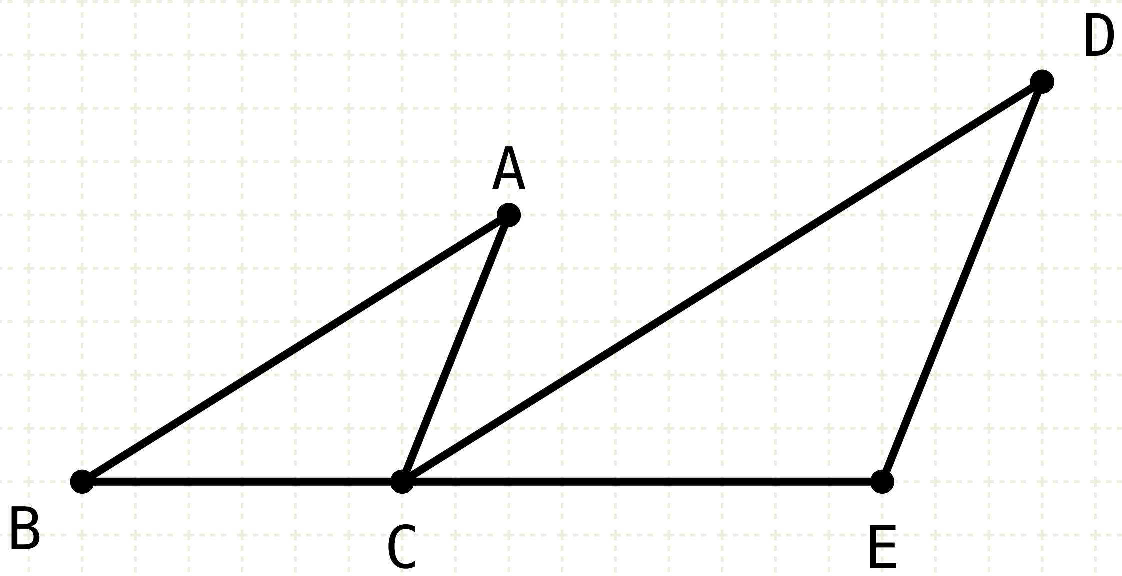
Proposition 32 of Book VI

If two triangles having two sides proportional to two sides be placed together at one angle so that their corresponding sides are also parallel, the remaining sides of the triangle will be in a straight line



In other words

Start with two triangles, where the ratio AB to AC equals the ratio CD to DE

and AB is parallel to DC and AC is parallel to DE

AB:AC = CD:DE

AB || DC

AC || DE

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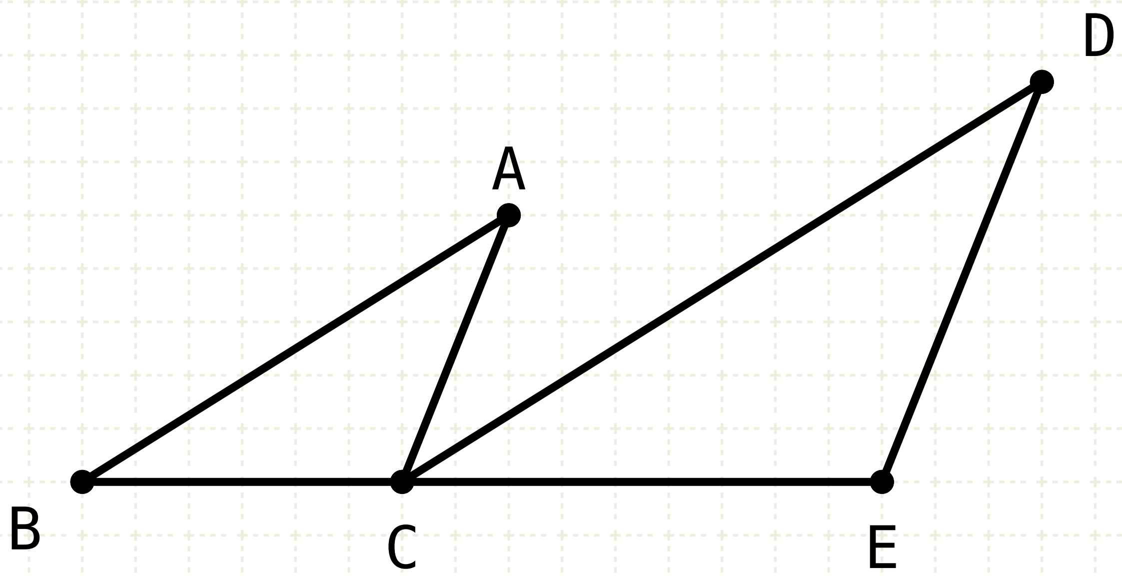

In other words

Start with two triangles, where the ratio AB to AC equals the ratio CD to DE

and AB is parallel to DC and AC is parallel to DE

The lines BC, CE form a straight line

$AB:AC = CD:DE$

$AB \parallel DC$

$AC \parallel DE$

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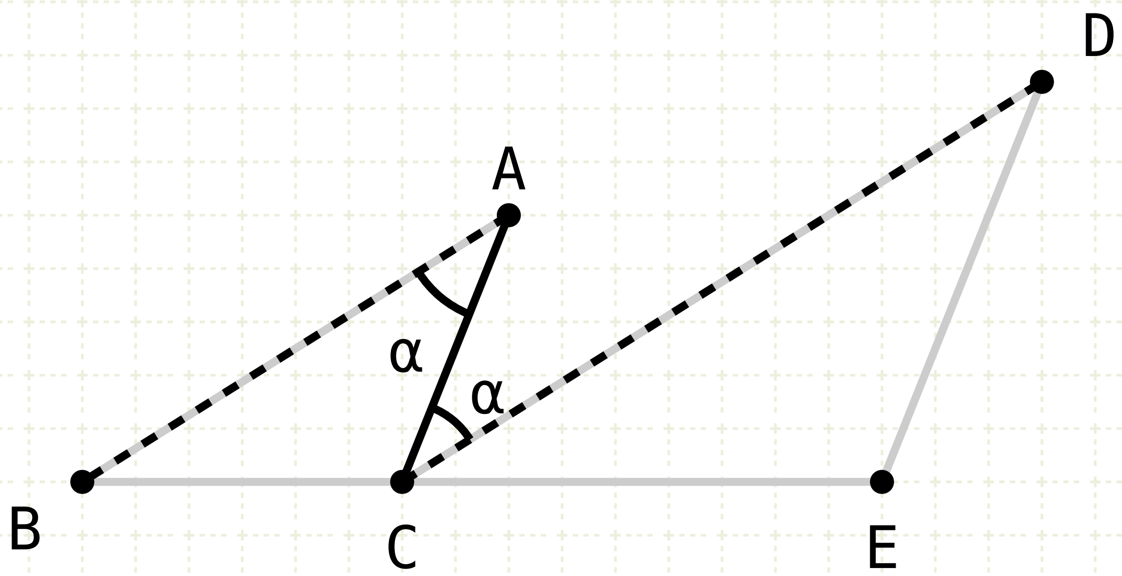

AB:AC = CD:DE
AB || DC
AC || DE

Proof

Since AB is parallel to DC, the alternate angles BAC, ACD are equal (I·29)

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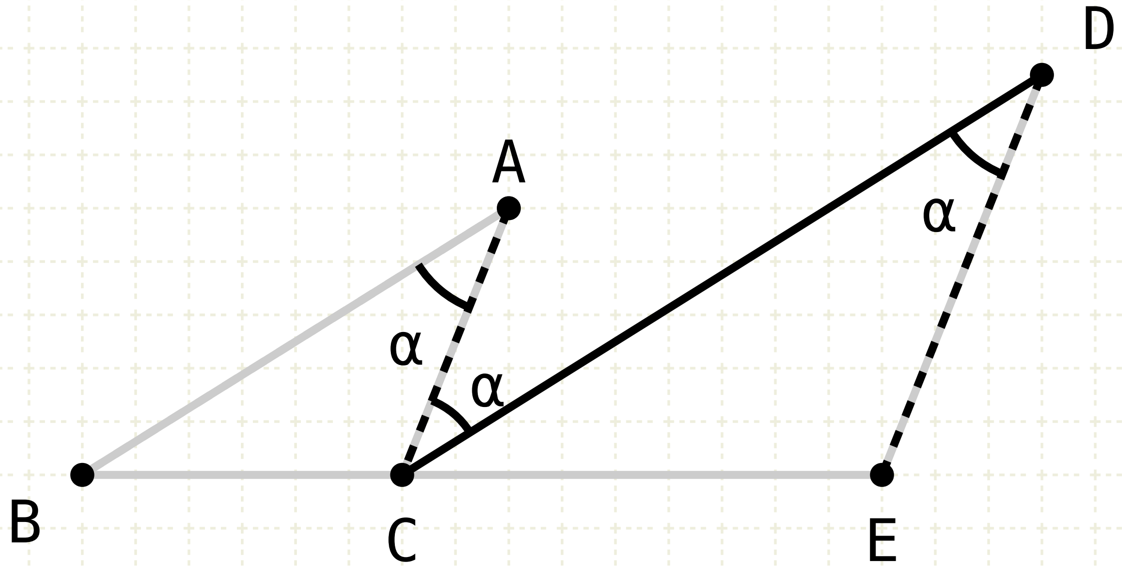

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Similarly, the angle CDE is equal to the angle ACD

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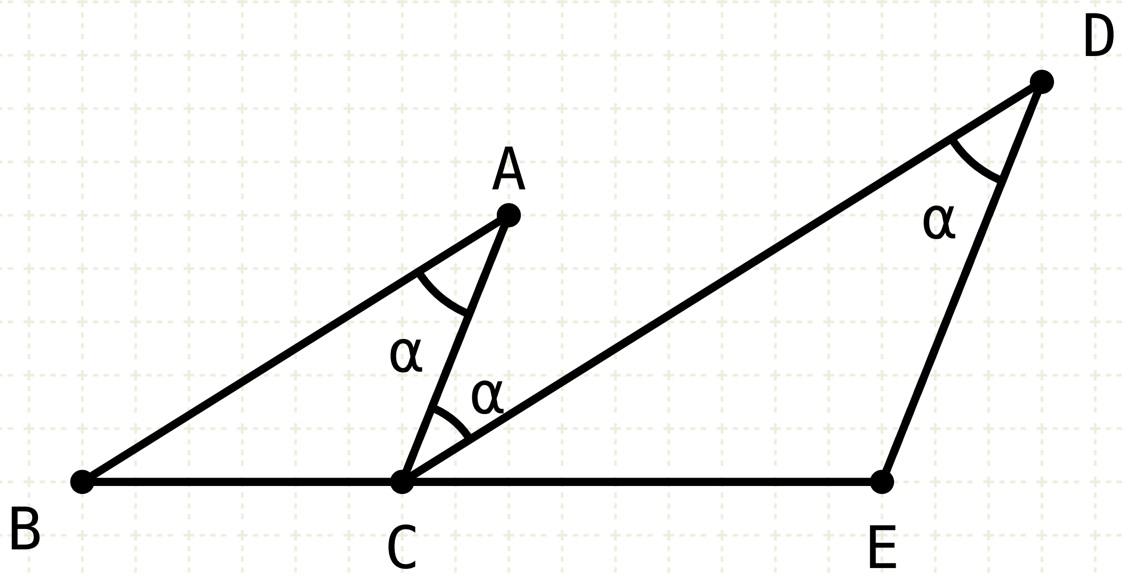

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Proof

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Similarly, the angle CDE is equal to the angle ACD

Since ABC, DCE have equal angles at A and D, and the sides about the equal angle are proportional, ABC is equiangular to DCE (VI·6)

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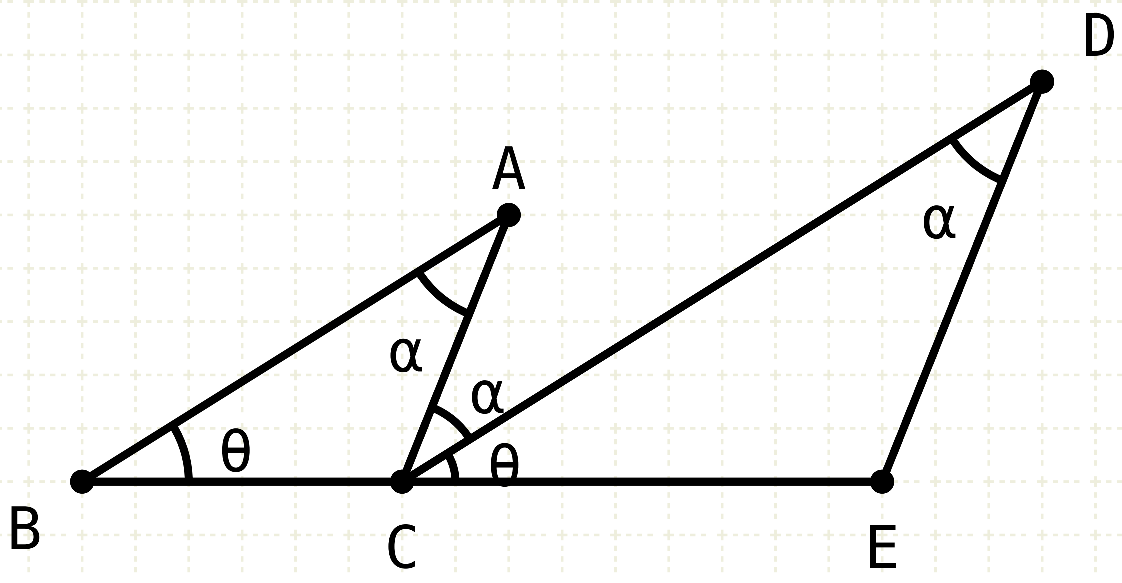

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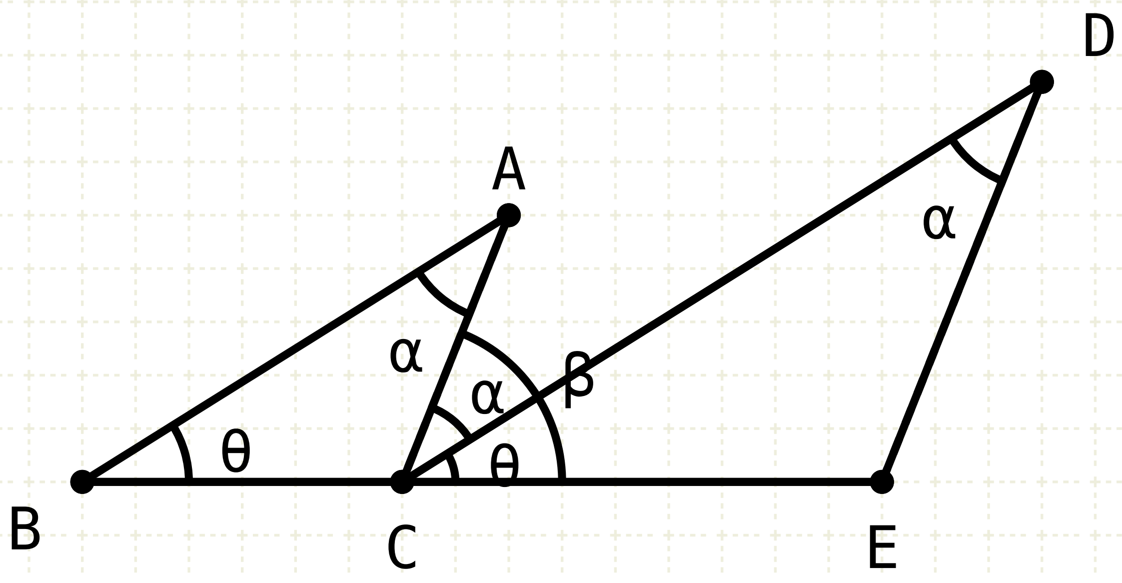

AB:AC = CD:DE

AB || DC

AC || DE

$\beta = \alpha + \theta$

Proof

Since AB is parallel to DC, the alternate angles BAC, ACD are equal (I·29)

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The angle ACE equals the sum of ABC and BAC

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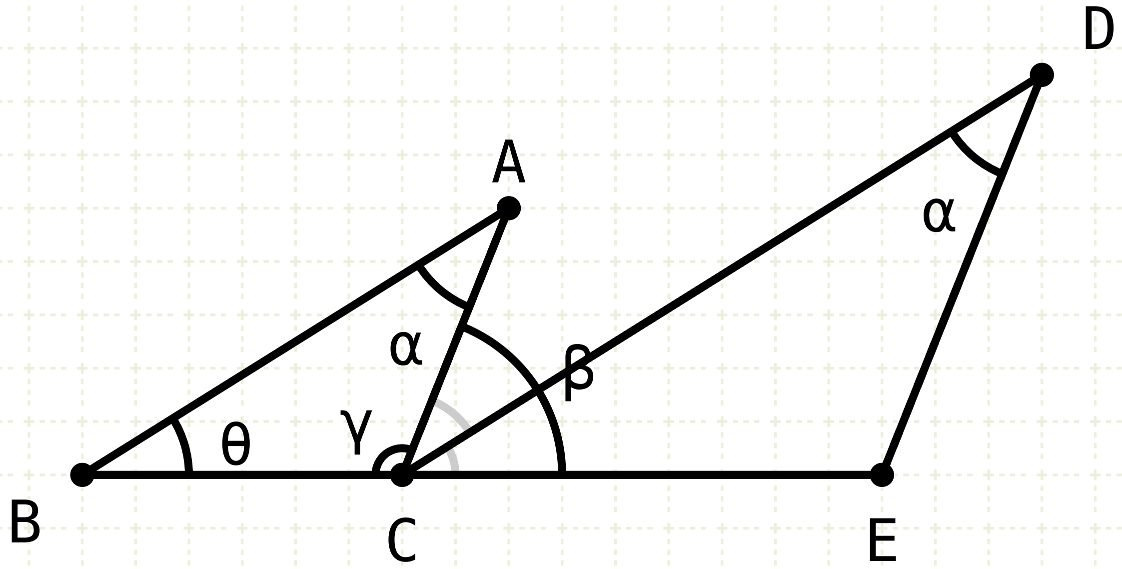

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$\gamma + \beta = \gamma + \alpha + \theta$

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The angle ACE equals the sum of ABC and BAC

Let the angle ACB be added to each;

Therefore the angles ACE, ACB equal BAC, ACB, CBA

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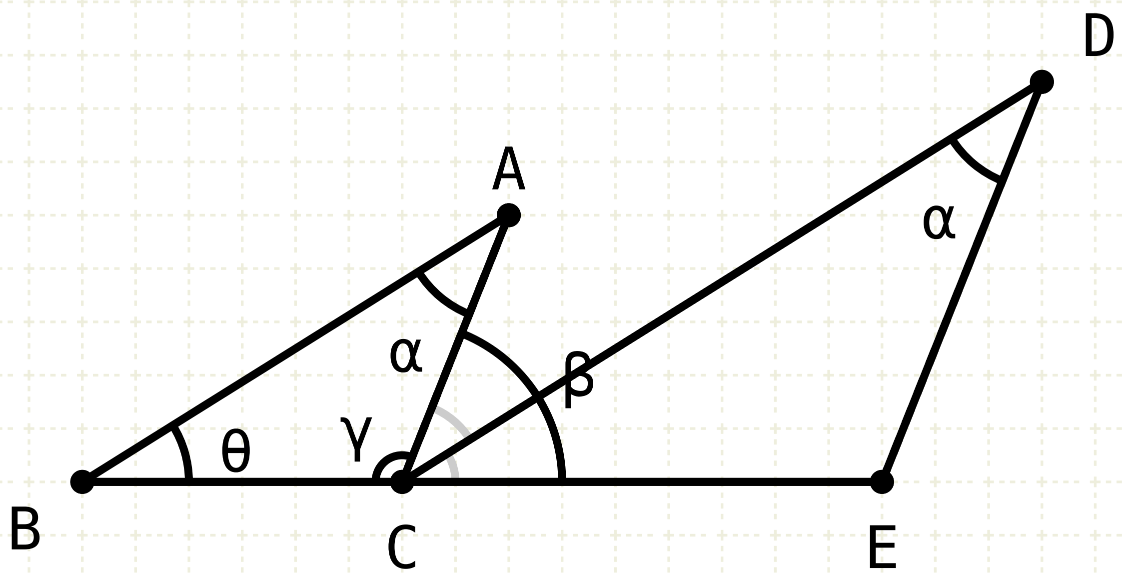

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$\gamma + \beta = \gamma + \alpha + \theta$

$\alpha + \theta + \gamma = 2∟$

$\therefore \gamma + \beta = 2∟$

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The angle ACE equals the sum of ABC and BAC

Let the angle ACB be added to each;

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But the sum of the angles BAC, ABC, ACB is equal to two right angles (I·32)

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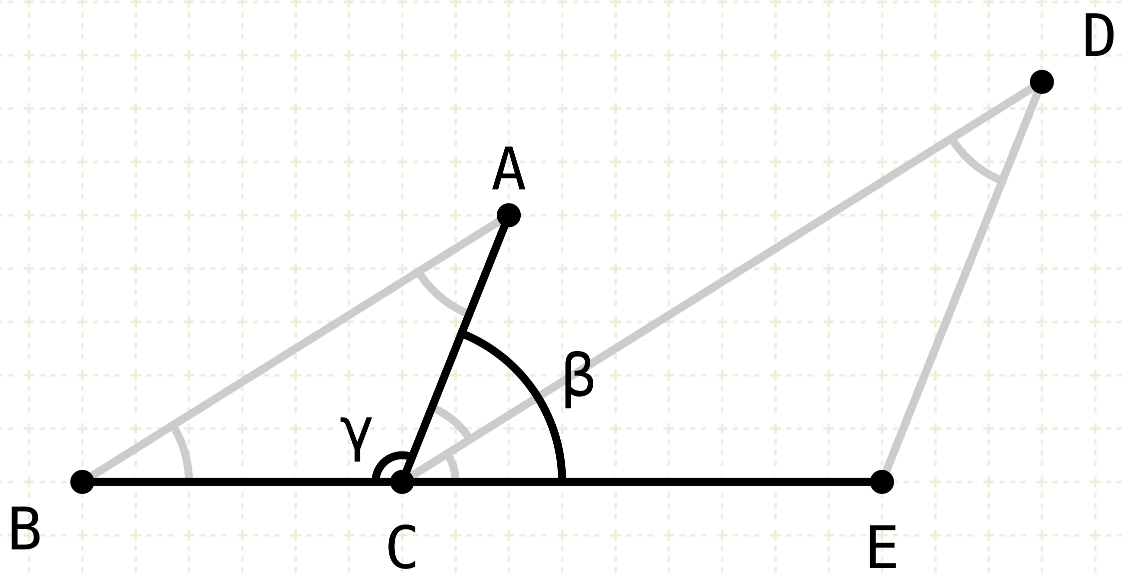

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But the sum of the angles BAC, ABC, ACB is equal to two right angles (I·32)

Given a straight line AC, if two straight lines BC,CE (not lying on the same side) have the sum of the angles ACE and ACB equal to two right angles, the lines BC and CE form a straight line (I·14)

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