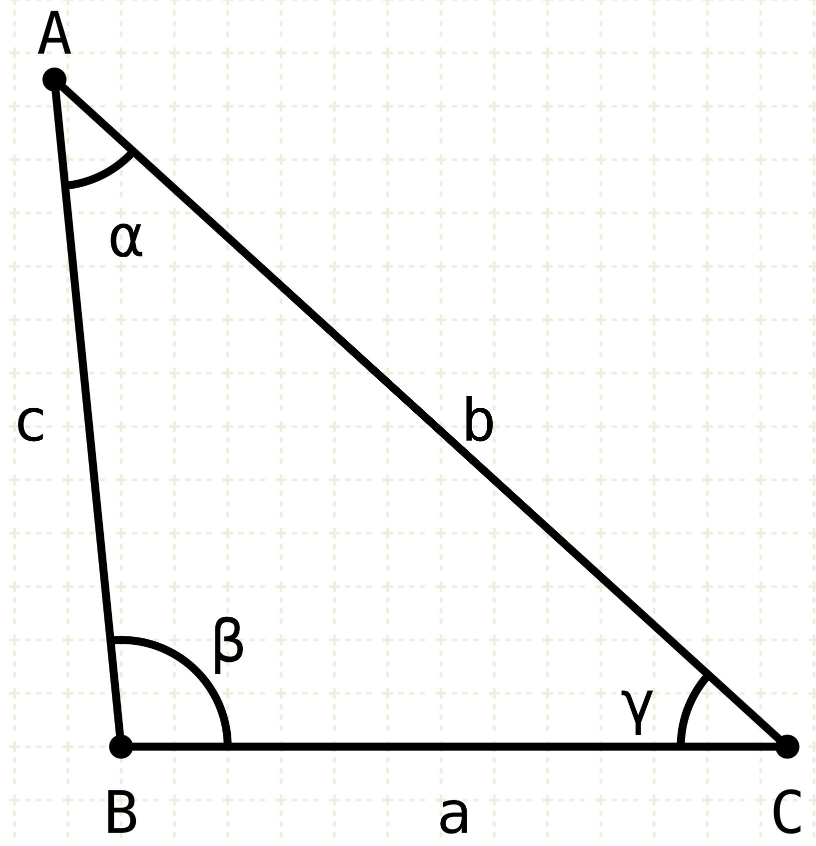

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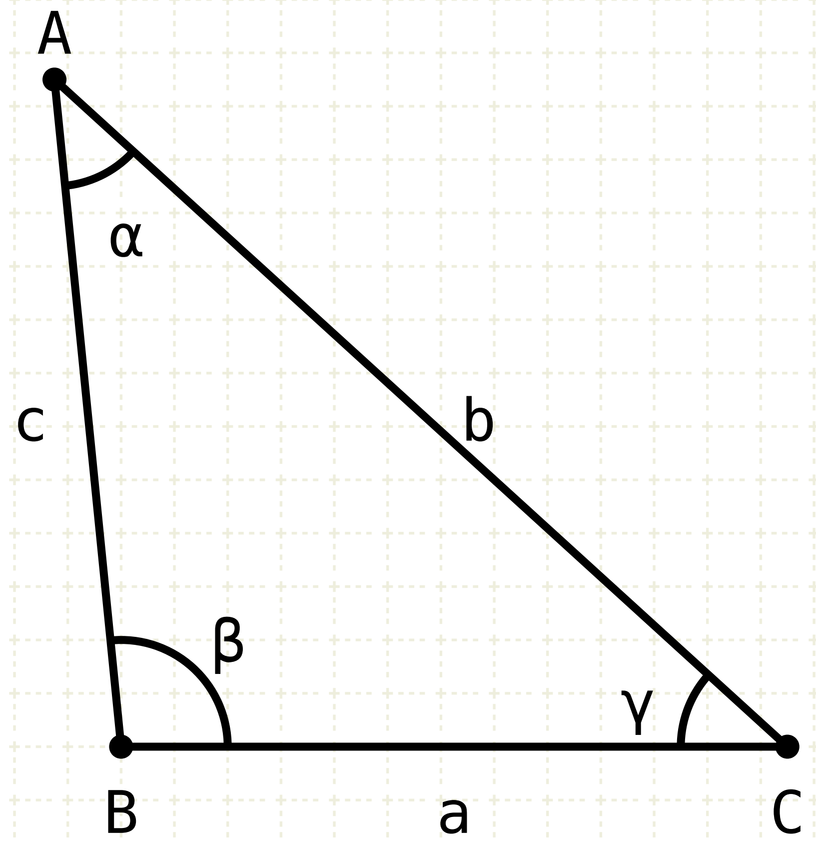

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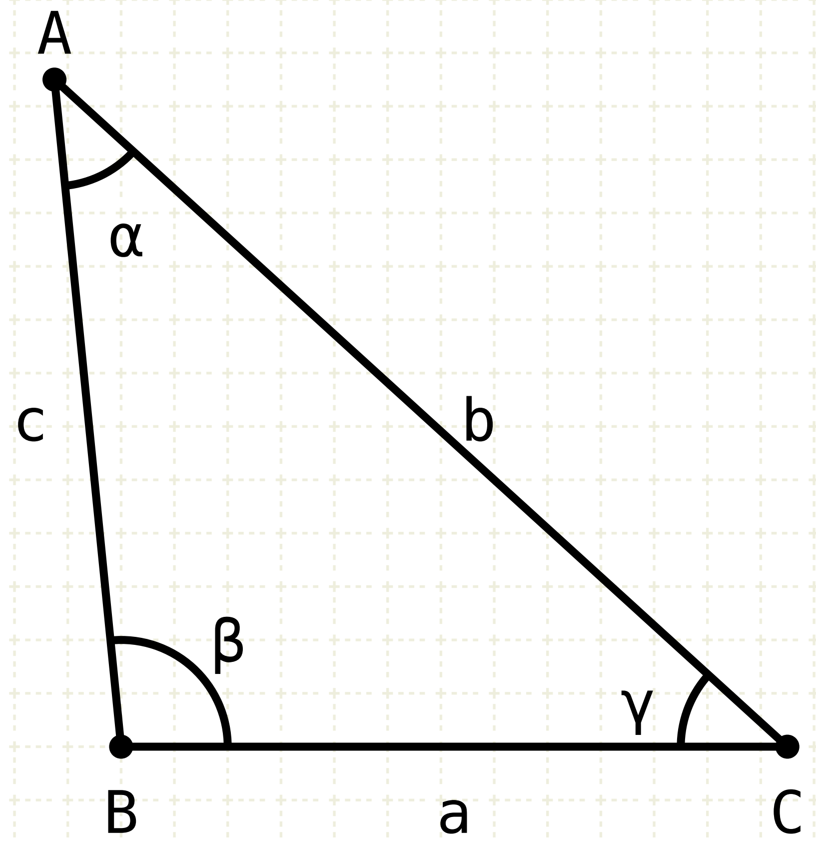

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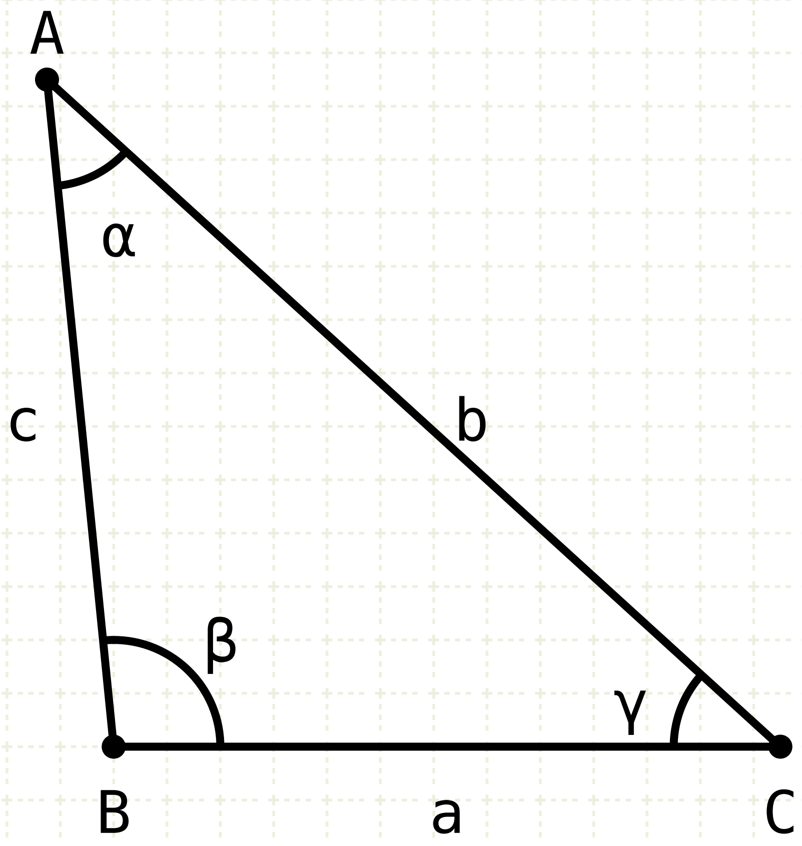

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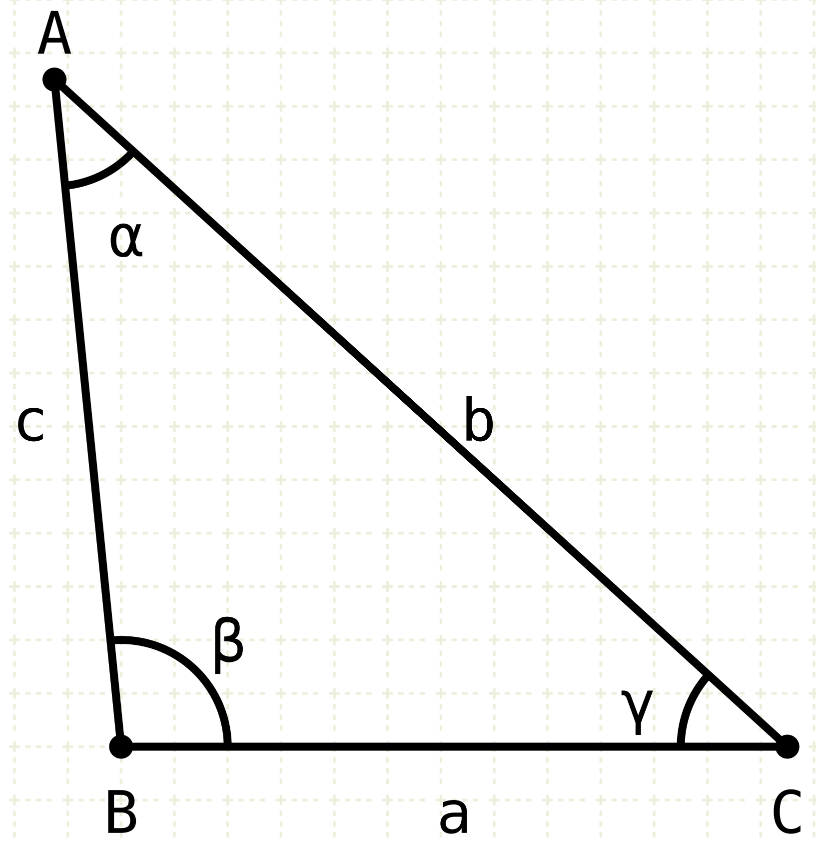

$\beta > \alpha \quad \beta > \gamma$

$AC \leq AB$

$AC = AB$

$\beta = \gamma$

$AC < AB$

$\beta < \gamma$

$\therefore AC > AB$

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Therefore, AC is greater than AB

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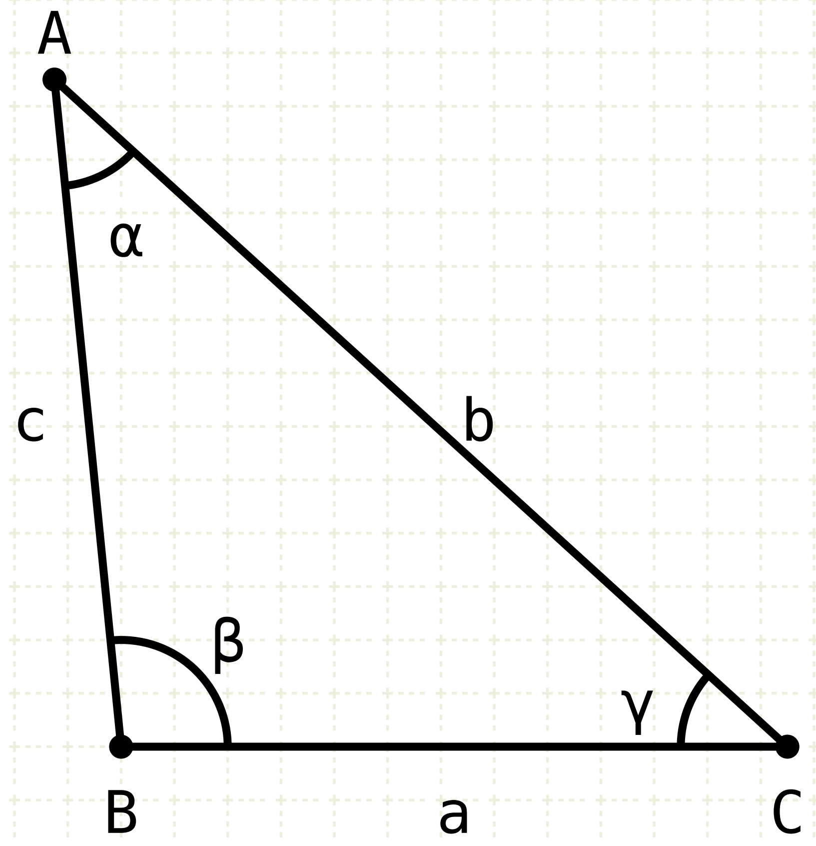

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