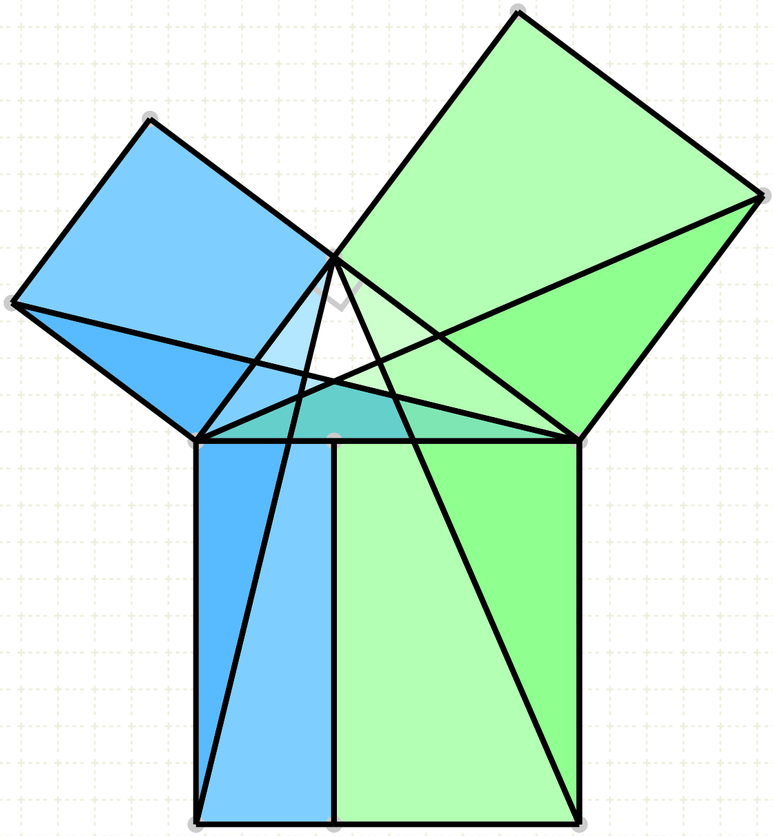
Euclid's Elements

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 12 of Book I

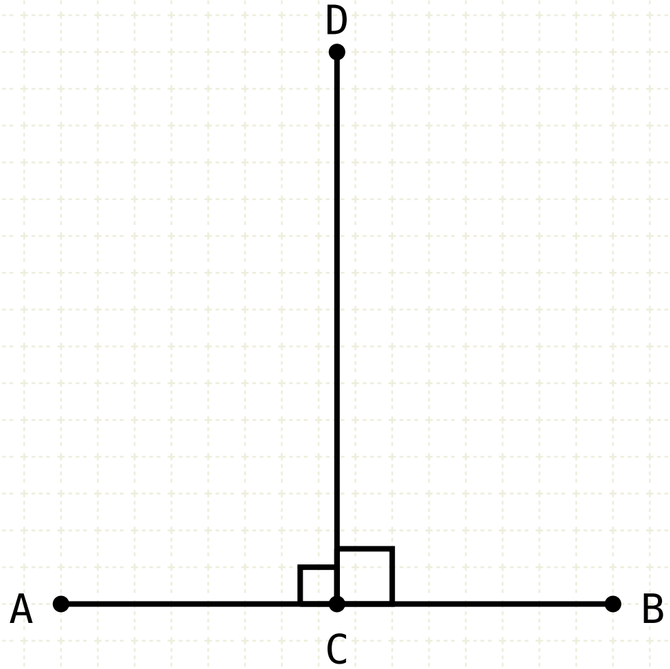
To draw a straight line perpendicular to a given infinite straight line from a given point not on it.

Proposition 12 of Book I

To draw a straight line perpendicular to a given infinite straight line from a given point not on it.

Definition - Right Angle

When a straight line standing on a straight line makes the adjacent angles equal to one another, each of the equal angles is right, and the straight line standing on the other is called a perpendicular to that on which it stands.



∠ACD = ∠BCD = ∟ (right angle)

DC is perpendicular to AB

Proposition 12 of Book I

To draw a straight line perpendicular to a given infinite straight line from a given point not on it.

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Construction:

Start with an arbitrary line segment AB and an arbitrary point C not on the line

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Start with an arbitrary line segment AB and an arbitrary point C not on the line

Define another point D on the other side of the line

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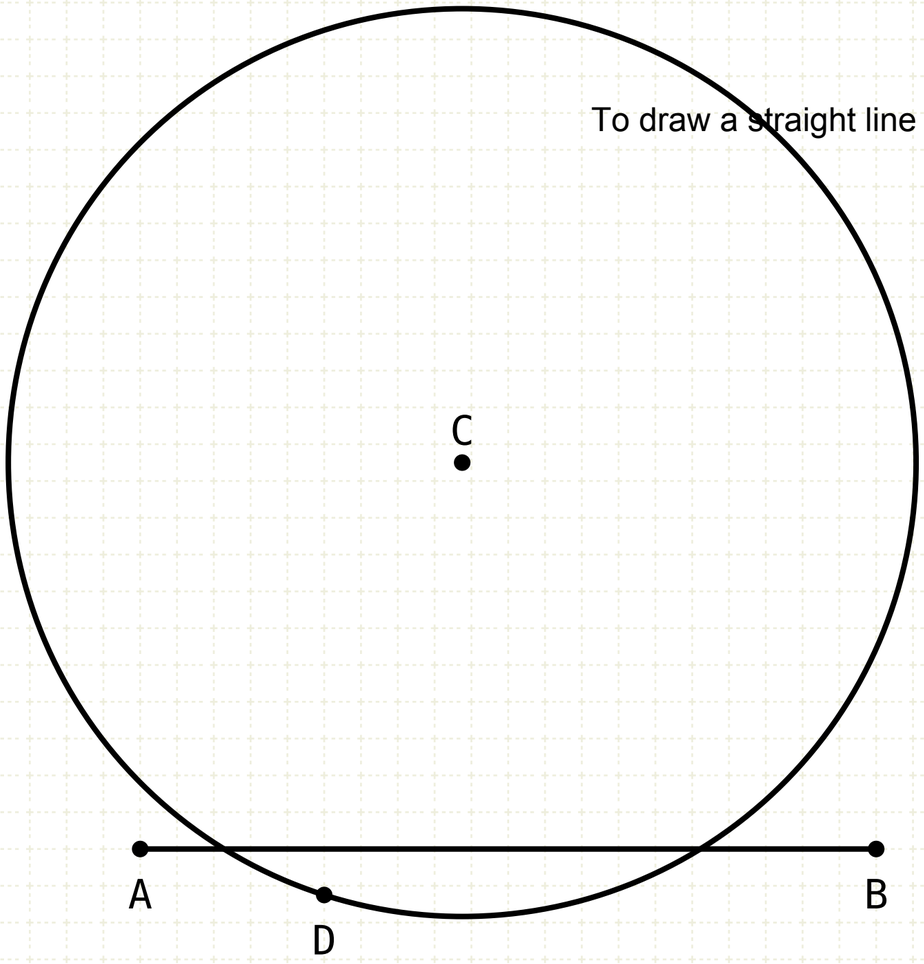

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Start with an arbitrary line segment AB and an arbitrary point C not on the line

Define another point D on the other side of the line

Construct a circle with center C, and radius CD

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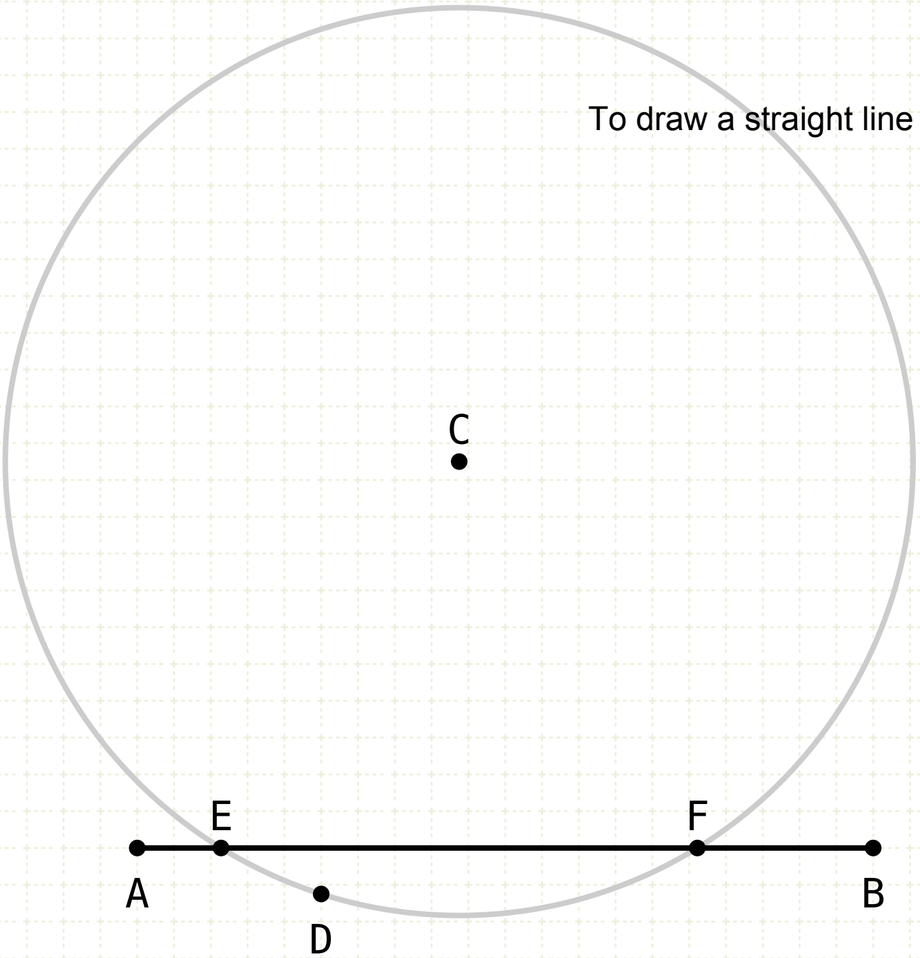

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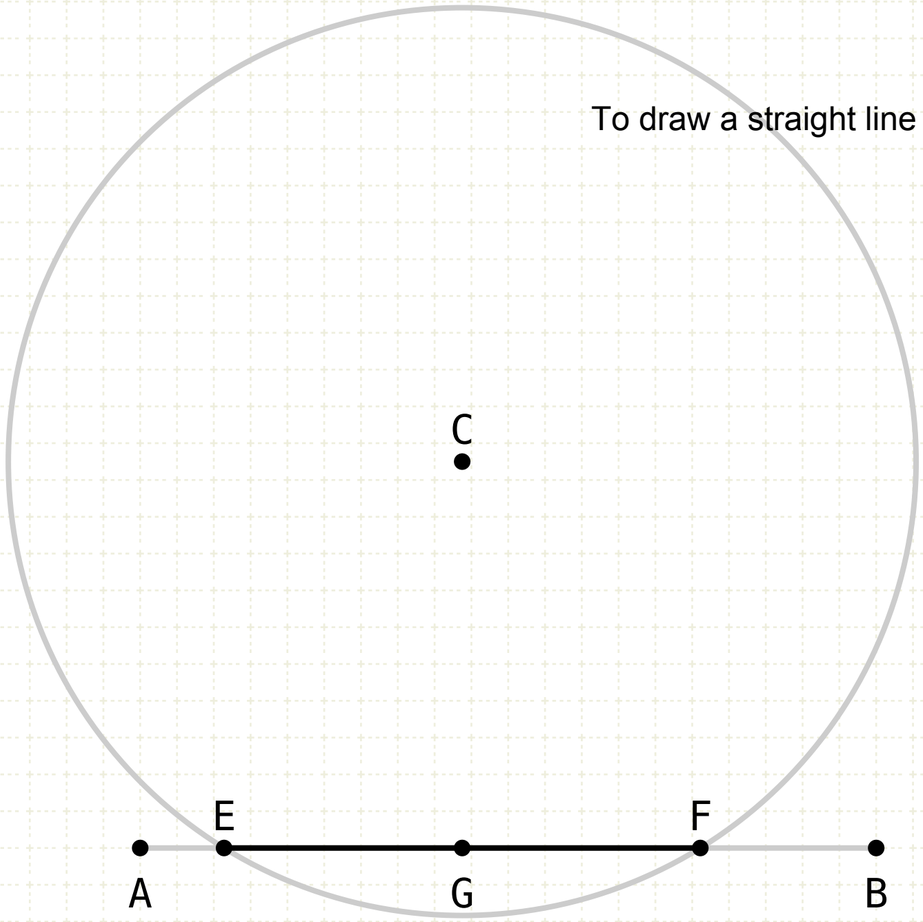

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Bisect line EF at point G (I·9)

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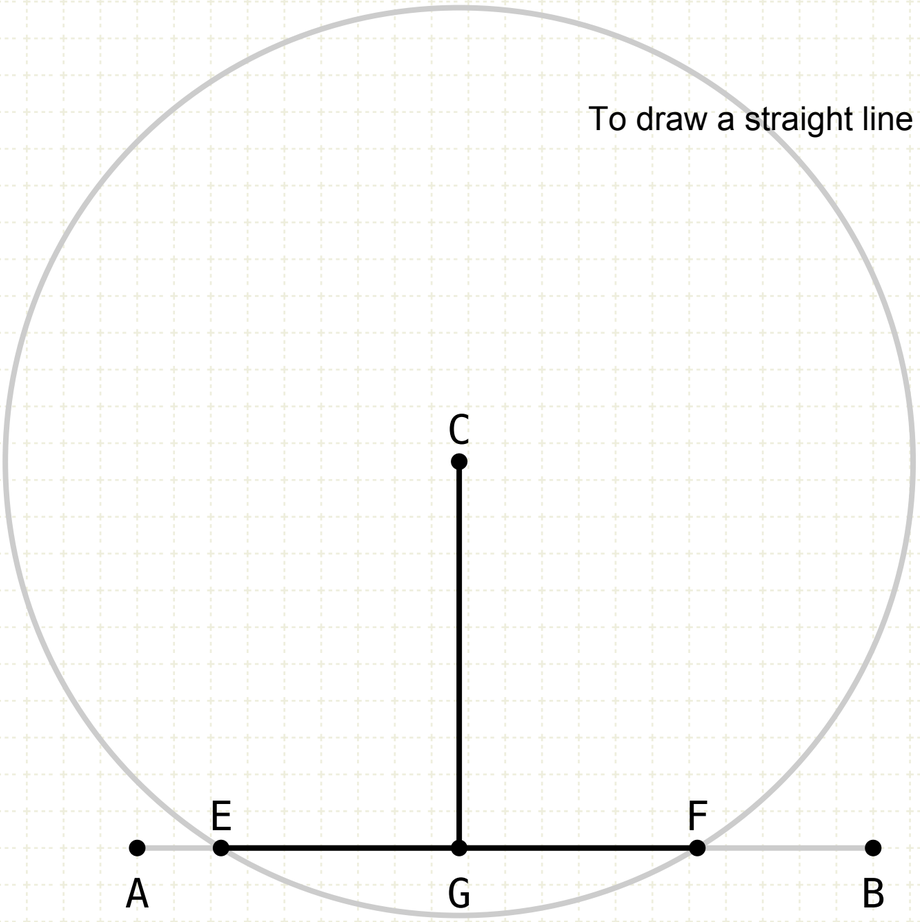

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Create line CG

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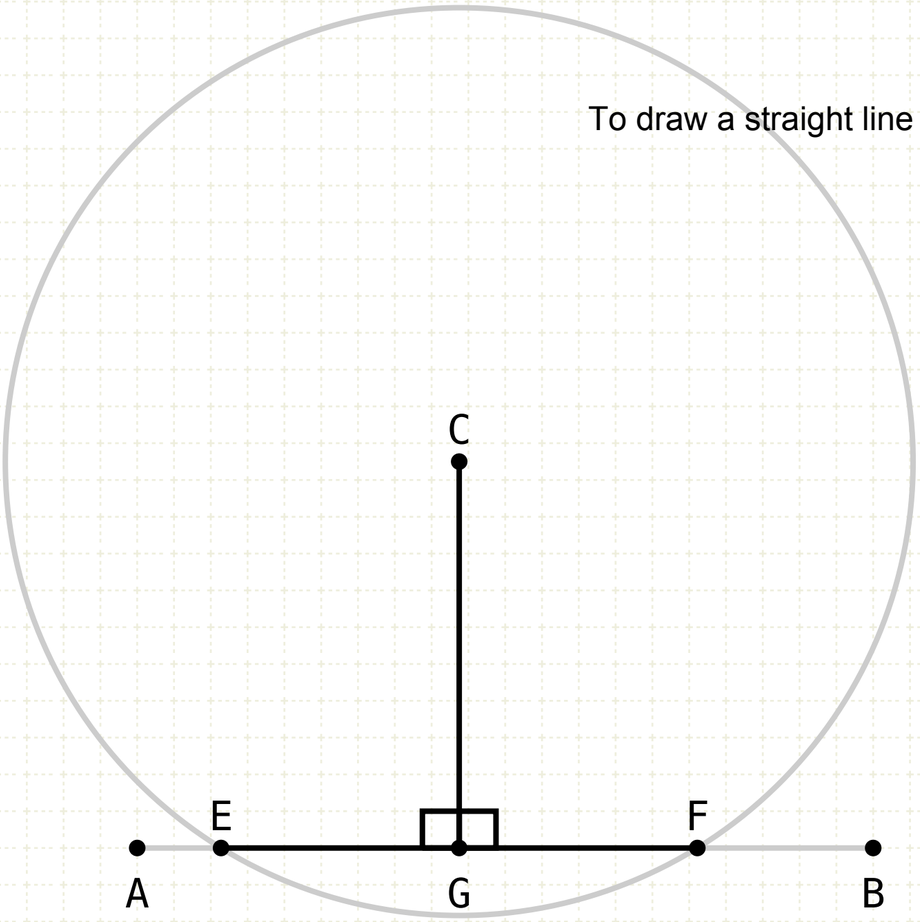

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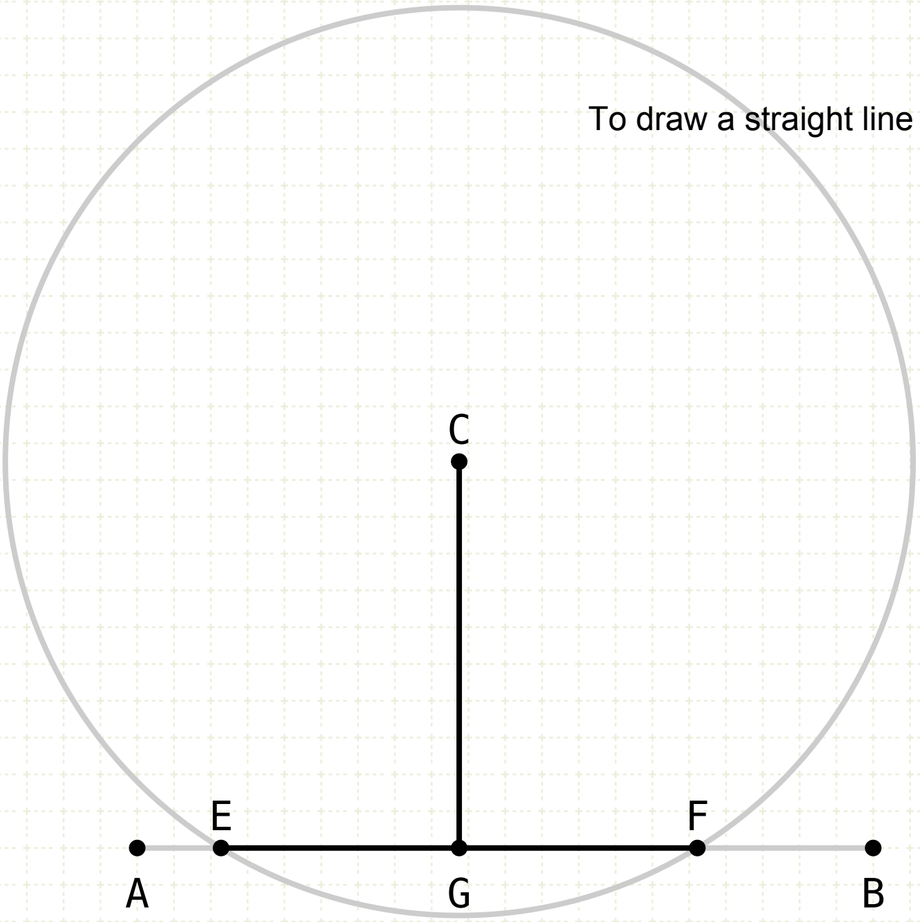

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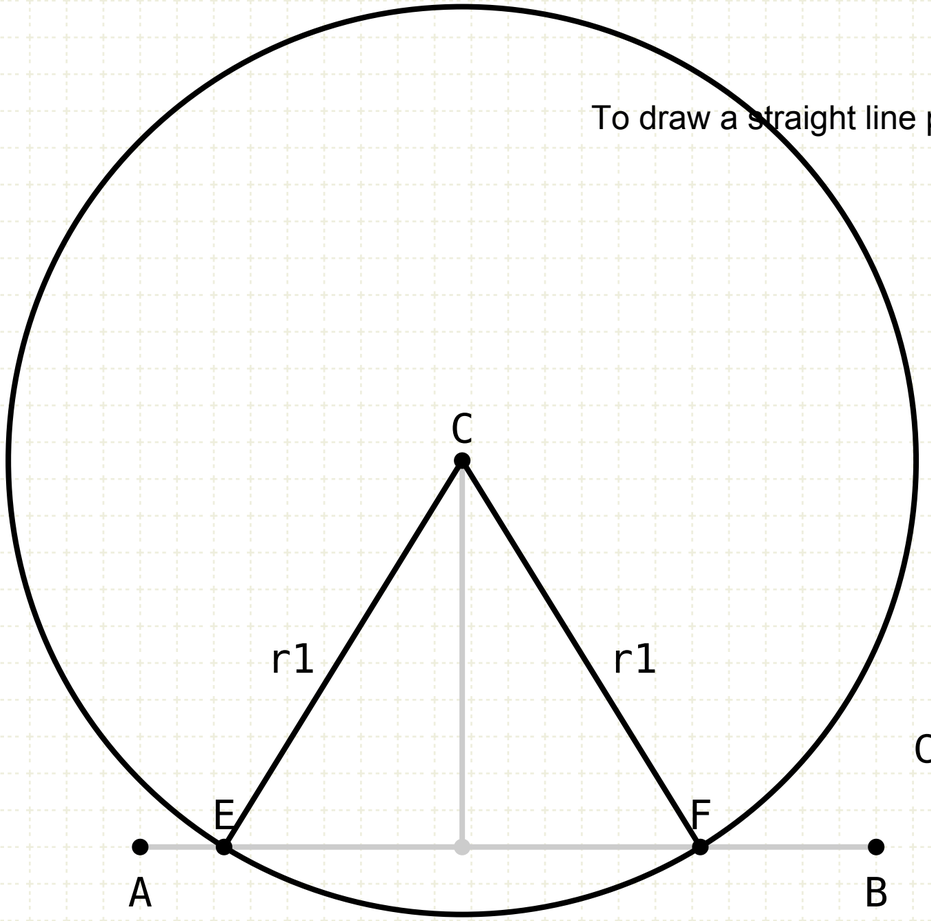

CE = CF = r1

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Create lines CE and CF

CE and CF are equal since they are radii of the same circle

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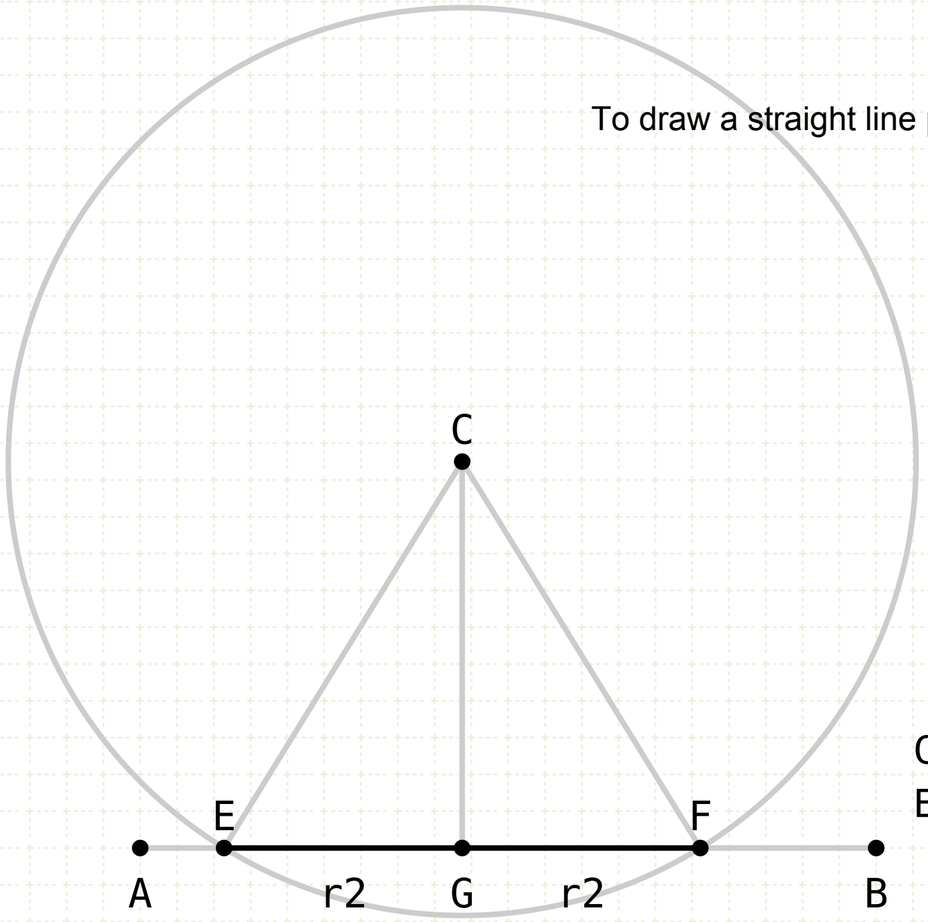

CE = CF = r1
EG = GF = r2

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CE and CF are equal since they are radii of the same circle

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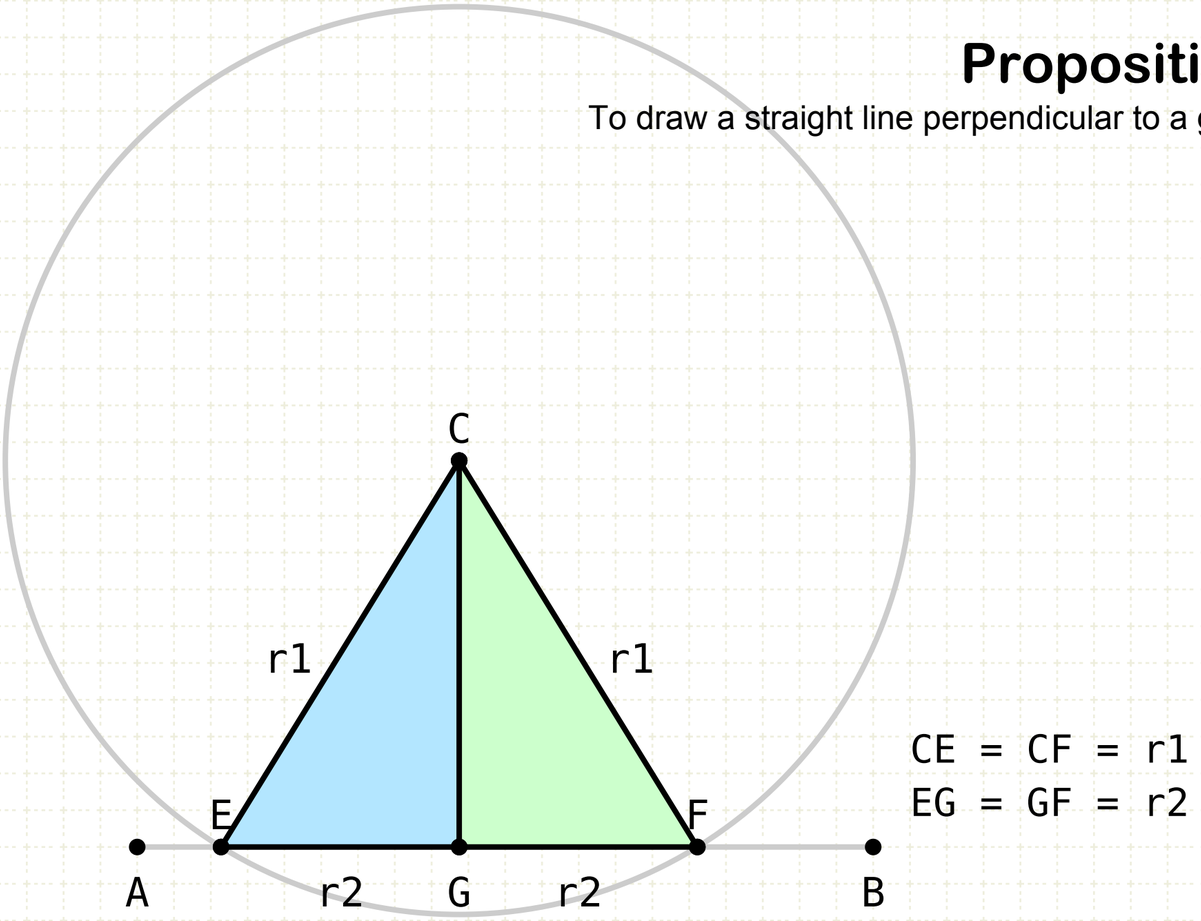

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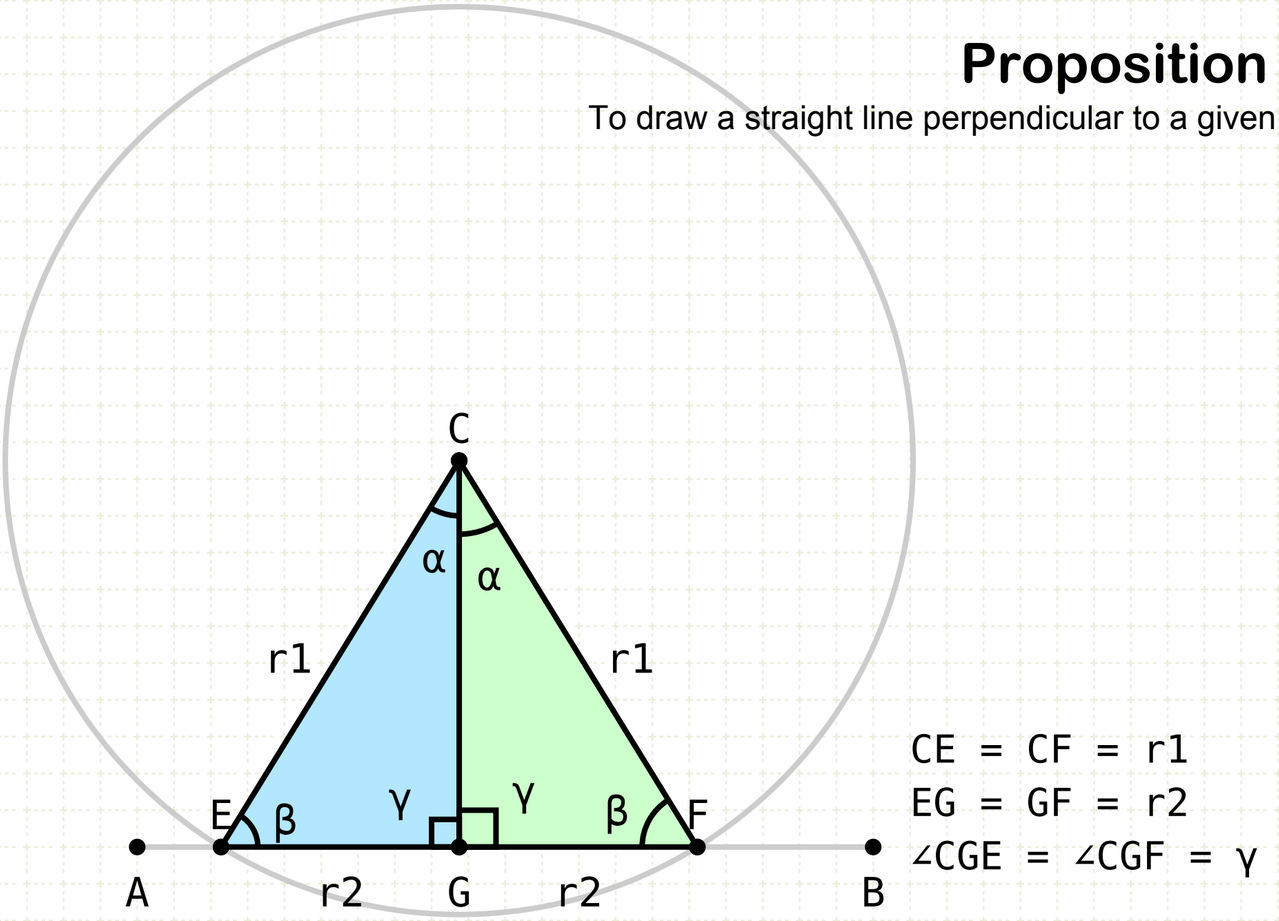

CE = CF = r1
EG = GF = r2
∠CGE = ∠CGF = γ

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hence the triangles are congruent, and all the angles are congruent

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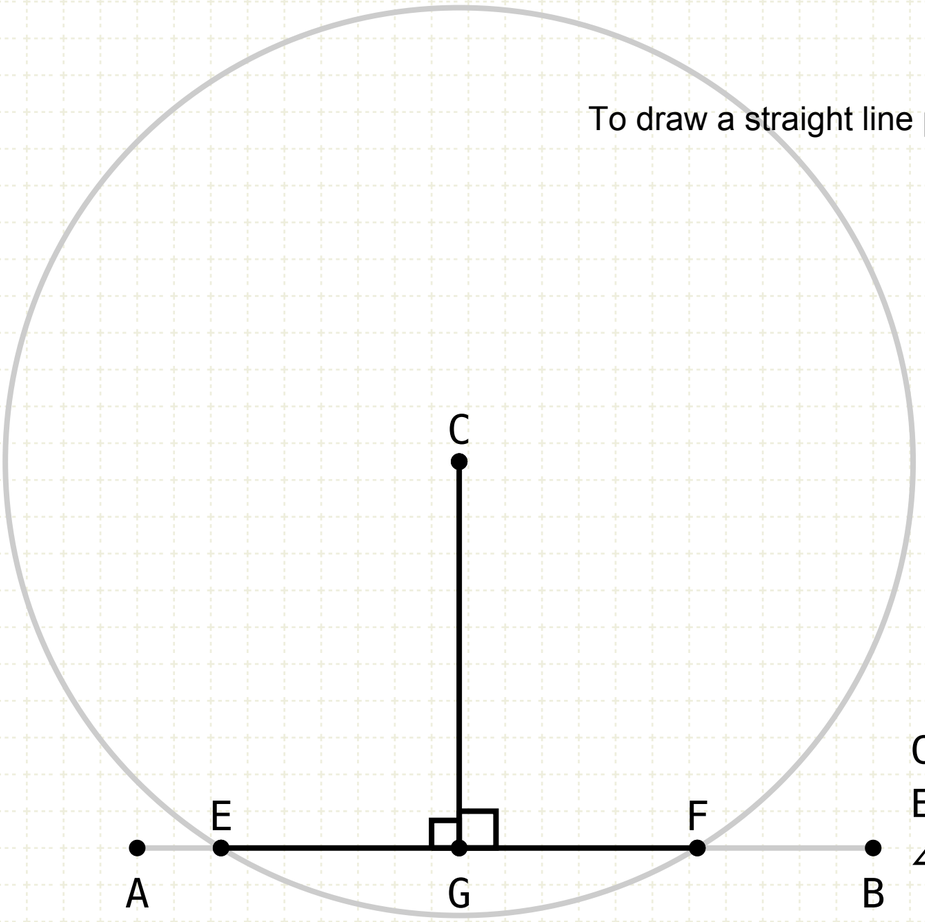

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hence the triangles are congruent, and all the angles are congruent

Since CGE and CGF are equal, and EF is a line, by definition the angles are right angles, and CG is perpendicular to EF

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