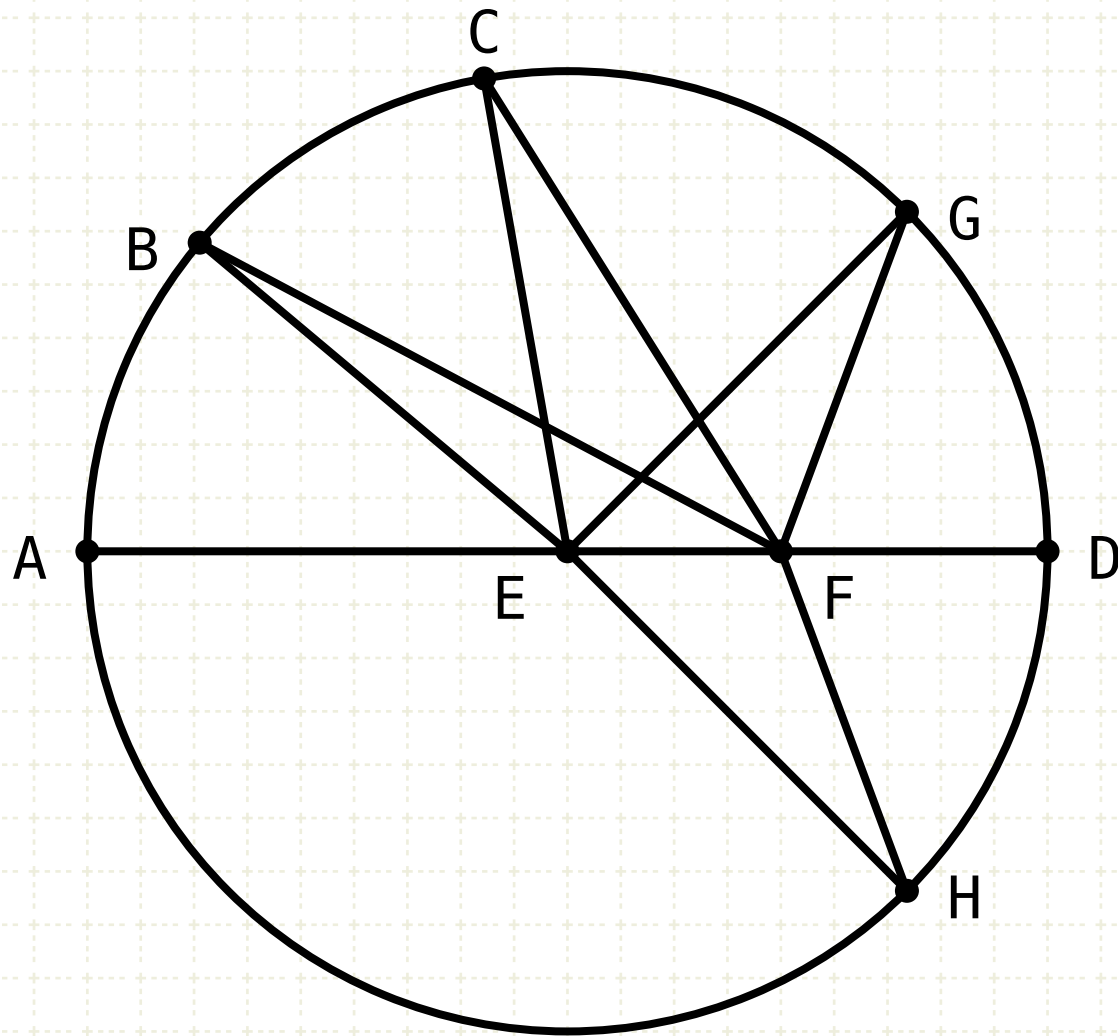


Euclid's Elements

Book III



A circle is a round straight line with a hole in the middle.

Mark Twain

quoting a schoolchild in "-English as She Is Taught-"

If people stand in a circle long enough, they'll eventually begin to dance.

George Carlin, Napalm and Silly Putty (2001)



Table of Contents, Chapter 3

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2	A chord of a circle always lies inside the circle	10	A circle does not cut a circle at more points than two	18	If line touches a circle, then it is perpendicular to the diameter that touches that point
3	A line through the centre of a circle bisects a chord, and vice versa	11	Point of contact between two internal circles, and their centres, are collinear	19	If line touches a circle, then the centre of the circle lies on a line perpendicular to the original
4	A line not through the centre of a circle does not bisect a chord	12	Point of contact between two external circles, and their centres, are collinear	20	The angle at the centre of a circle is twice that from an angle from the circumference
5	If two circles cut one another, they will not have the same center	13	A circle does not touch a circle at more points than one, whether it touch it internally or externally.	21	In a circle the angles in the same segment are equal to one another
6	If two circles touch one another, they will not have the same center	14	In a circle equal straight lines are equally distant from the centre, and those which are equally distant from the centre are equal to one another.	22	The opposite angles of quadrilaterals in circles are equal to two right angles
7	Consider two lines from a point inside a circle to the edge, the longer one will be the one closest to the longest part of the diameter passing through the original point	15	The longest line in a circle is its diameter, shorter the farther away from the diameter	23	On the same straight line there cannot be constructed two similar and unequal segments of circles on the same side
8	Consider two lines from a point outside a circle to the edge, the line closest to the centre will be longer on the concave side and shorter on the convex side	16	A line on the circle, perpendicular to the diameter, lies outside the circle	24	Similar segments of circles on equal straight lines are equal to one another



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| 26 | In equal circles equal angles stand on equal circumferences | 35 | If two circle chords intersect, the segments on one multiplied together equals the segments of the other multiplied together |
| 27 | In equal circles angles standing on equal circumferences are equal to one another | | |
| 28 | In equal circles equal straight lines cut off equal circumferences | 36 | Secant-tangent law |
| 29 | In equal circles equal circumferences are subtended by equal straight lines | 37 | Converse of the secant-tangent law |
| 30 | To bisect a given circumference | | |
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| 32 | The angle between a tangent and a straight line cutting a circle is equal to the angle in the alternate segment | | |
| 33 | Construct a circle segment on a given line, such that the angle within the segment is equal to a given angle | | |



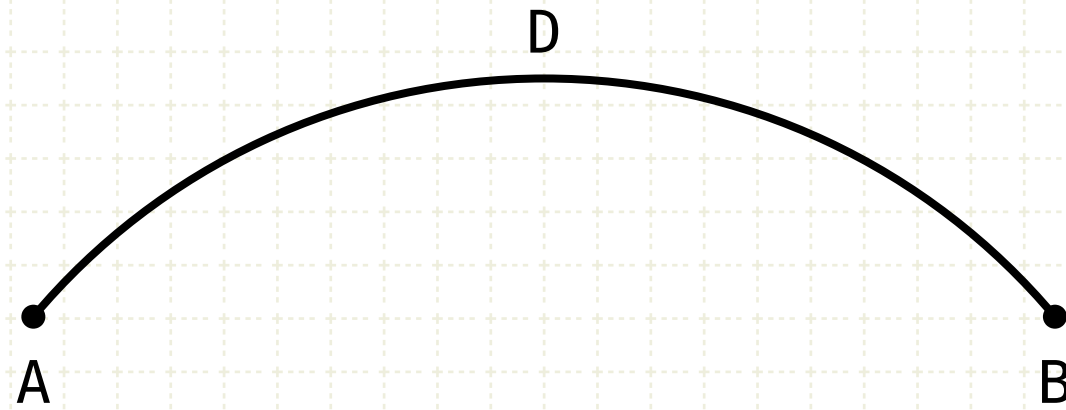
Proposition 30 of Book III

To bisect a given circumference.



Proposition 30 of Book III

To bisect a given circumference.



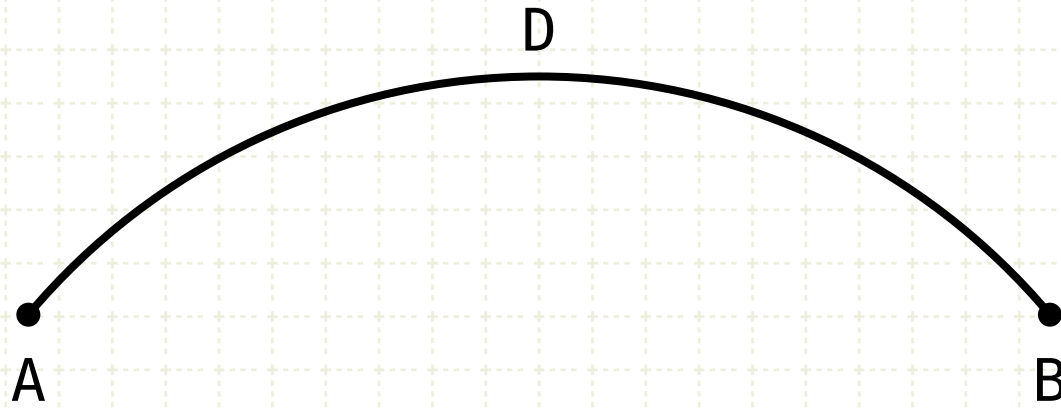
In other words

Describe the necessary steps to bisect the circumference
ADB



Proposition 30 of Book III

To bisect a given circumference.



In other words

Describe the necessary steps to bisect the circumference

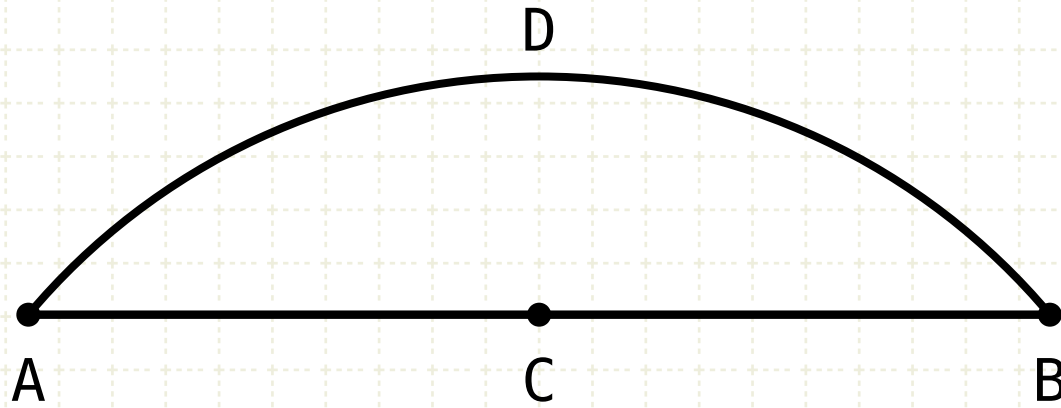
ADB

Construction



Proposition 30 of Book III

To bisect a given circumference.



$$AC = CB$$

In other words

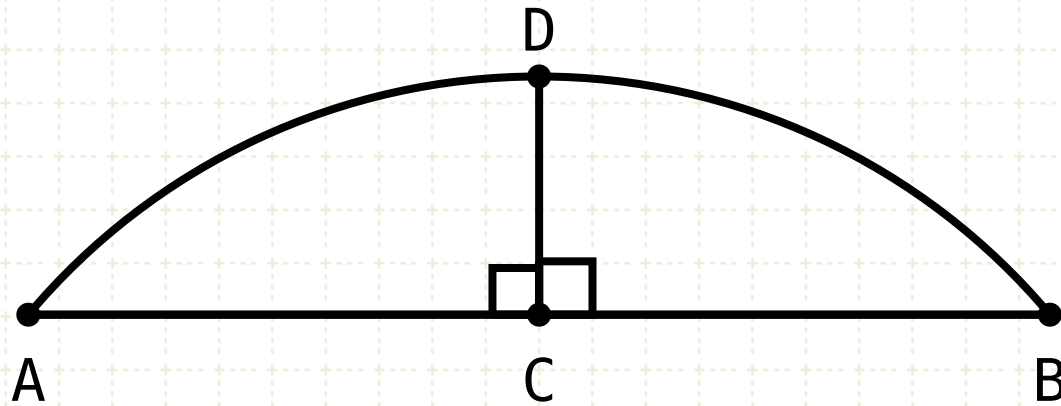
Describe the necessary steps to bisect the circumference ADB

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Draw line AB, and bisect at point C

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Describe the necessary steps to bisect the circumference ADB

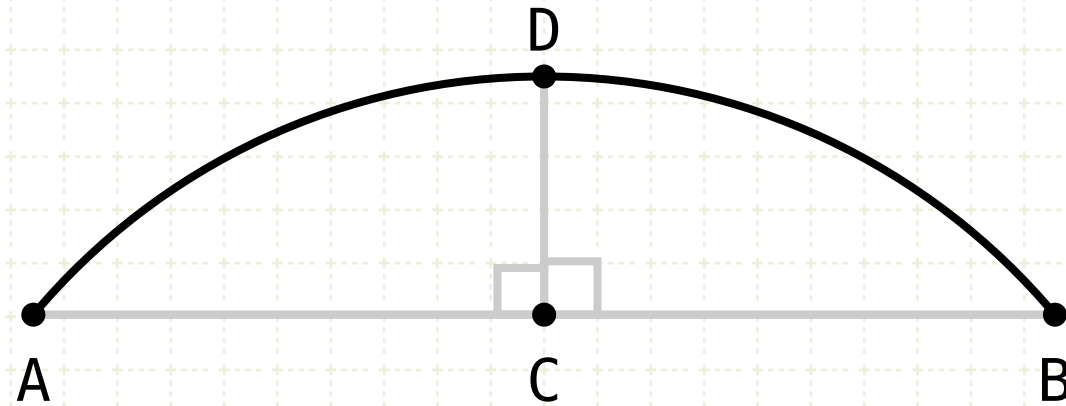
Construction

Draw line AB, and bisect at point C

Draw a line perpendicular to AB, and label the intersection of the circumference point D

Proposition 30 of Book III

To bisect a given circumference.



$$AC = CB$$

$$\angle AD = \angle DB$$

In other words

Describe the necessary steps to bisect the circumference ADB

Construction

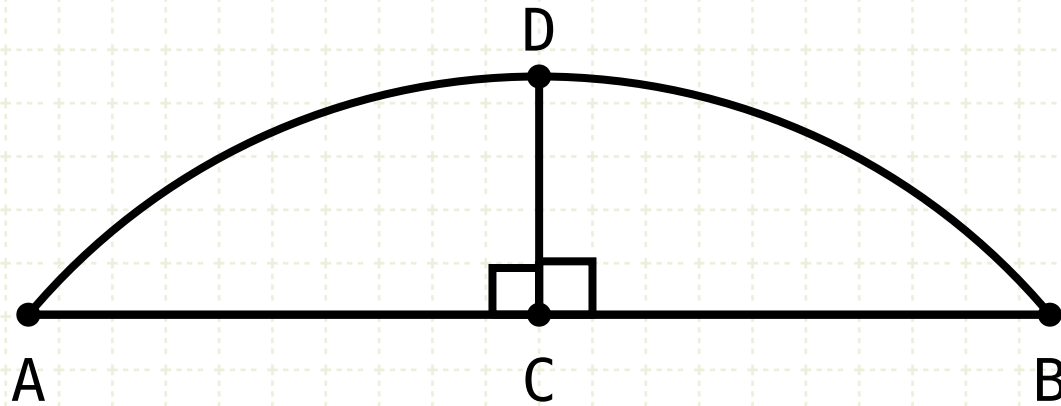
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The point D bisects the circumference ADB

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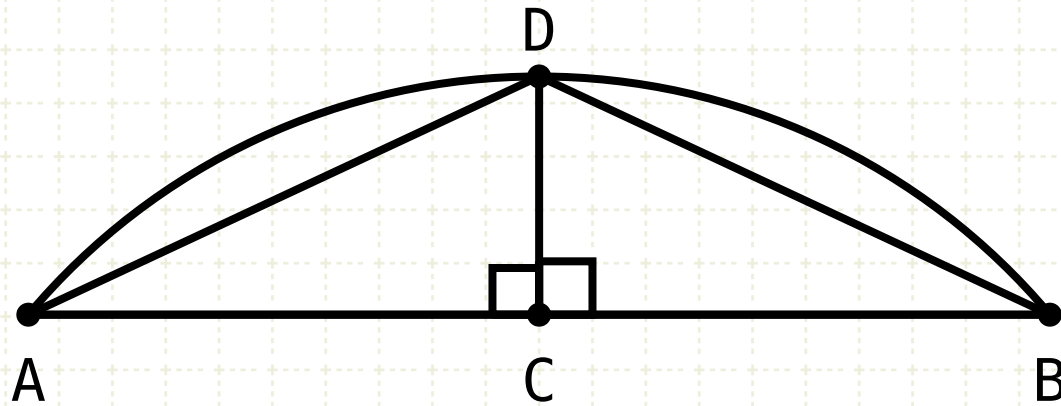
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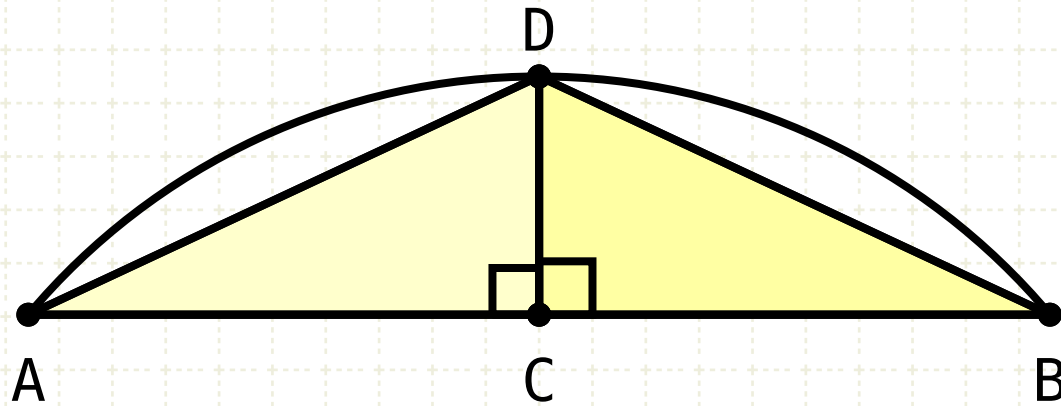
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Draw the lines AD and DB

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$$AC = CB$$

$$\triangle ACD \equiv \triangle DCB$$

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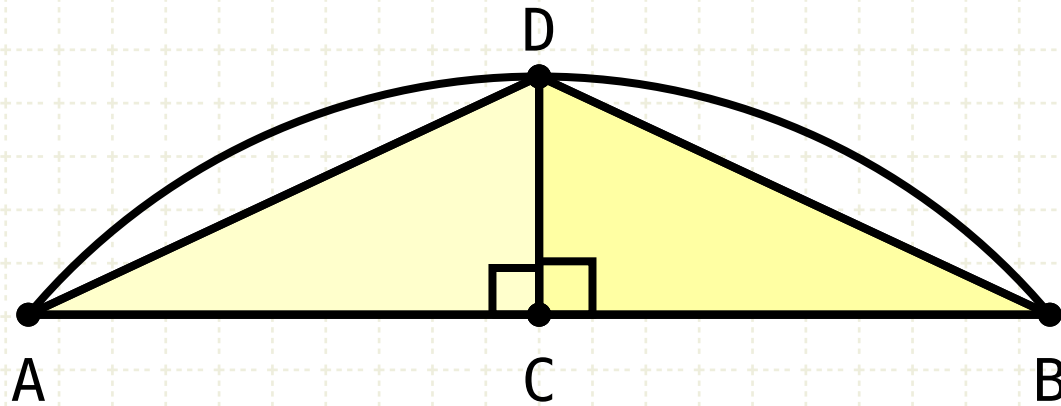
Proof

Draw the lines AD and DB

Since the two triangles ACD and DCB have two sides equal to two sides respectively, and the angles between them are also equal (side-angle-side), then the two triangles are equal in all respects (I.4)

Proposition 30 of Book III

To bisect a given circumference.



$$AC = CB$$

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$$AD = DB$$

In other words

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The point D bisects the circumference ADB

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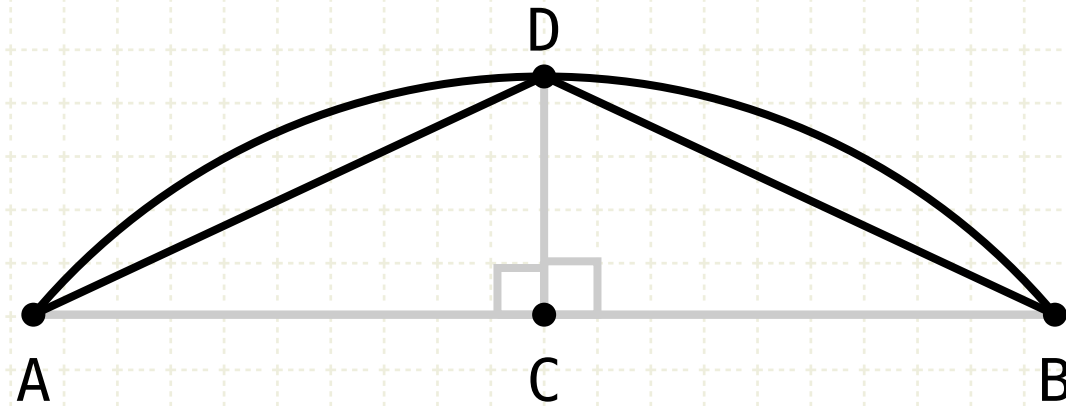
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Since the two triangles ACD and DCB have two sides equal to two sides respectively, and the angles between them are also equal (side-angle-side), then the two triangles are equal in all respects (I-4)

Therefore, AD equals DB

Proposition 30 of Book III

To bisect a given circumference.



$$\begin{aligned}AC &= CB \\ \triangle ACD &\equiv \triangle DCB \\ AD &= DB \\ \sphericalcap AD &= \sphericalcap DB\end{aligned}$$

In other words

Describe the necessary steps to bisect the circumference ADB

Construction

Draw line AB, and bisect at point C

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The point D bisects the circumference ADB

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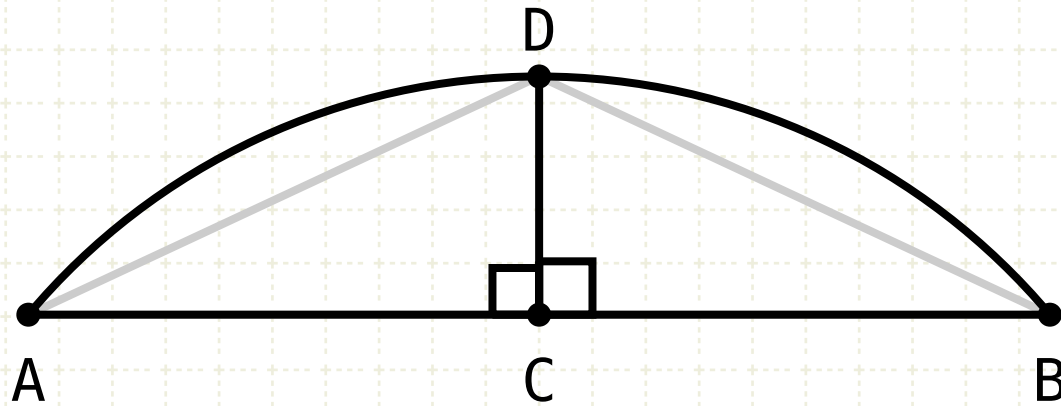
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But equal straight lines cut off equal circumferences (III·28), therefore the circumference AD equals DB

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