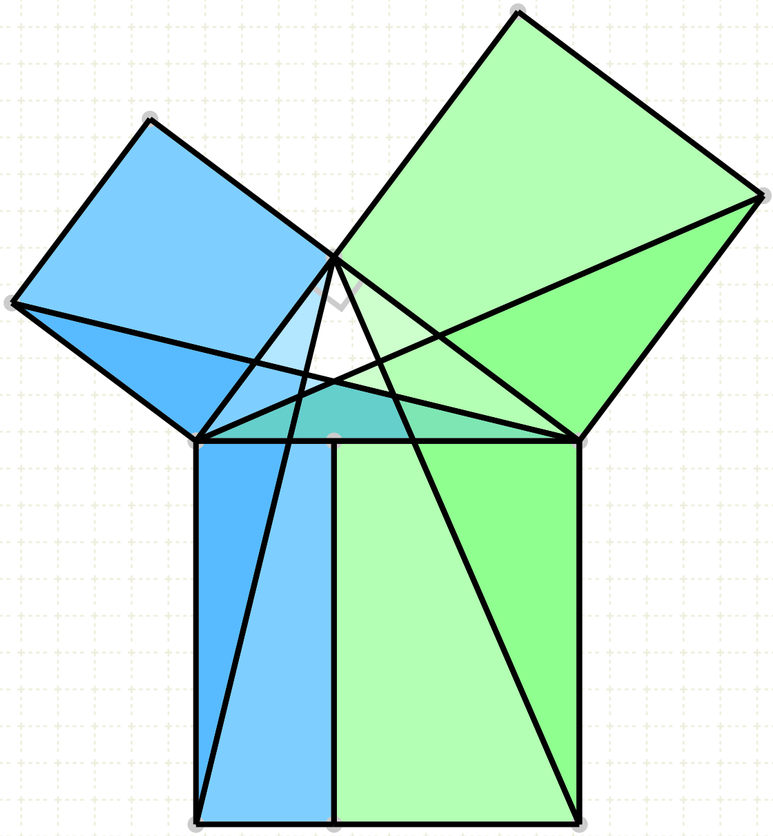
Euclid's Elements

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 33 of Book I

Straight lines which join the ends of equal and parallel straight lines in the same directions are themselves equal and parallel.

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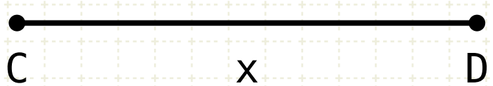
$AB = CD$

$AB \parallel CD$

In other words

Let lines AB and CD be parallel and equal



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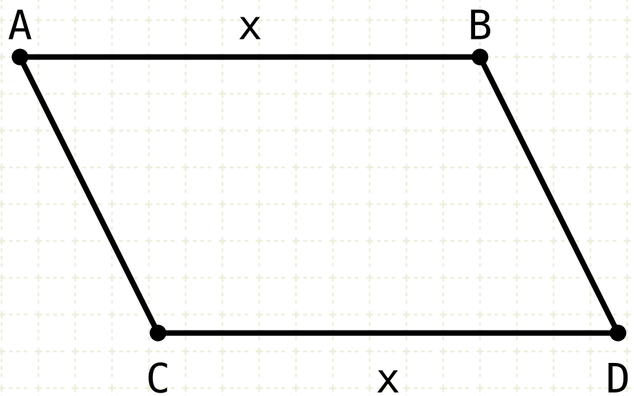

$AB = CD$

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In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

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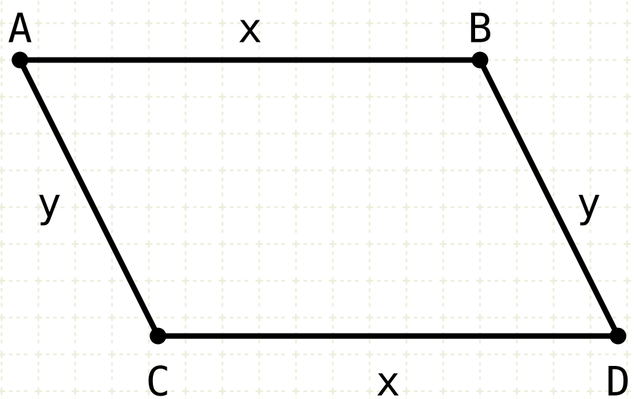

AB = CD
AB || CD

AC = BD
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In other words

Let lines AB and CD be parallel and equal

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Lines AC and BD are equal and parallel

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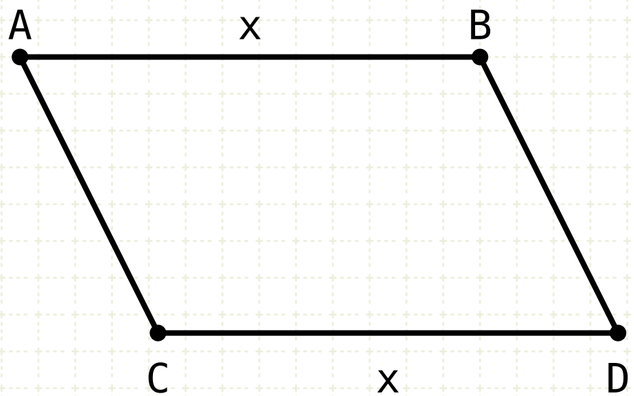

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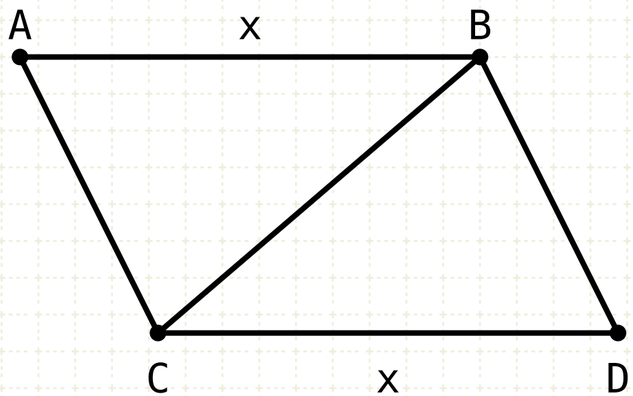

AB = CD

AB ∥ CD

In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

Lines AC and BD are equal and parallel

Proof

Join points BC

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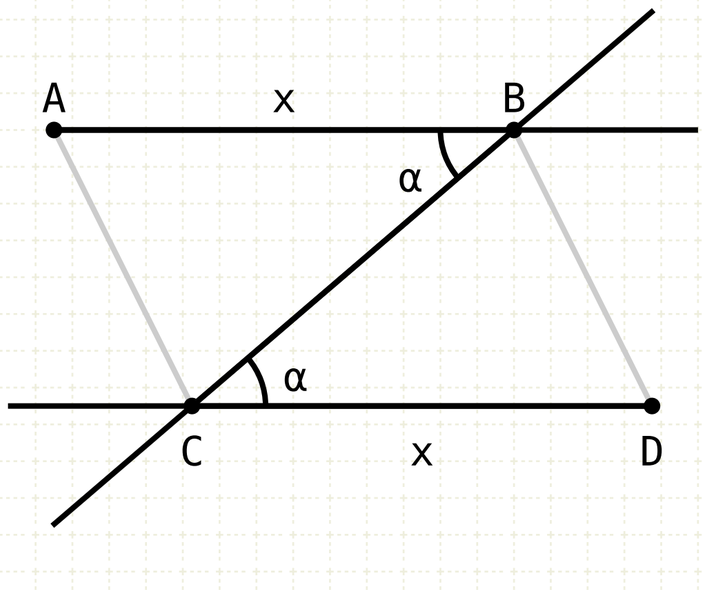

AB = CD
AB ∥ CD

∠ABC = ∠BCD = α

In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

Lines AC and BD are equal and parallel

Proof

Join points BC

Since line BC intersects two parallel lines (AB and CD), angles ABC and BCD are equal (I·29)

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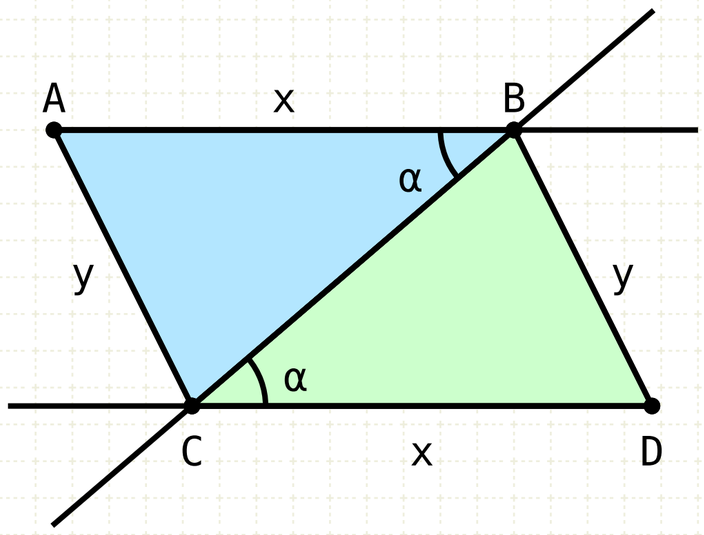

AB = CD

AB ∥ CD

∠ABC = ∠BCD = α

ΔABC ≡ ΔBCD

In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

Lines AC and BD are equal and parallel

Proof

Join points BC

Since line BC intersects two parallel lines (AB and CD), angles ABC and BCD are equal (I·29)

Since triangles ABC and BCD have two sides equal to each other, with the angle between the two sides equal, then the triangles are equal (I·4)

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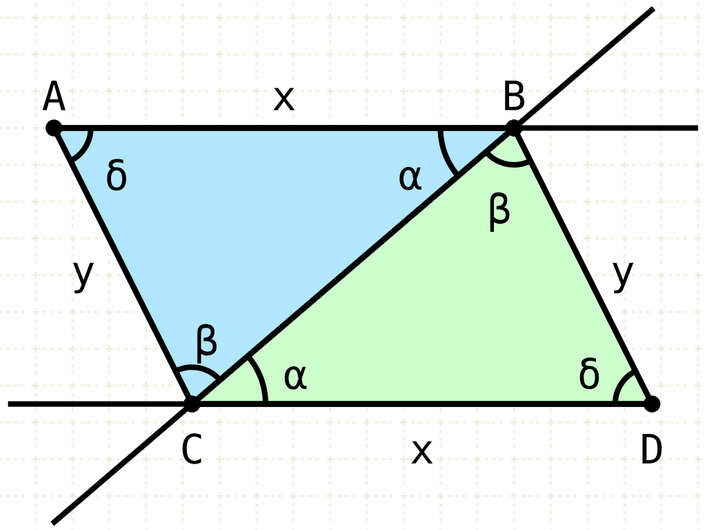

AB = CD
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∠ABC = ∠BCD = α
ΔABC ≡ ΔBCD

∴ AC = BD
∠CBD = ∠ACB = β
∠BAC = ∠CDB = δ

In other words

Let lines AB and CD be parallel and equal

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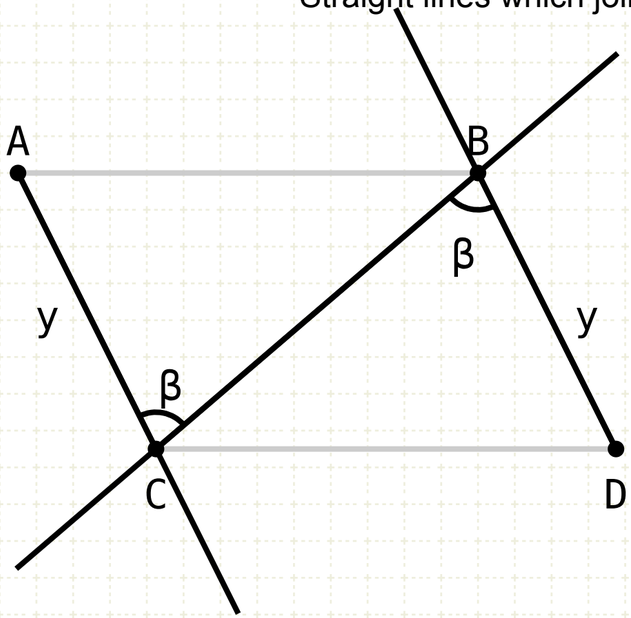

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∴ AC = BD
∠CBD = ∠ACB = β
∠BAC = ∠CDB = δ

BD ∥ AC

In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

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Lines BD and AC are parallel since the alternate angles are equal (I·27)

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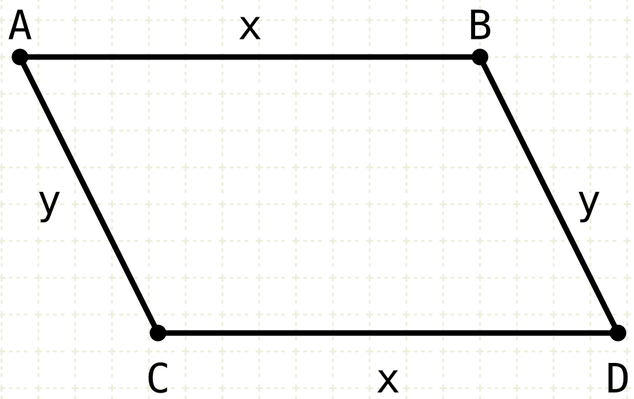

$AB = CD$

$AB \parallel CD$

$\angle ABC = \angle BCD = \alpha$

$\Delta ABC \equiv \Delta BCD$

$\therefore AC = BD$

$\angle CBD = \angle ACB = \beta$

$\angle BAC = \angle CDB = \delta$

$BD \parallel AC$

In other words

Let lines AB and CD be parallel and equal

Create lines AC and BD

Lines AC and BD are equal and parallel

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