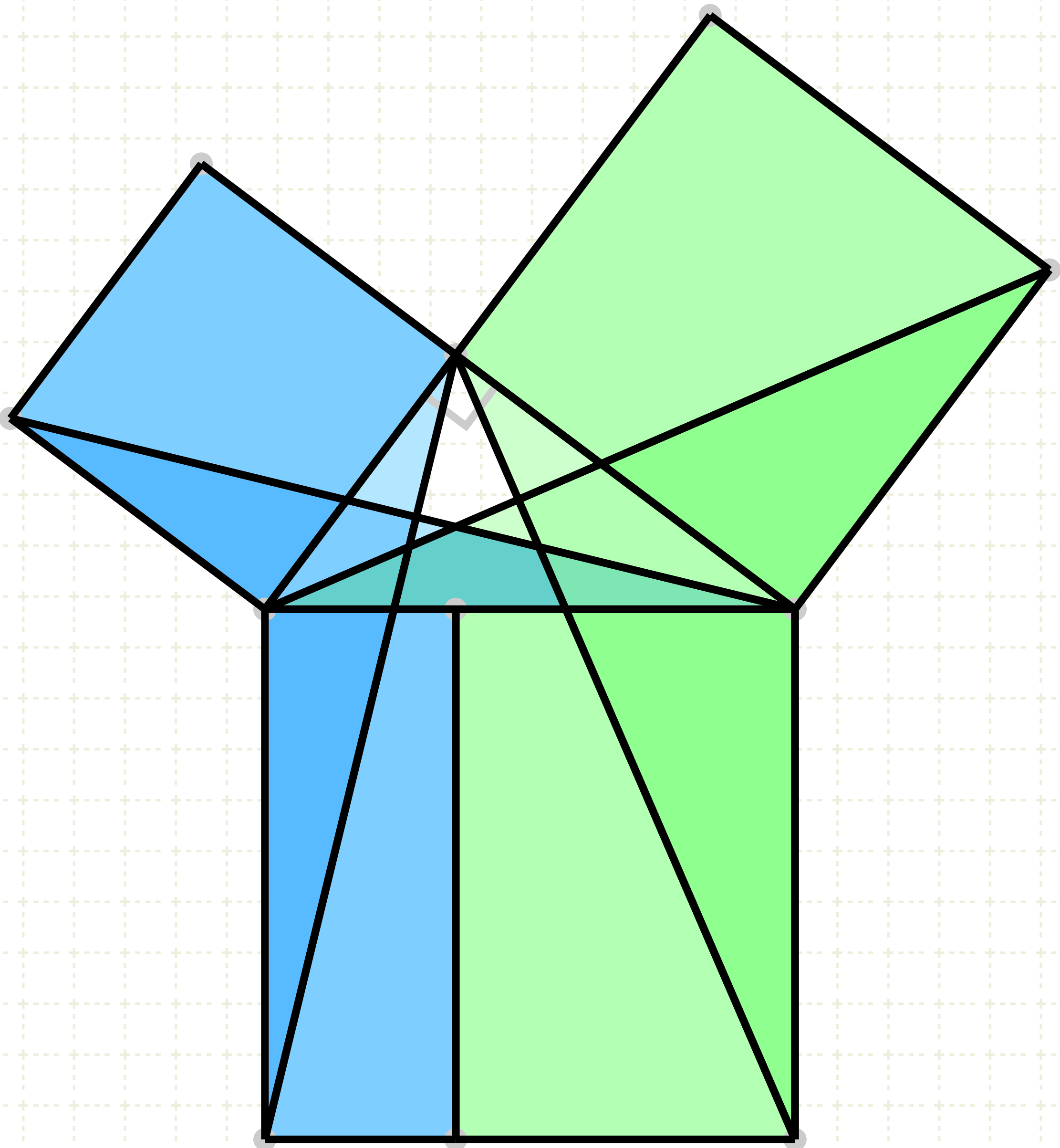
Euclid's Elements

Book I



If Euclid did not kindle your youthful enthusiasm, you were not born to be a scientific thinker.

Albert Einstein

Table of Contents, Chapter 1

Table of Contents, Chapter 1

Proposition 13 of Book I

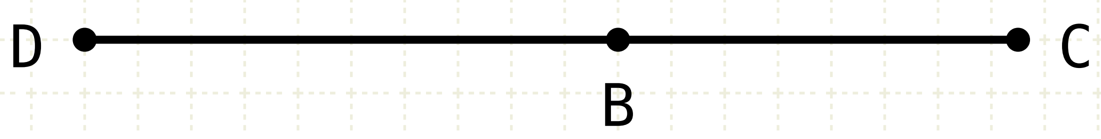
If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.

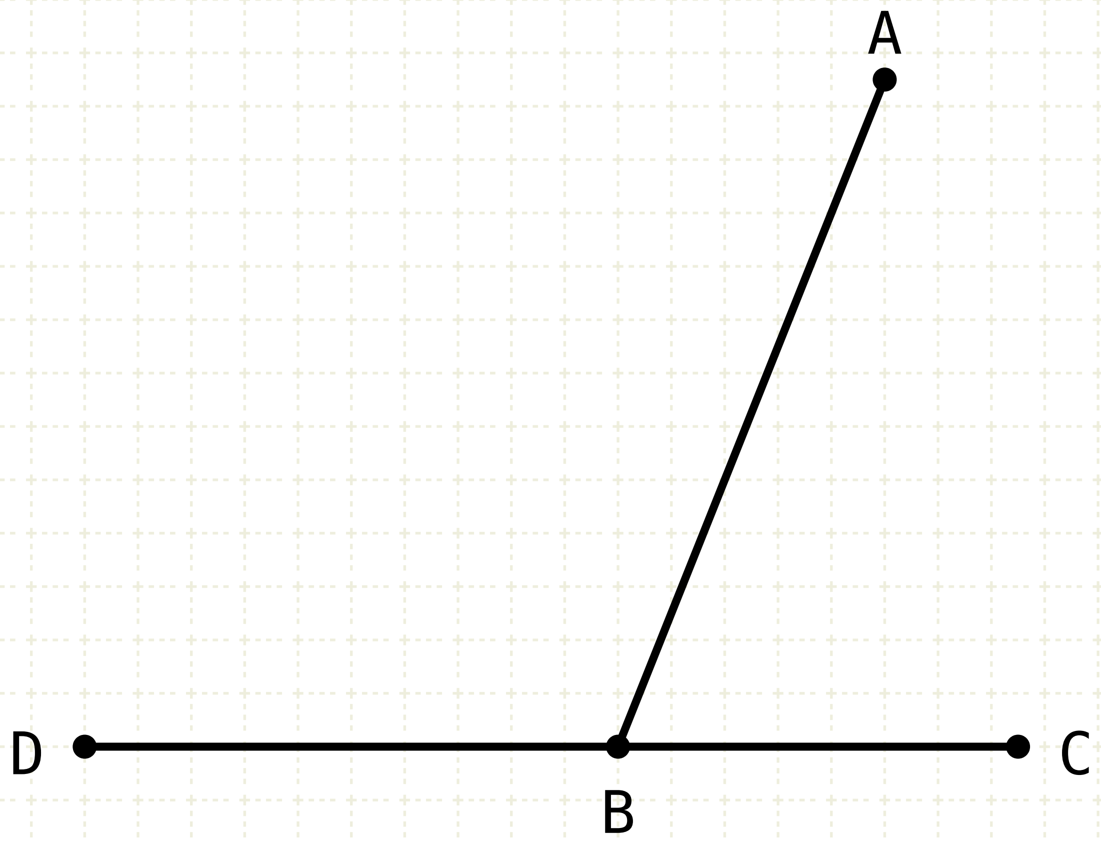
In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line



Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



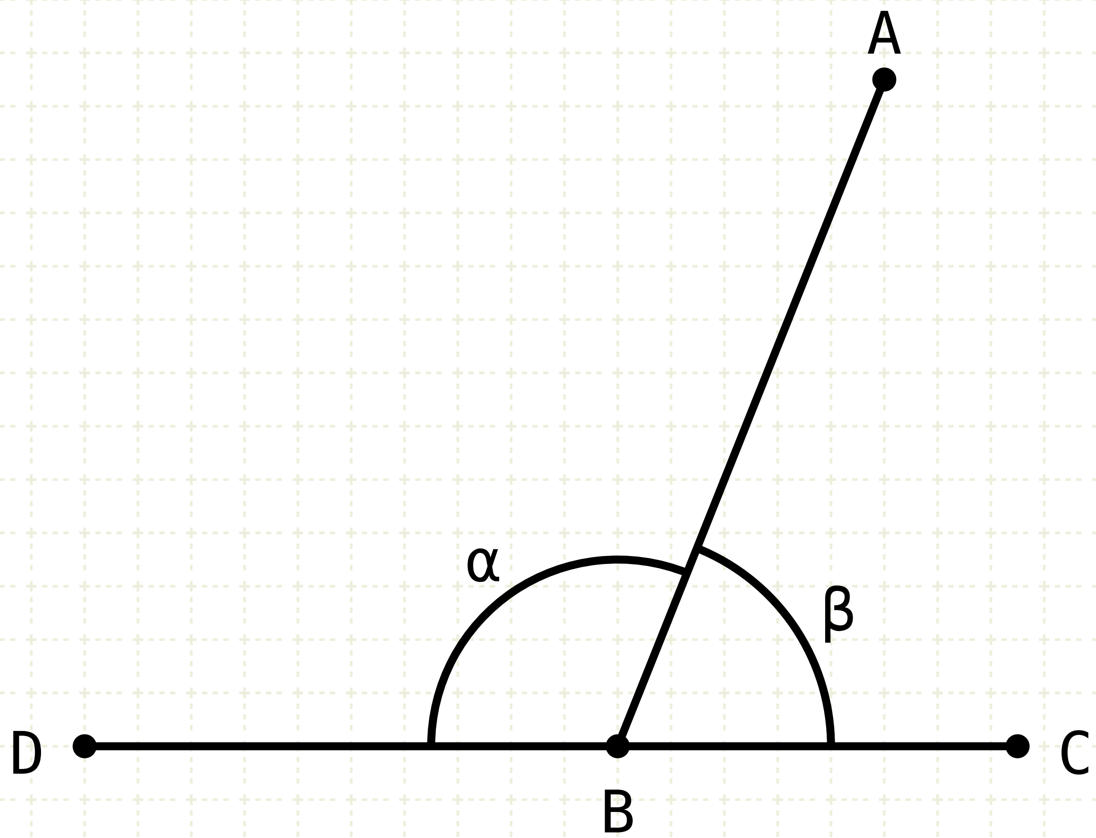
In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

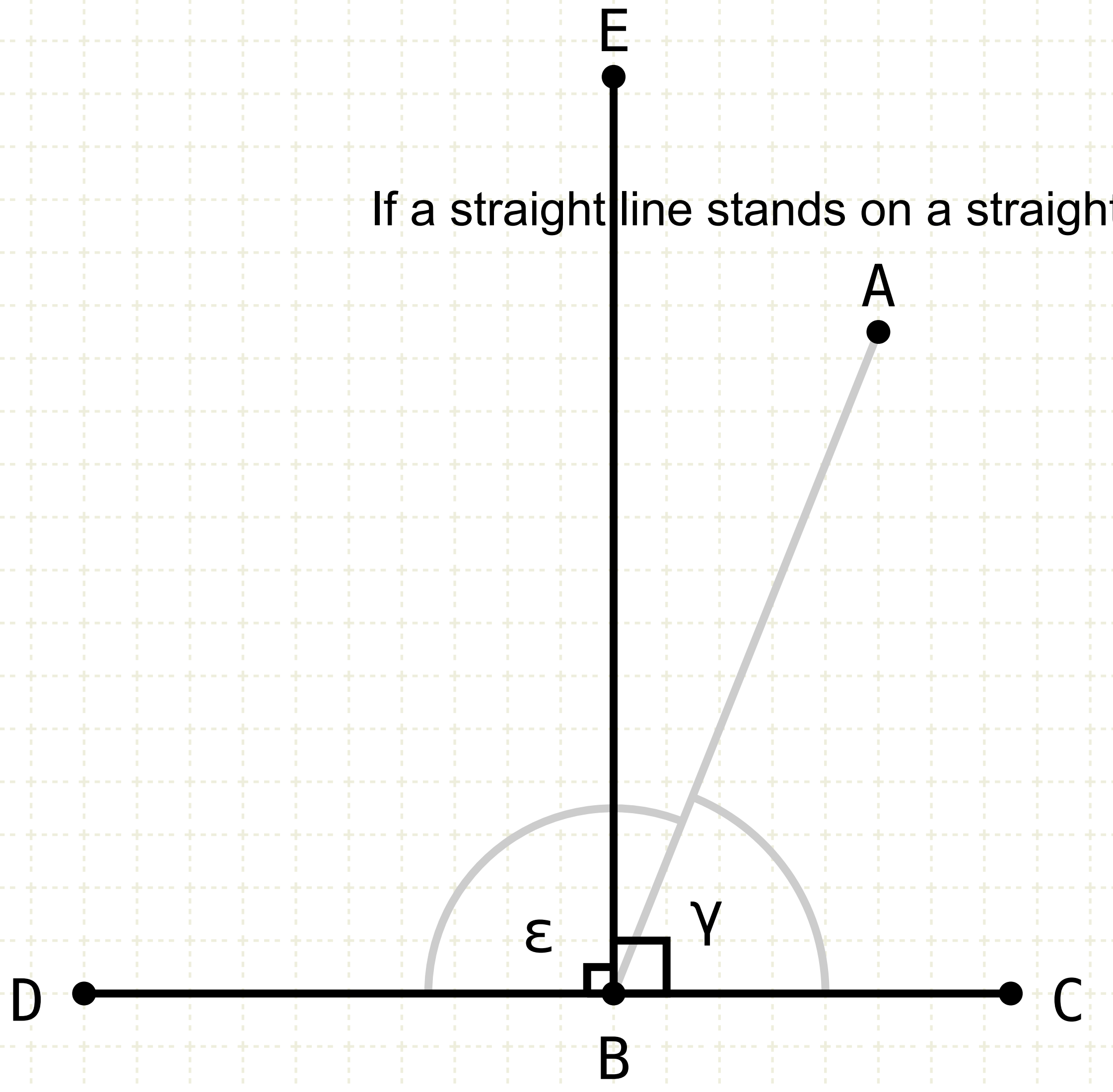
Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

$$\angle DBA + \angle ABC = 2 ∟$$
$$\alpha + \beta = 2 ∟$$

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

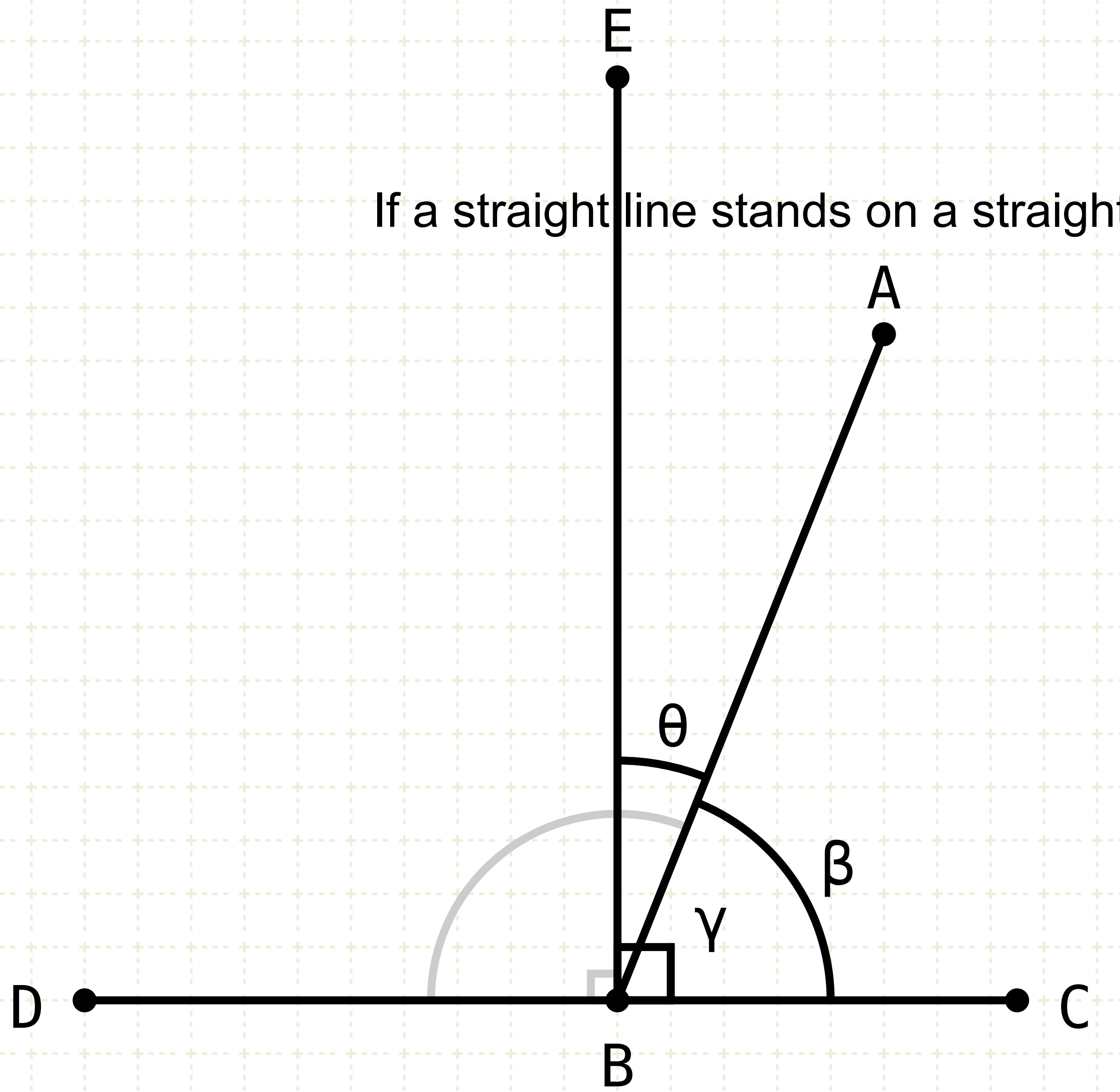
Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$
2. $\gamma = \beta + \theta$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

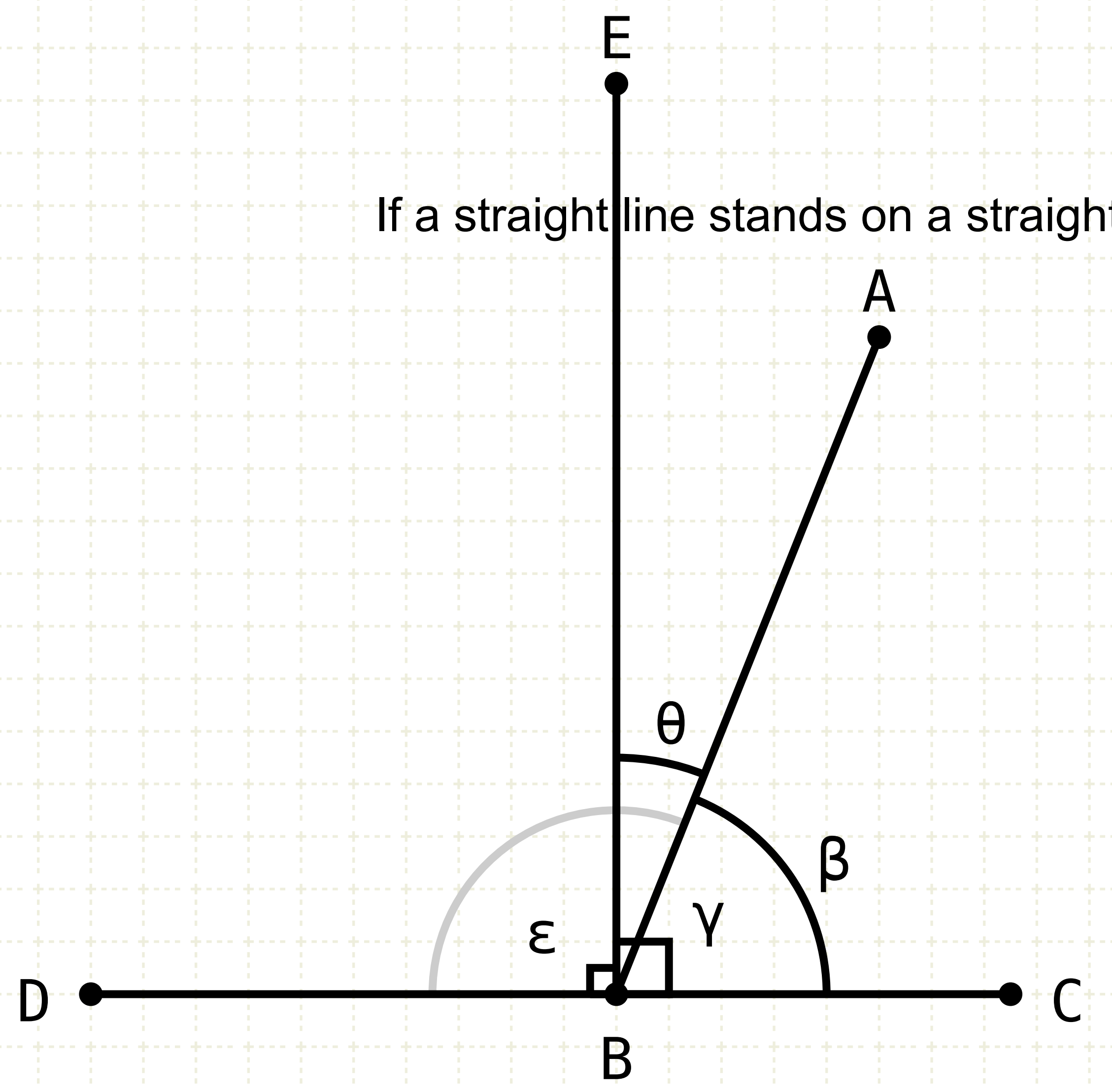
Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$
2. $\gamma = \beta + \theta$
3. $\varepsilon + \gamma = \beta + \theta + \varepsilon$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

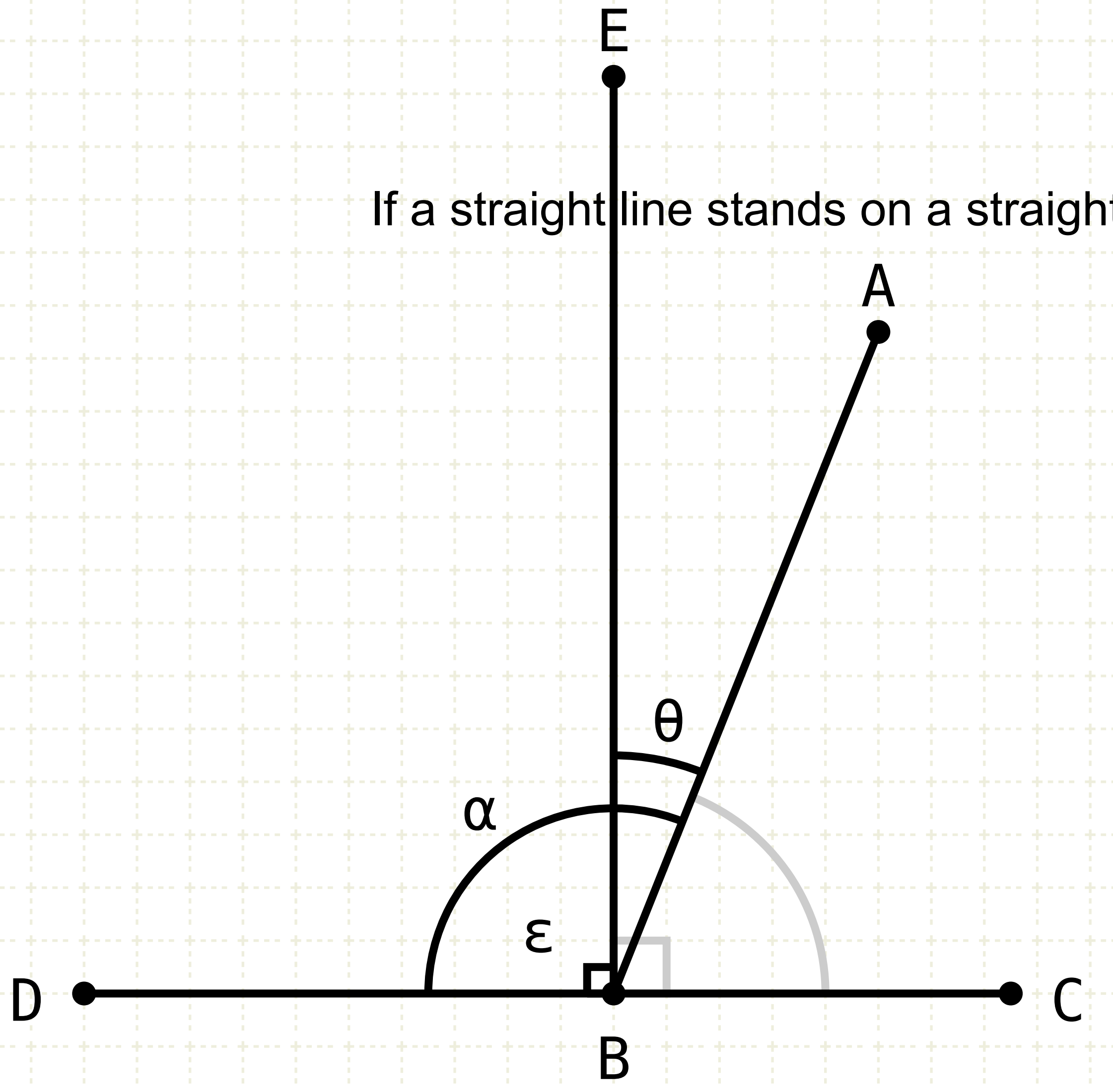
Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ
3. Add angle ε to γ and to θ plus β

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$
2. $\gamma = \beta + \theta$
3. $\varepsilon + \gamma = \beta + \theta + \varepsilon$
4. $\alpha = \theta + \varepsilon$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

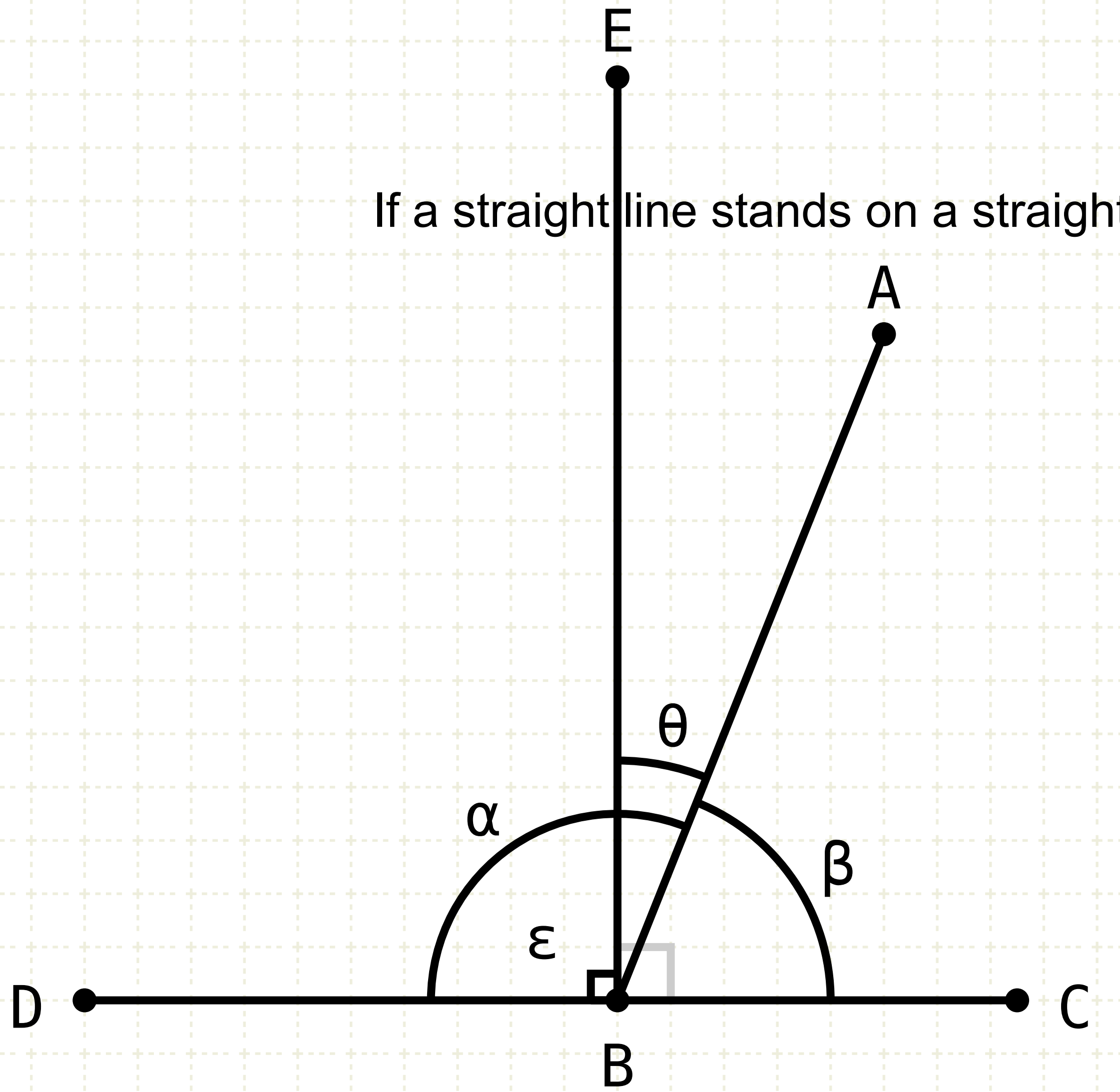
Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ
3. Add angle ε to γ and to θ plus β
4. Angle α is the sum of angles θ and ε

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$
2. $\gamma = \beta + \theta$
3. $\varepsilon + \gamma = \beta + \theta + \varepsilon$

4. $\alpha = \theta + \varepsilon$
5. $\beta + \alpha = \beta + \theta + \varepsilon$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

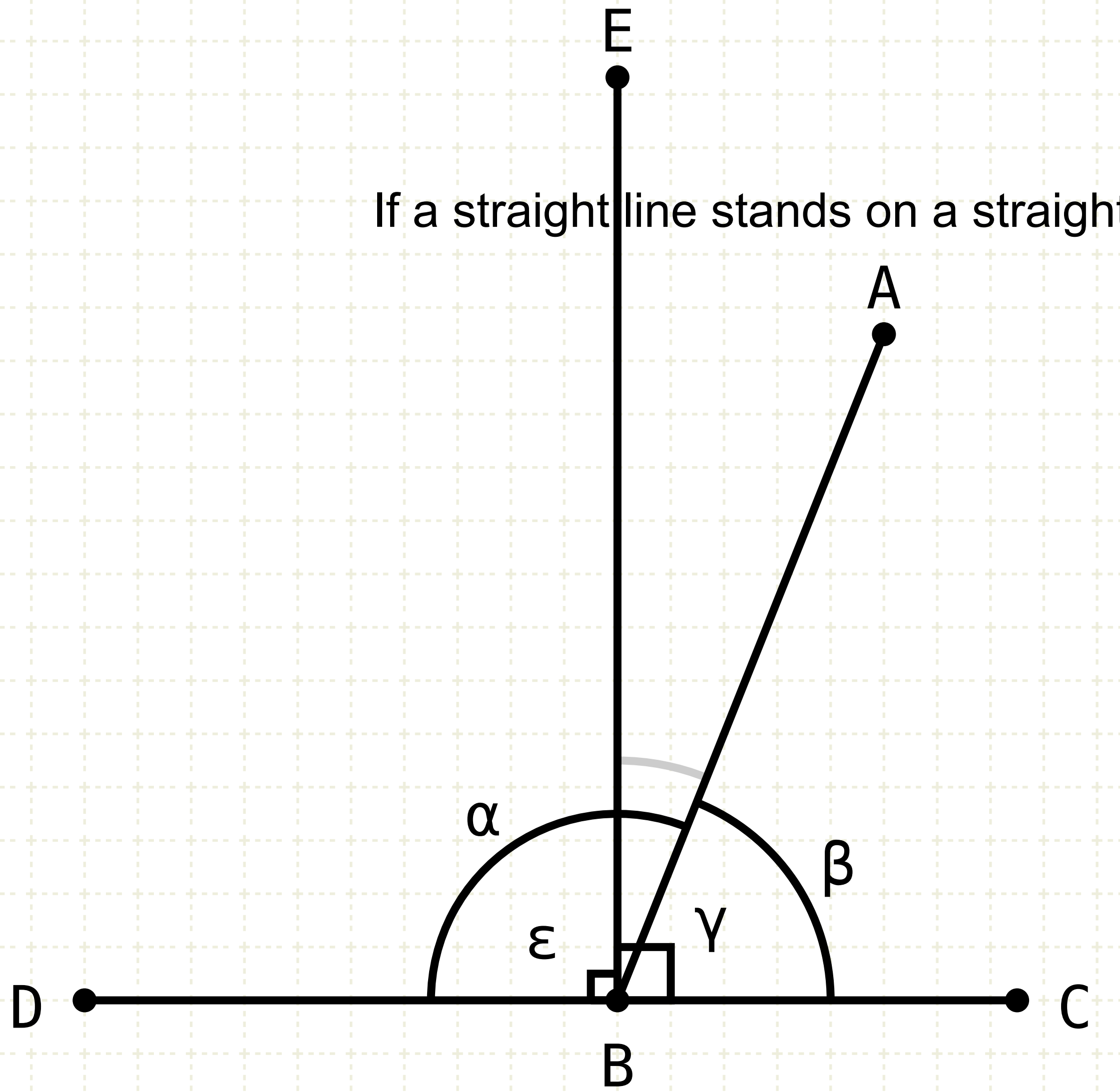
Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ
3. Add angle ε to γ and to θ plus β
4. Angle α is the sum of angles θ and ε
5. Add angle β to α and to θ plus ε

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



1. $\varepsilon = \gamma$
2. $\gamma = \beta + \theta$
3. $\varepsilon + \gamma = \beta + \theta + \varepsilon$

4. $\alpha = \theta + \varepsilon$
5. $\beta + \alpha = \beta + \theta + \varepsilon$
6. $\beta + \alpha = \gamma + \varepsilon = 2 \llcorner$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

Proof

Construct a perpendicular line to point E (I·11)

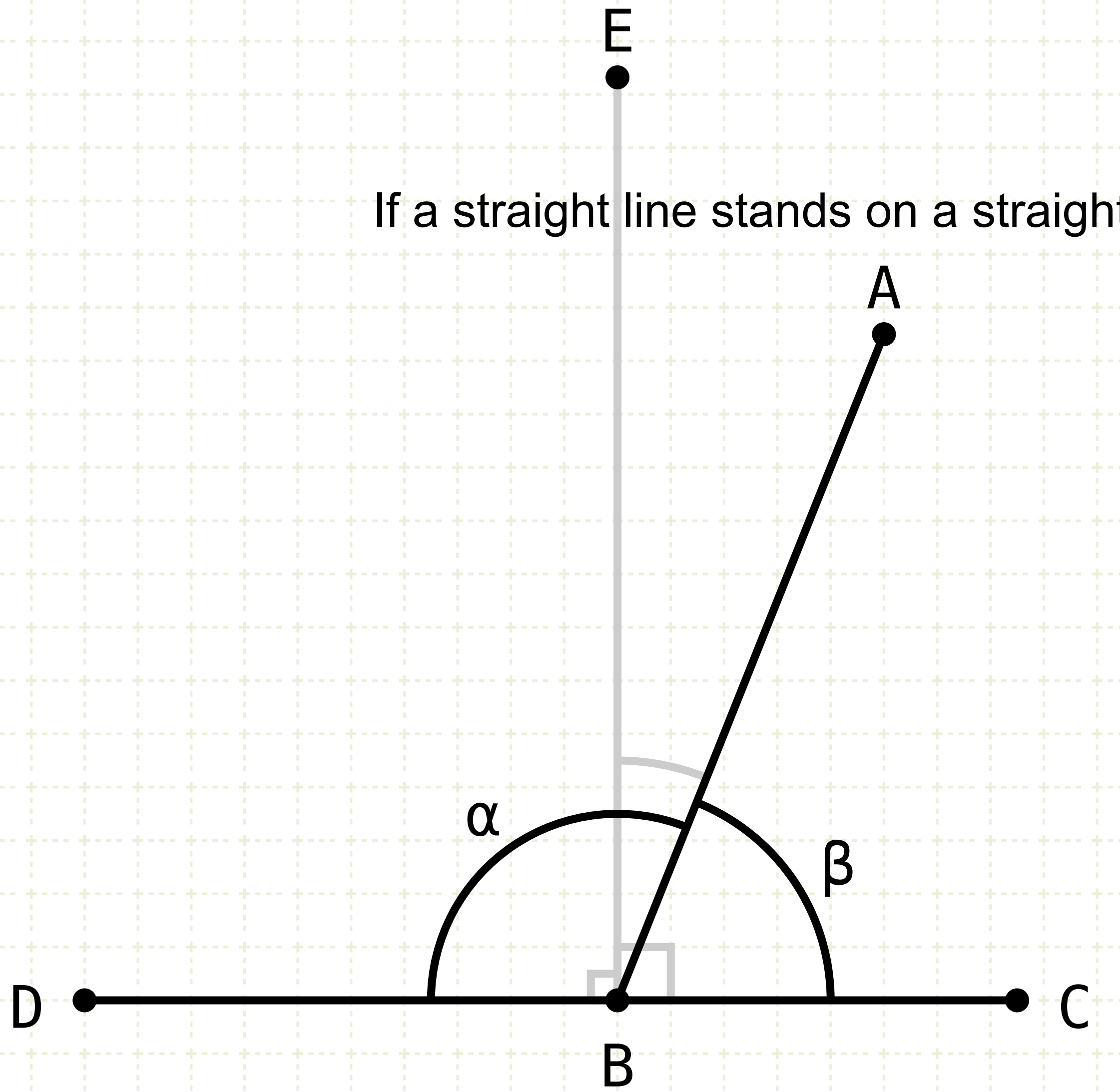
1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ
3. Add angle ε to γ and to θ plus β
4. Angle α is the sum of angles θ and ε
5. Add angle β to α and to θ plus ε
6. From equations 3 and 5, we have the sums of two angles equal to the sum of β, θ and ε

And since things that equal the same thing equal each other…

The sum of β and α equals the sum of the two right angles, γ and ε

Proposition 13 of Book I

If a straight line stands on a straight line, then it makes either two right angles or angles whose sum equals two right angles.



$$
\begin{aligned}
&1. & \varepsilon &= \gamma \\
&2. & \gamma &= \beta + \theta \\
&3. & \varepsilon + \gamma &= \beta + \theta + \varepsilon
\end{aligned}
$$

$$
\begin{aligned}
&4. & \alpha &= \theta + \varepsilon \\
&5. & \beta + \alpha &= \beta + \theta + \varepsilon \\
&6. & \beta + \alpha &= \gamma + \varepsilon = 2 \llcorner
\end{aligned}
$$

$$\angle ABC + \angle ABD = 2 \llcorner$$

In other words

Start with an arbitrary line segment CD and an arbitrary point B on the line

Draw a line from point an arbitrary point A to point B

The sum of the angles ABD and ABC is equal to two right angles

Proof

Construct a perpendicular line to point E (I·11)

1. Angles γ and ε are right angles
2. Angle γ is the sum of angles β and θ
3. Add angle ε to γ and to θ plus β
4. Angle α is the sum of angles θ and ε
5. Add angle β to α and to θ plus ε
6. From equations 3 and 5, we have the sums of two angles equal to the sum of β, θ and ε

And since things that equal the same thing equal each other…

The sum of β and α equals the sum of the two right angles, γ and ε

Youtube Videos

https://www.youtube.com/c/SandyBultena