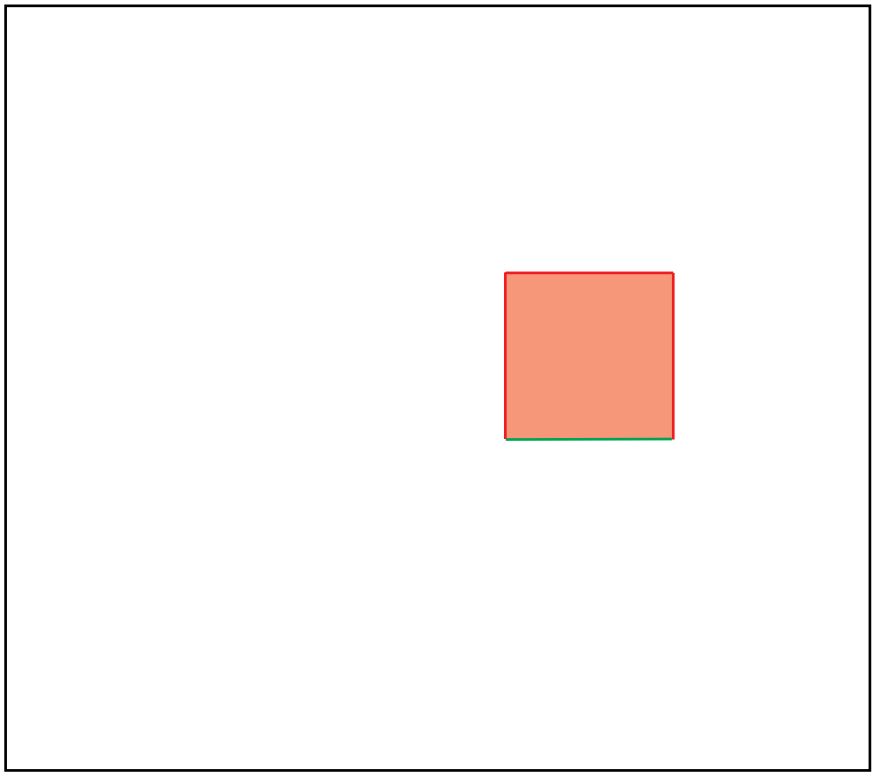
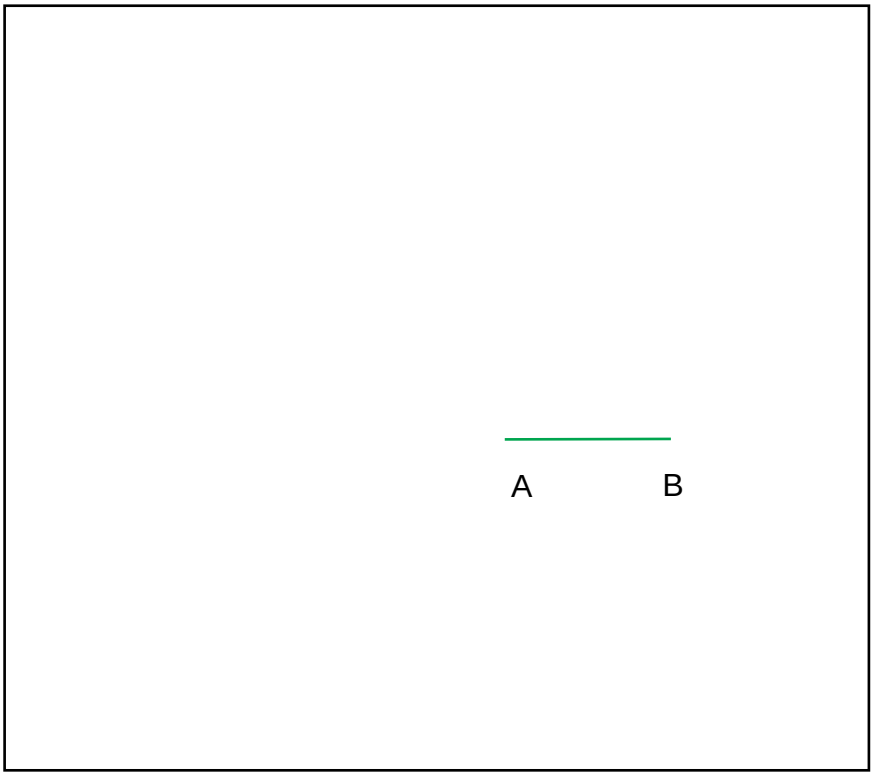
Construction 14: Book I, Proposition 46

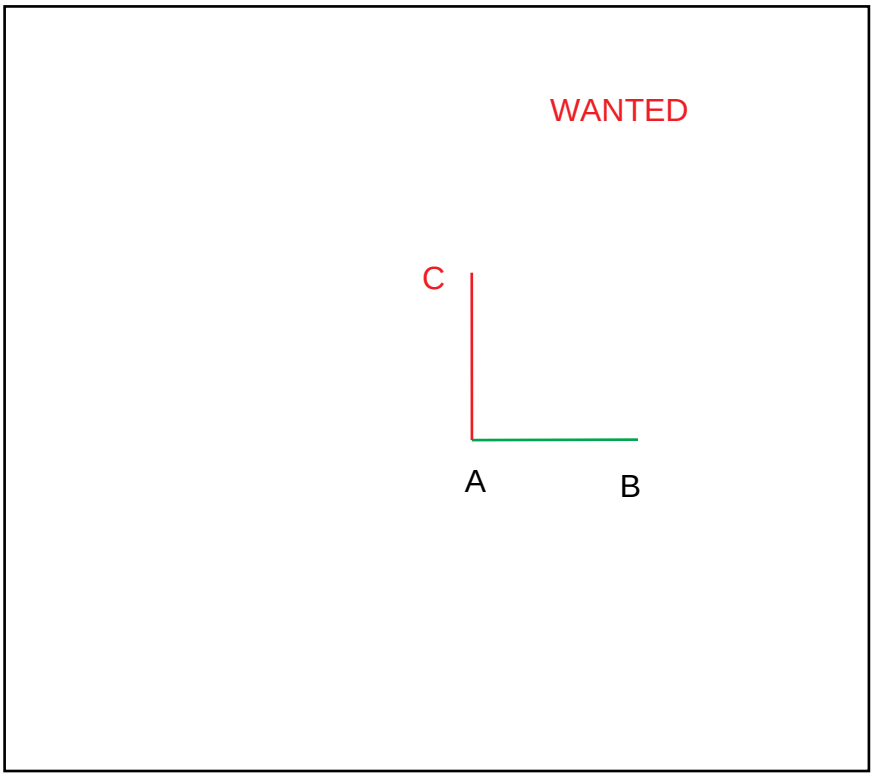
On a given straight line to describe a square.



I.46:2. Let AB be the given straight line.

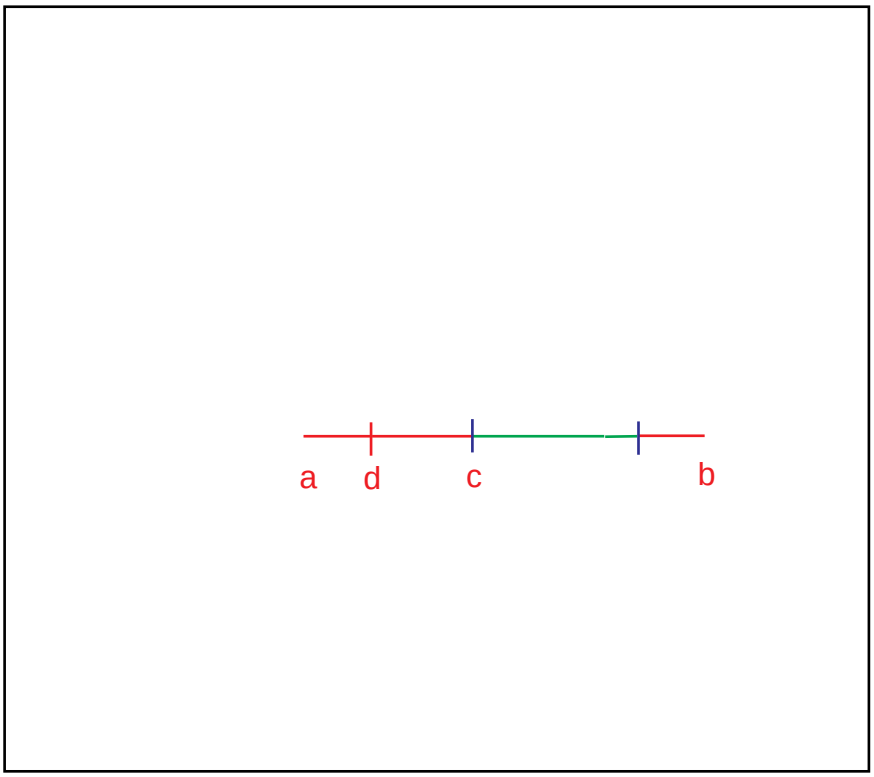


I.46:5. Let AC be drawn at right angles to the straight line AB from the point A on it [I.11];

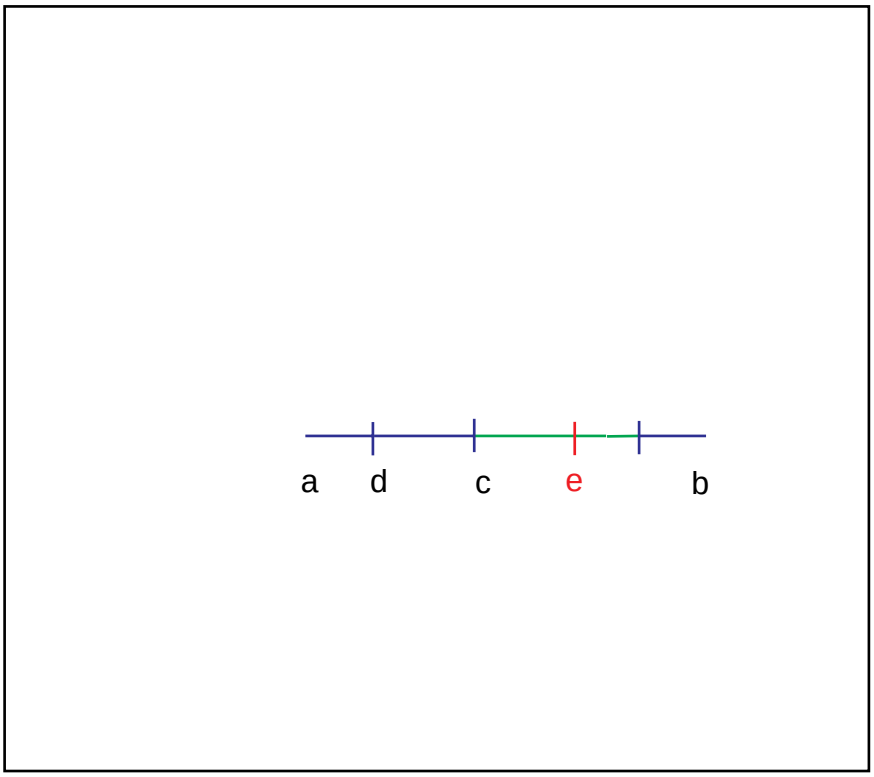


GOSUB I.11
Extend AB, relabel.

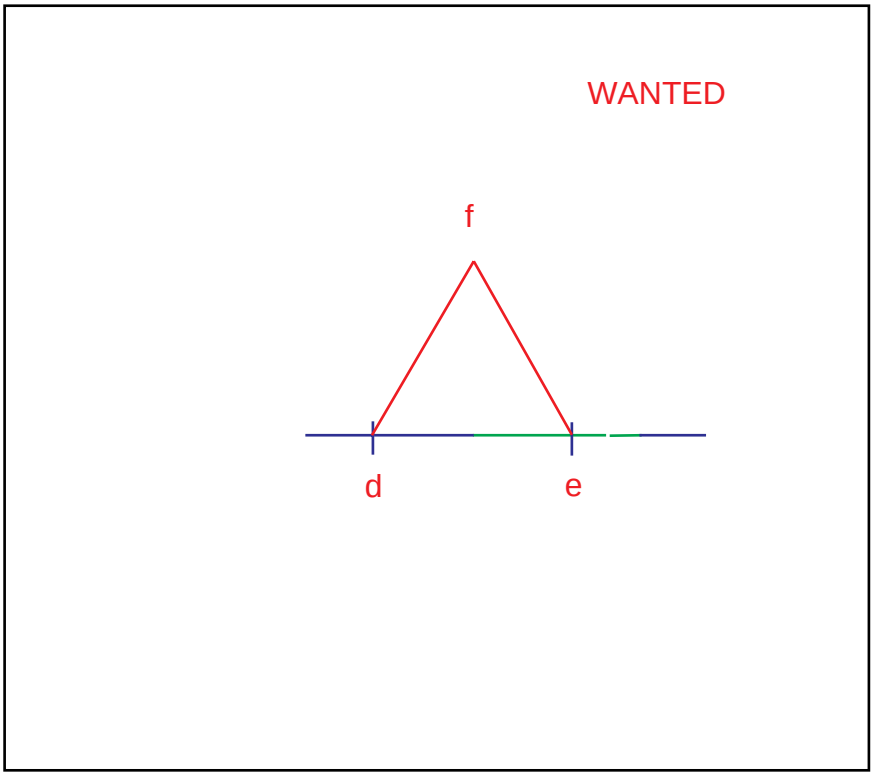
I.11:8. Let a point d be taken at random on ac;



I.11:10. let ce be made equal to cd; [I.3] (dividers)

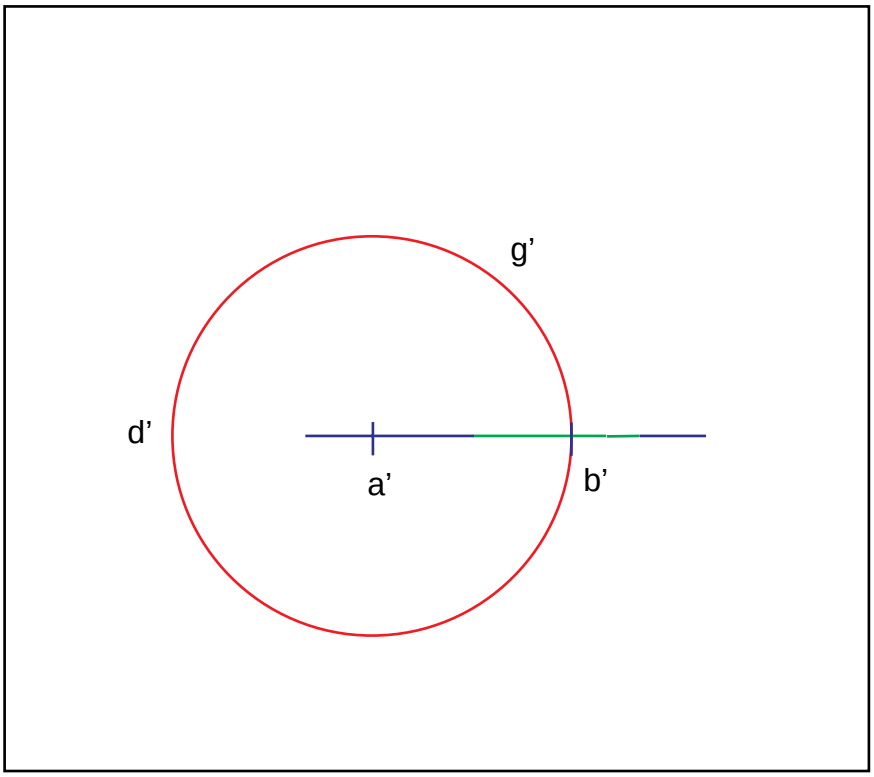


I.11:11. on de let the equilateral triangle fde be constructed, [I.1]

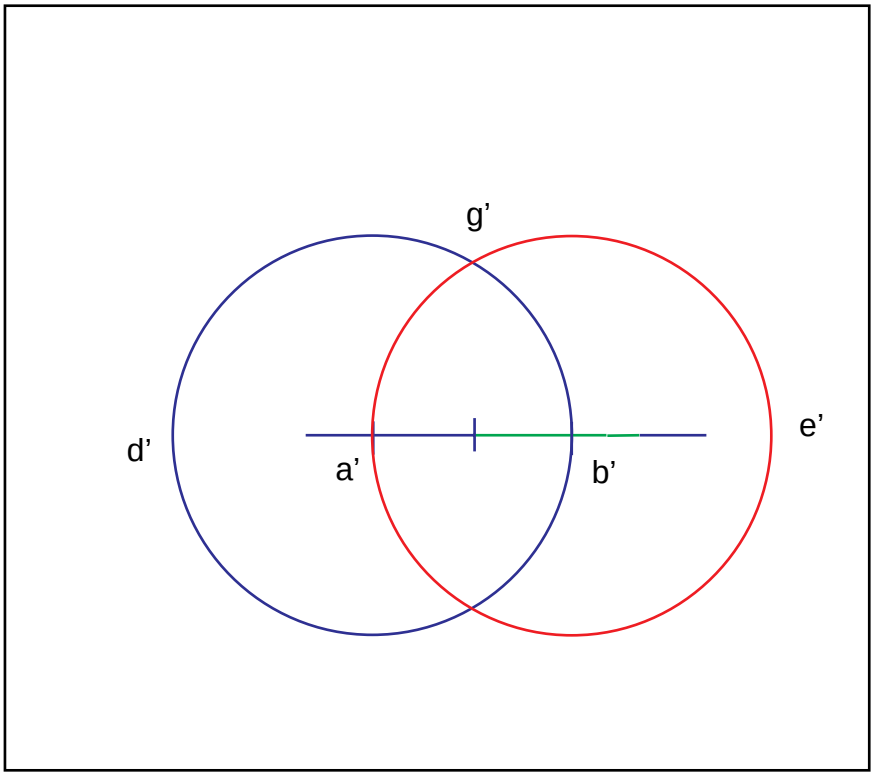


GOSUB I.1.
Relabel.

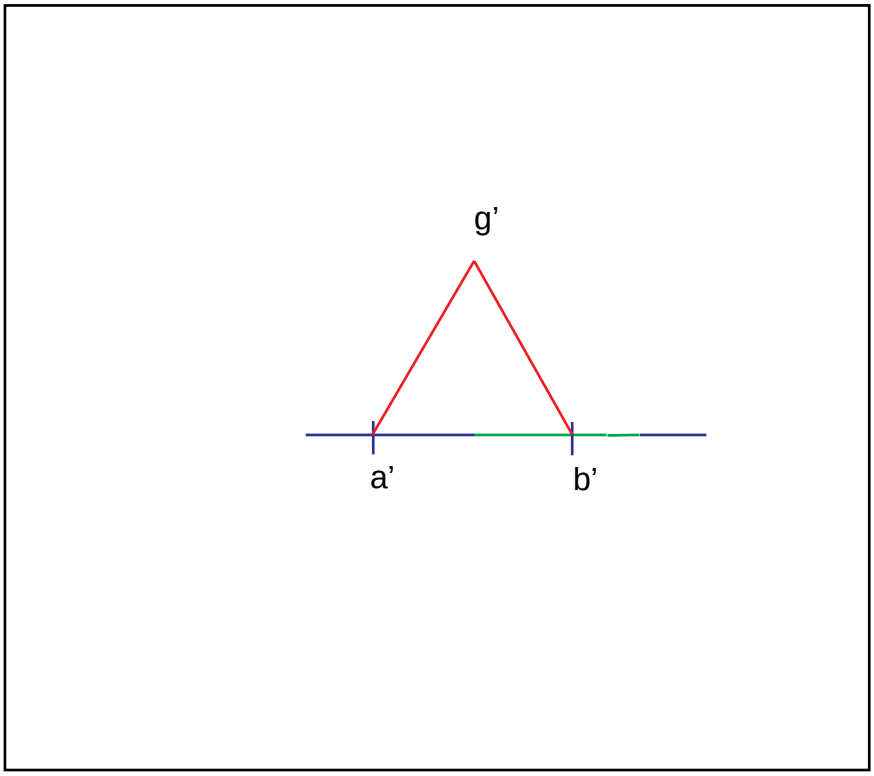
I.1:7. with centre a’ and distance a’b’ let the circle b’g’d’ be described; [Post. 3]



I.1:10 again, with centre b'and distance b'a'let the circle a'g'e' be described; [Post. 3]



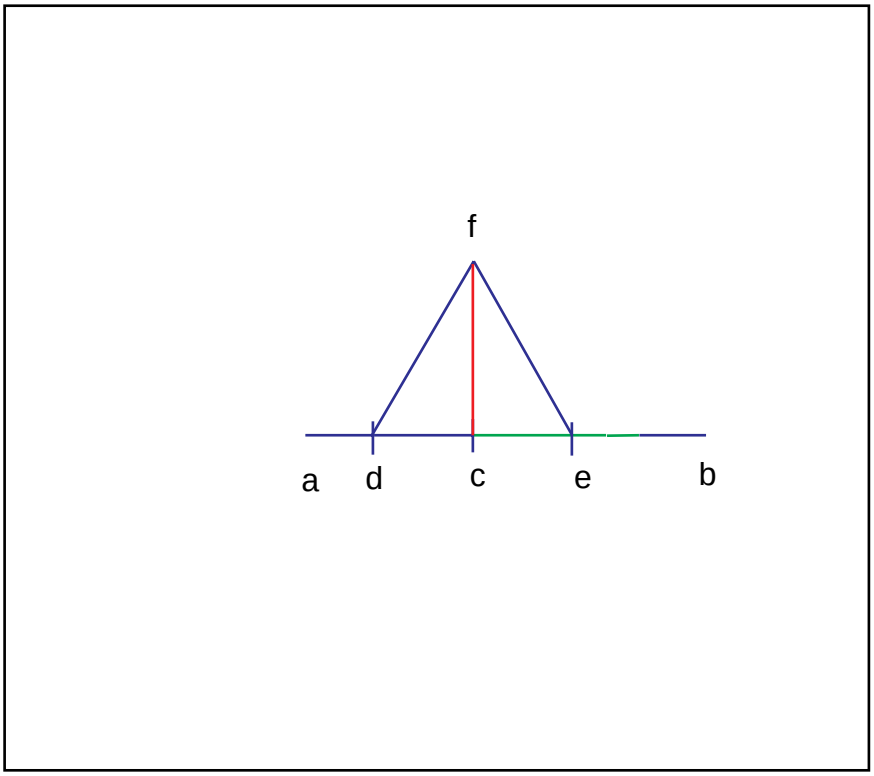
I.1:13. and from the point g', in which the circles cut one another, to the points a', b' let the straight lines g'a', g'b' be joined.



(These two lines are not really necessary)

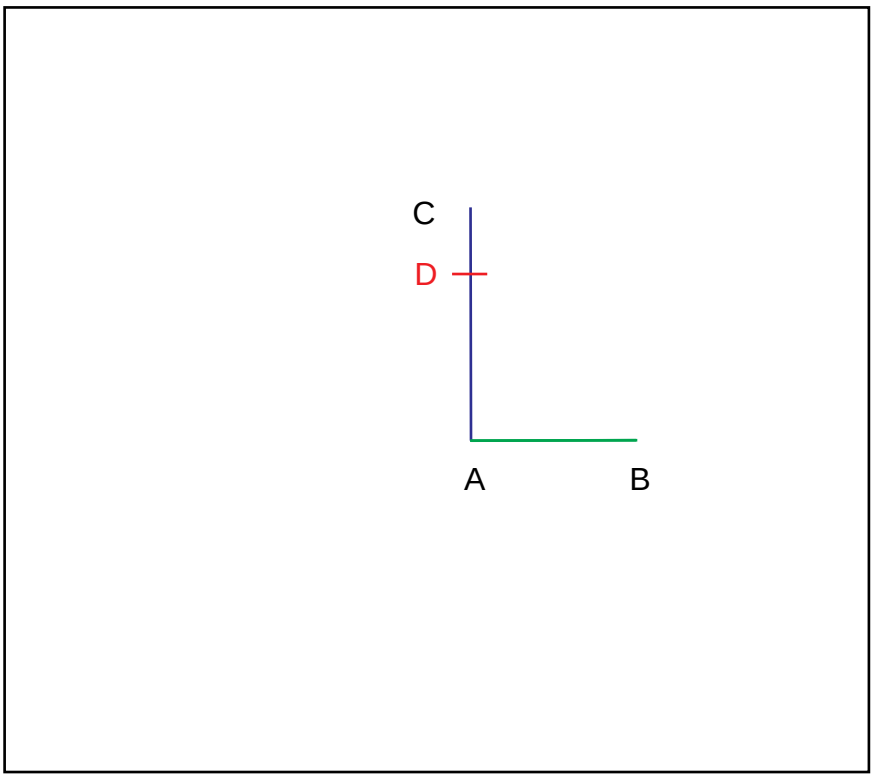
RETURN to I.11 at line 11. Relabel.

I.11:13. and let fc be joined



RETURN to I.46 at line 5.
Cleanup, relabel.

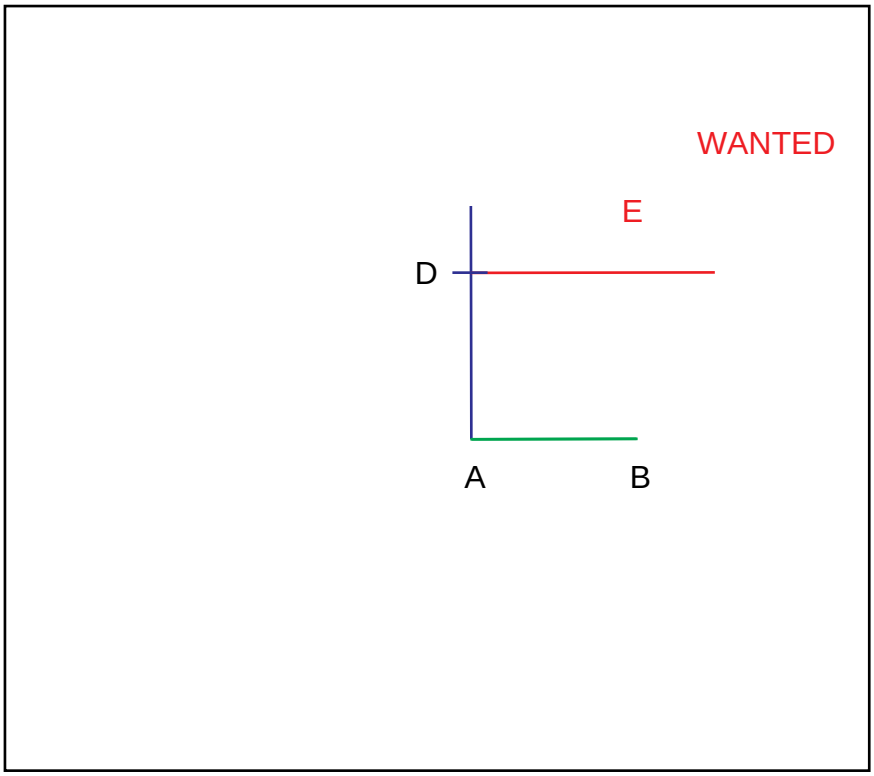
I.46:7. and let AD be made equal to AB;
[I.3], (dividers)



I.46:9. through the point D let DE be drawn parallel to AB, [I.31]

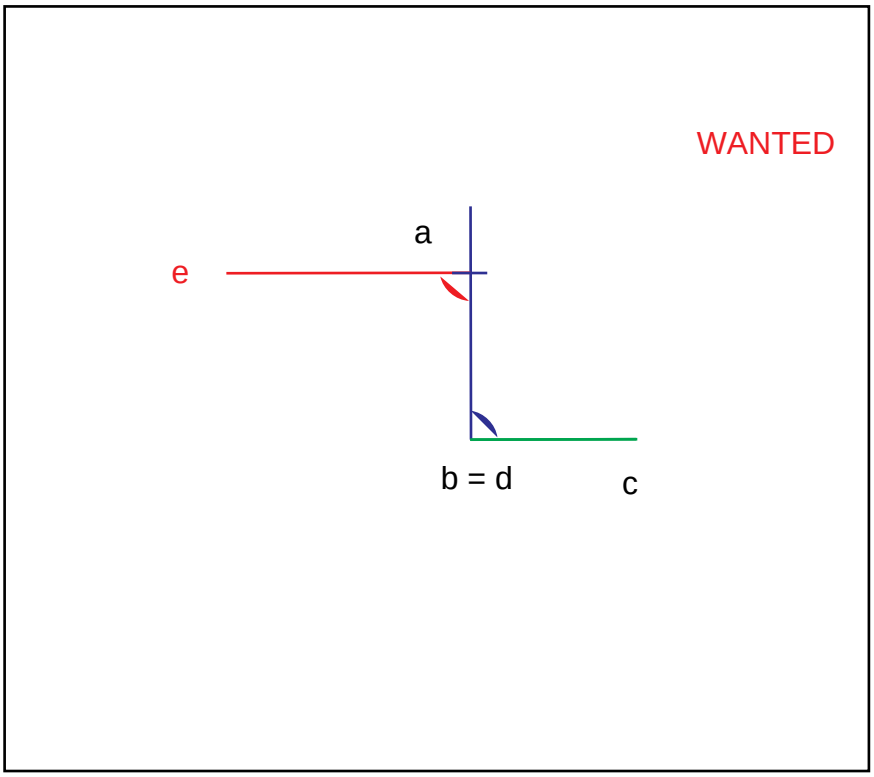
NOTE: We could use I.11 here.

GOSUB I.31.
Relabel.

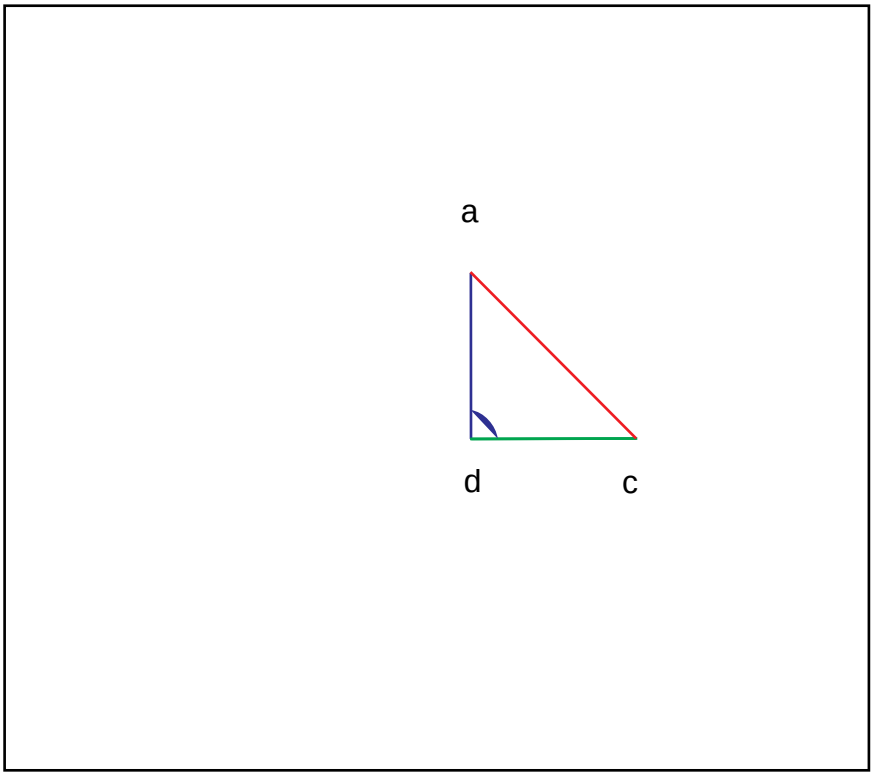


I.31:7. Let a point d be taken at random on bc, (we choose d = b) and let ad be joined; on the straight line da and at the point a on it, let the angle dae be constructed equal to the angle adc [I.23]

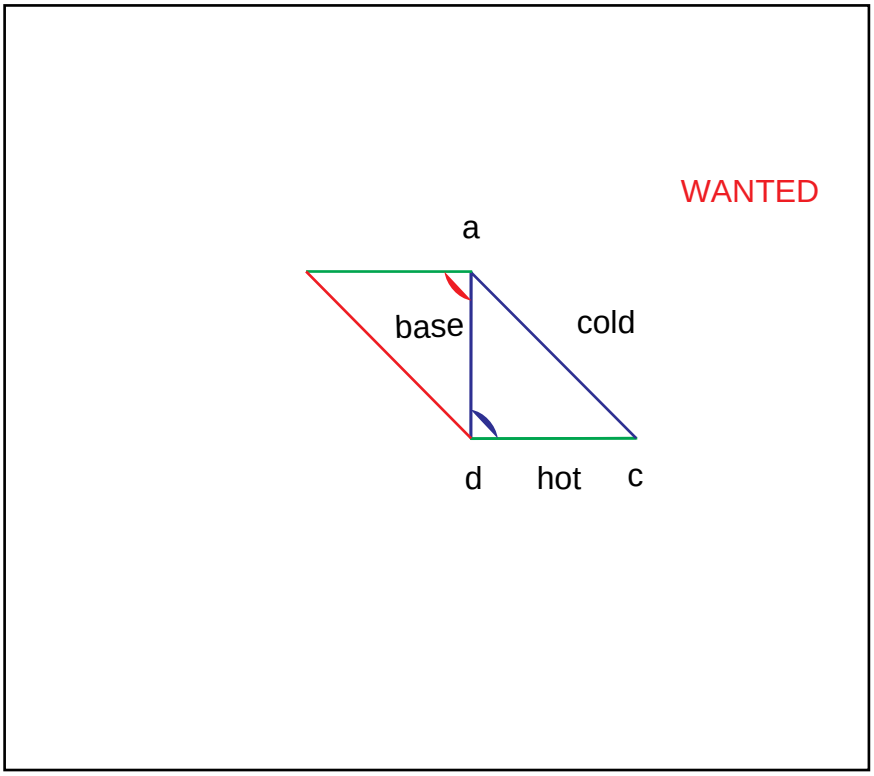
GOSUB I.23.
(skip relabelling)



I.23:10. let ac be joined.

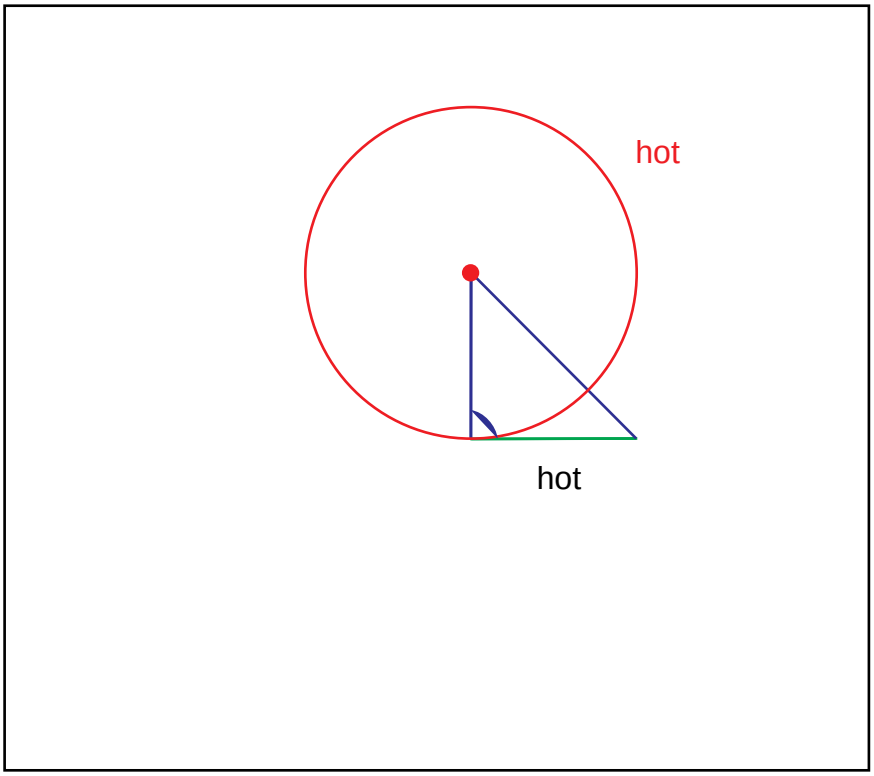


I.23:11.
(Paraphrase).
Move the triangle, rotating around the midpoint of the base ad. [I.22]

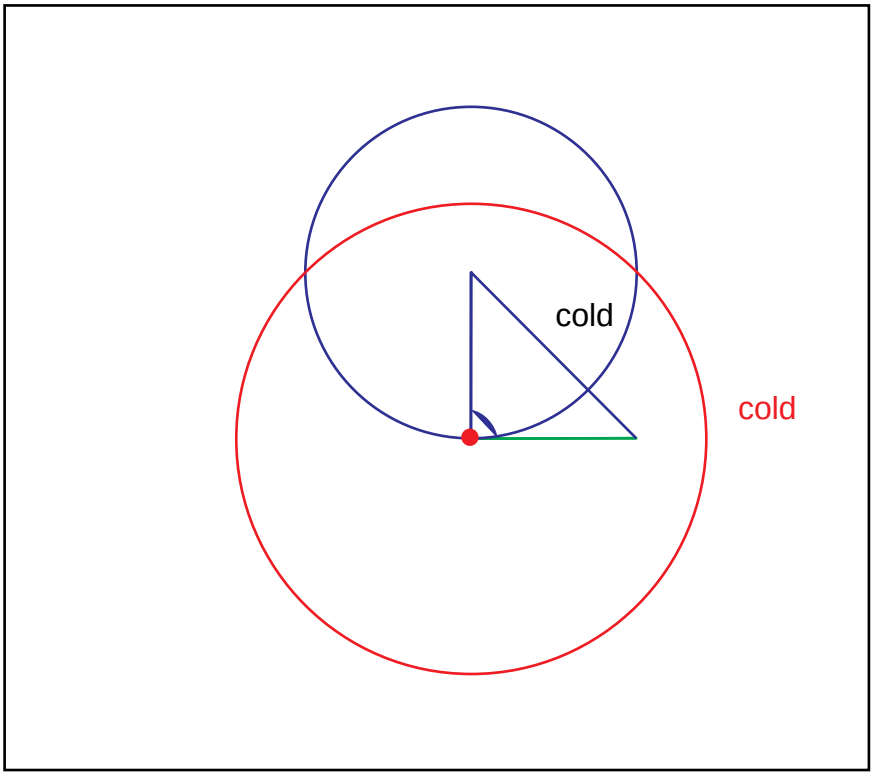


GOSUB I.22P.

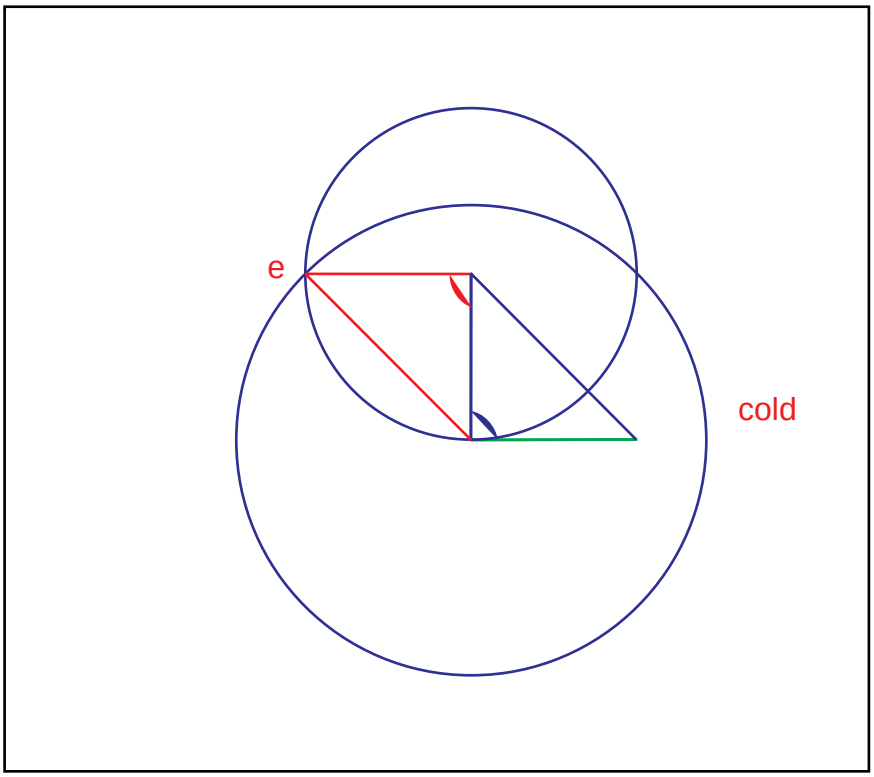
Move the hot arm, swing it.



Move the cold arm, swing it.



Connect the crossing point on the opposite side to the ends of the base.

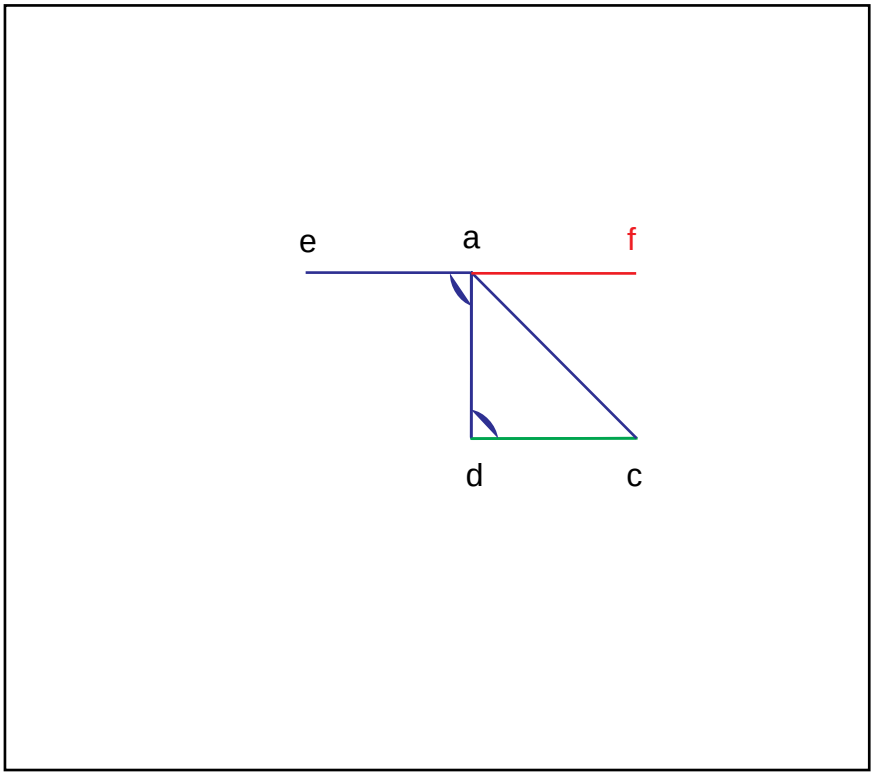


Cleanup. RETURN to I.23 at line 11.

RETURN to I.31 at line 9.
Cleanup.

Restore labels.

I.31:11. and let the straight line af be produced in a straight line with ea.

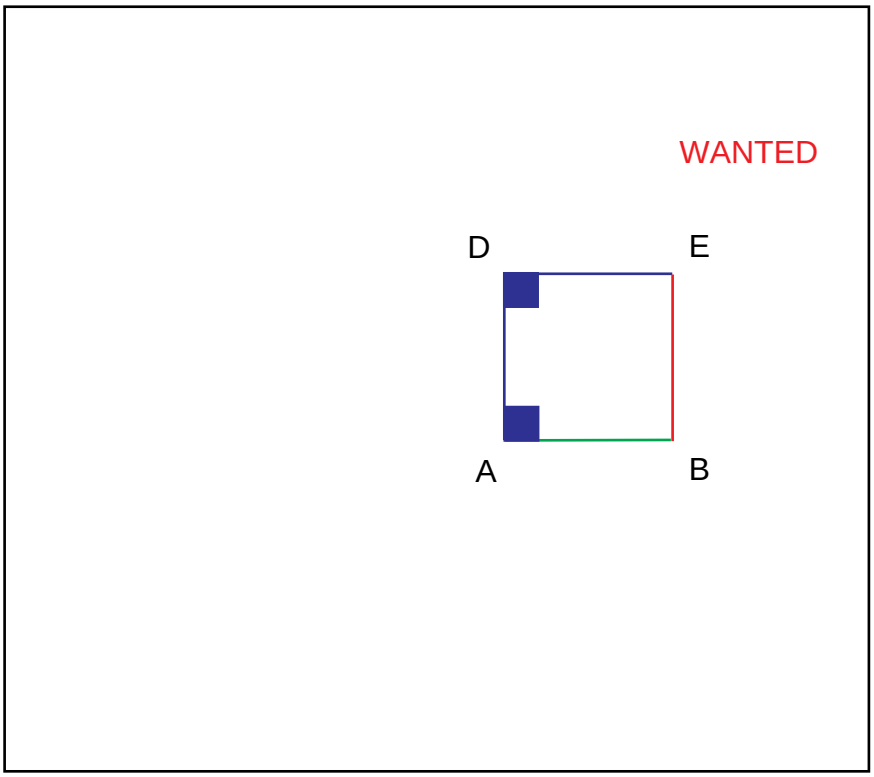


RETURN to I.46 at line 9.
Cleanup. Relabel.

I.46:11. and through the point B let BE be drawn parallel to AD. [I.31]

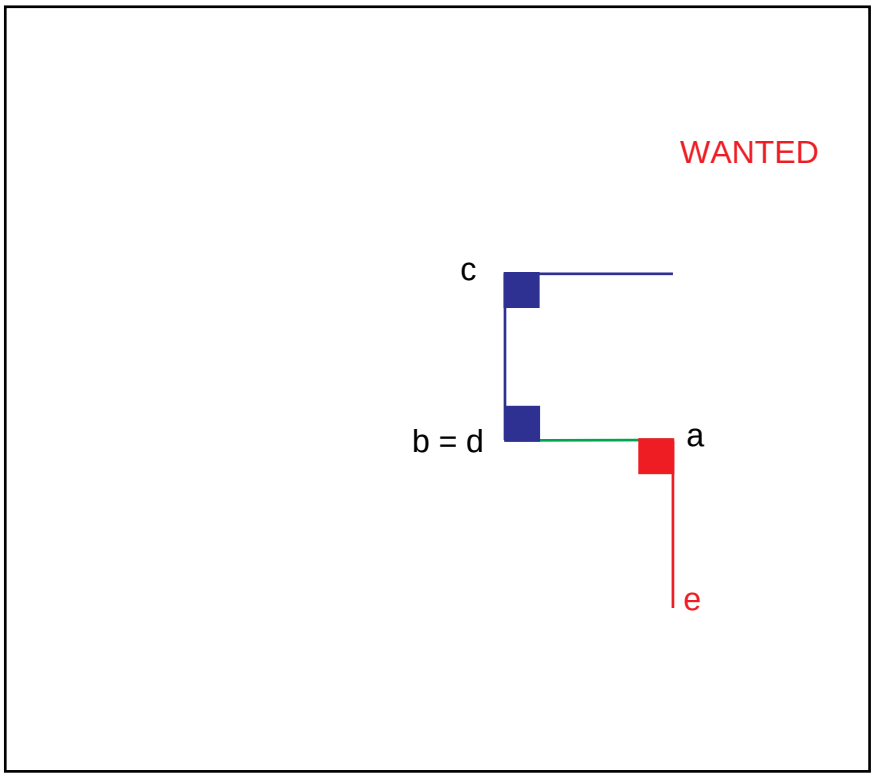
NOTE: Again I.31! And again, we could use I.11, but we will follow Euclid.

GOSUB I.31.
Relabel.

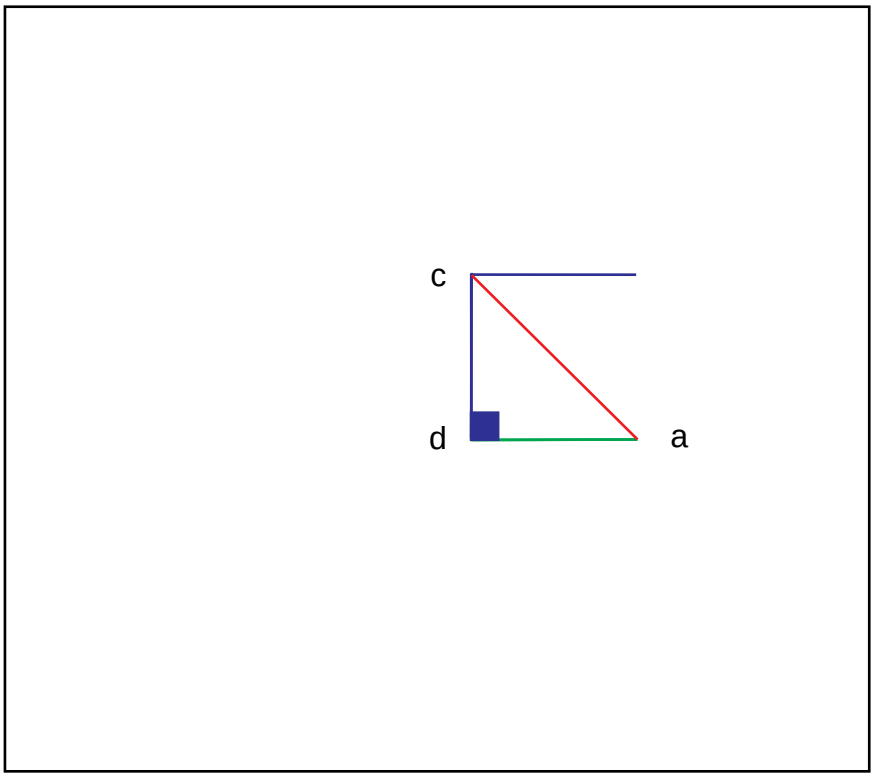


I.31:8. on the straight line da, and at the point a on it, let the angle dae be conbstructed equal to the angle adc [I.23];

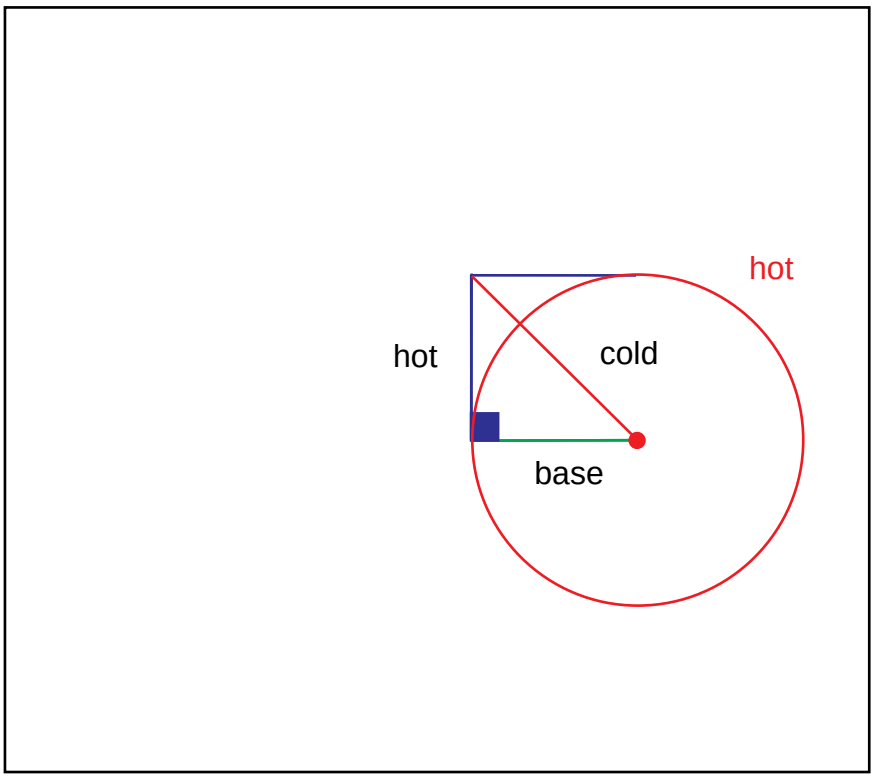
Now we repeat steps 7, 8, 9, 10, 11.



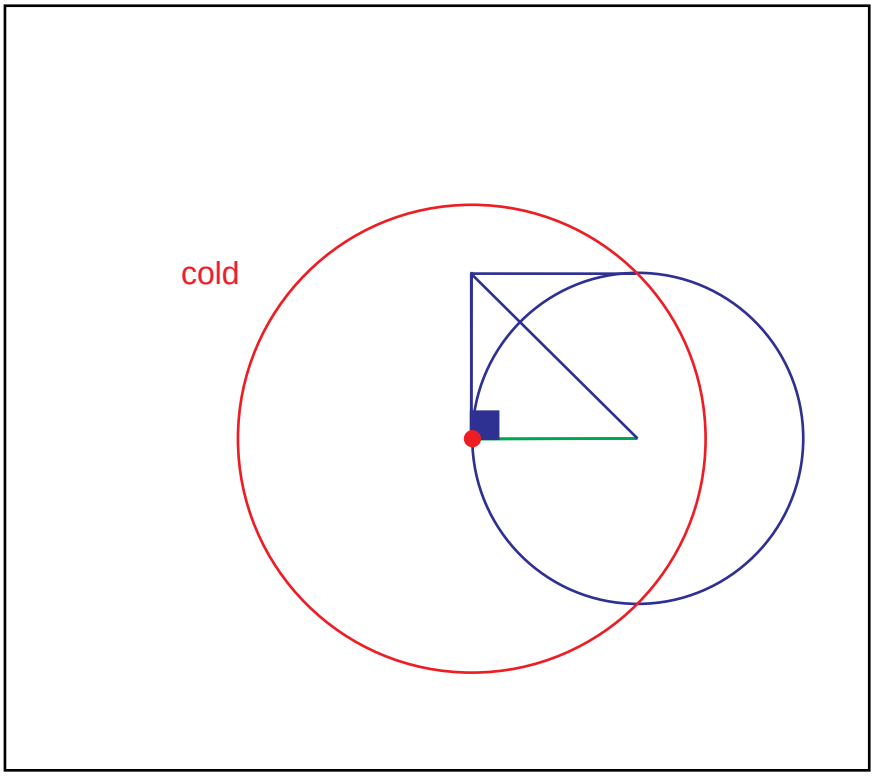
I.23:10. let ac be joined.



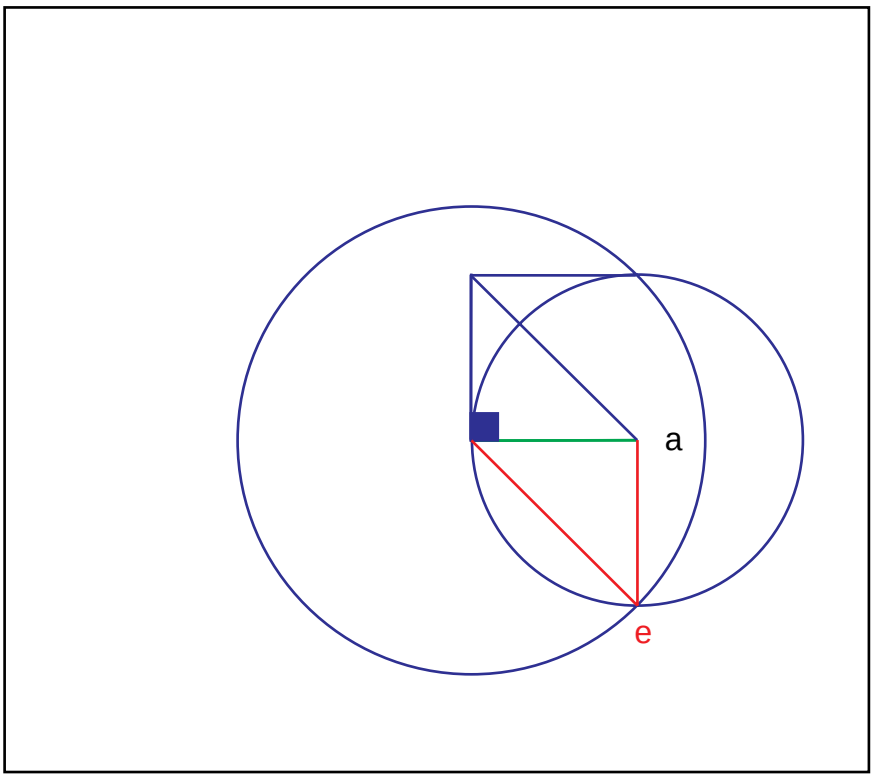
I.22P. Swing hot.



I.22P. Swing cold.

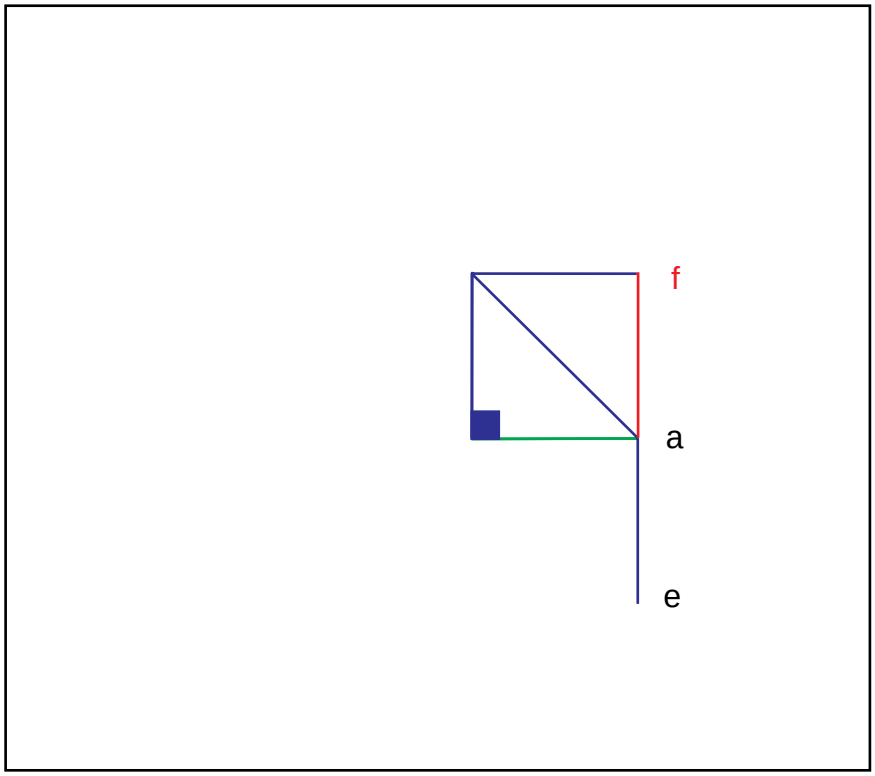


I.22P. Connect.



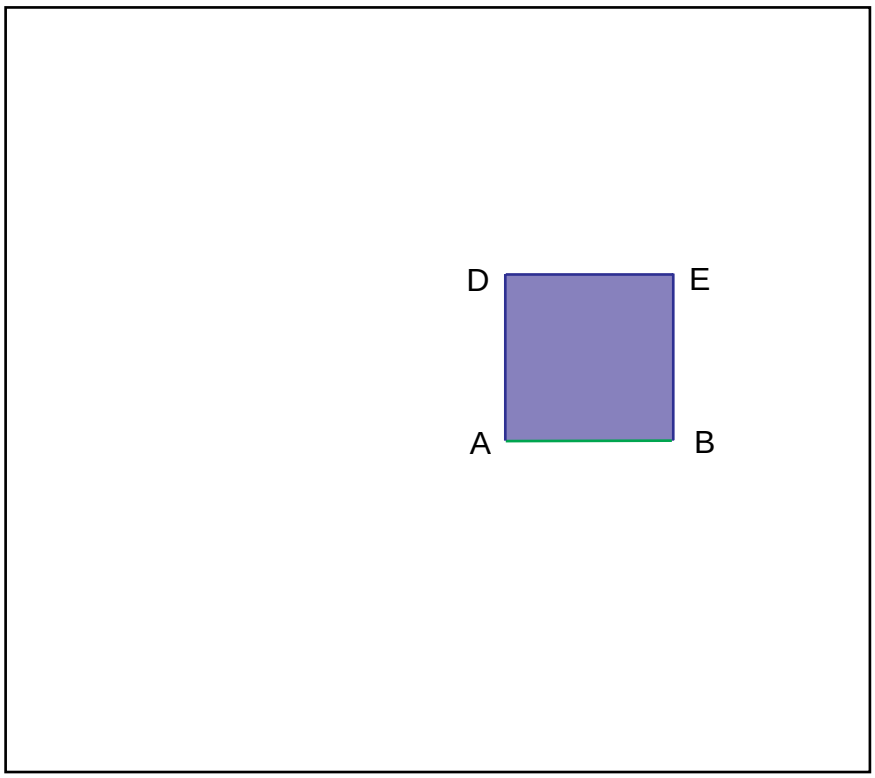
Cleanup. RETURN to I.31 at line 9.

I.37:11. and let the straight line af be produced in a straight line with ea.



Cleanup.
RETURN to I.46 at line 11.
Relabel.

I.46:30. it is a square; and it is described on the line AB.



Q.E.F.