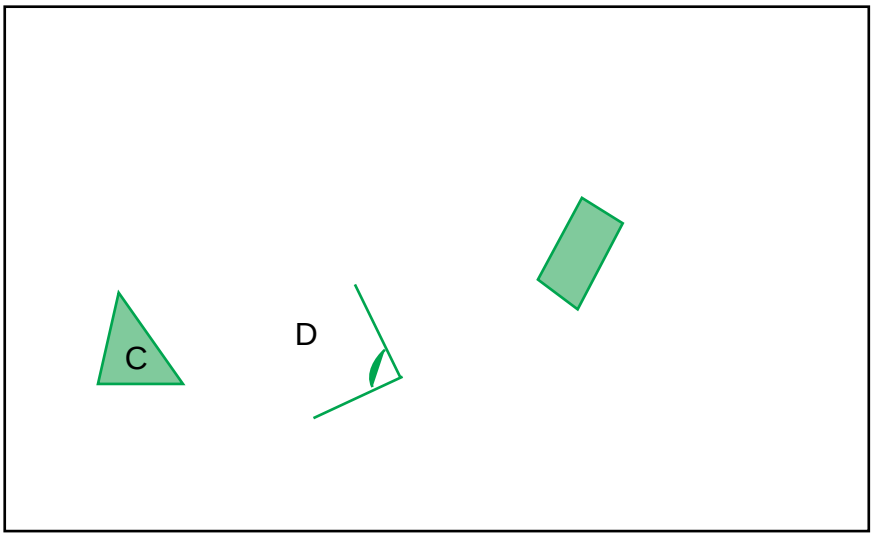
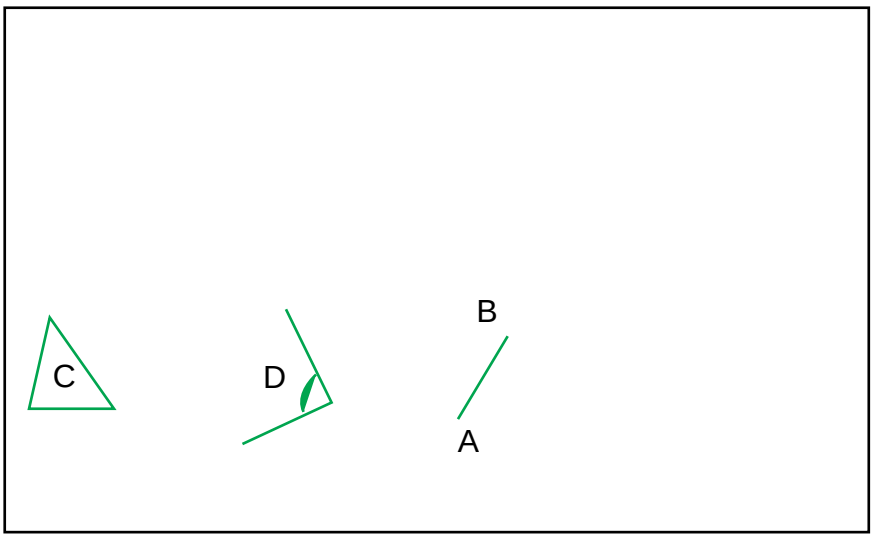
Construction 12B: Book I, Proposition 44

(The Application of Areas)

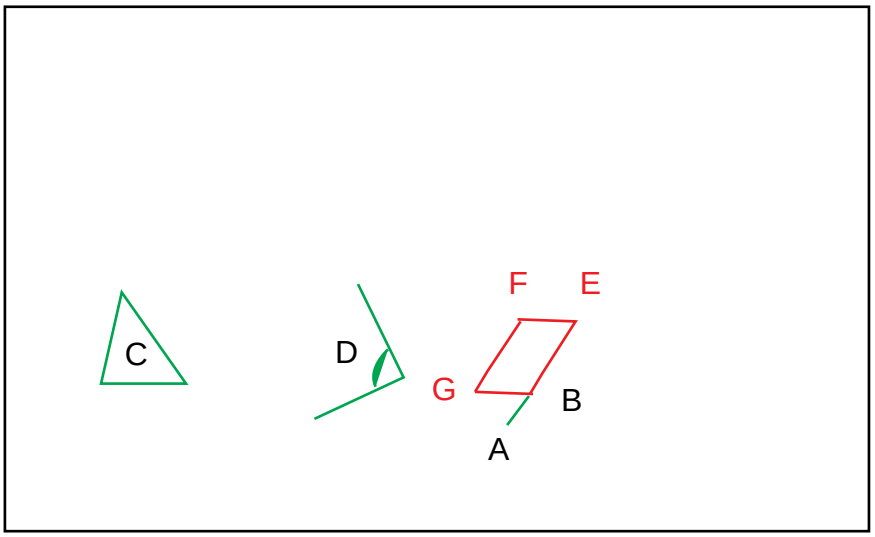
To a given straight line to apply, in a given rectilineal angle, a parallelogram equal to a given triangle.



I.44:3. Let AB be the given straight line, C the given triangle and D the given rectilineal angle;

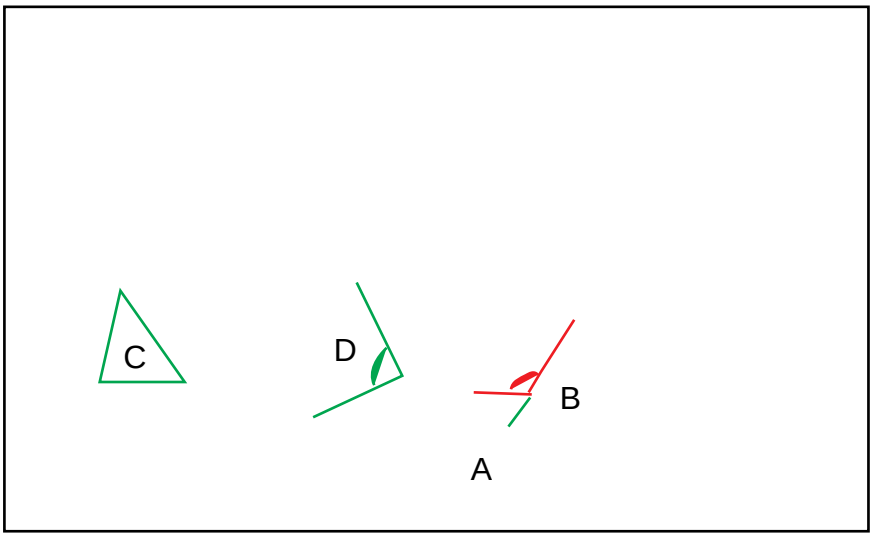


I.44:8. Let the parallelogram BEFG be constructed equal to the triangle C, in the angle EBG which is equal to D [I.42]; and let it be placed so that BE is in a straight line with AB;



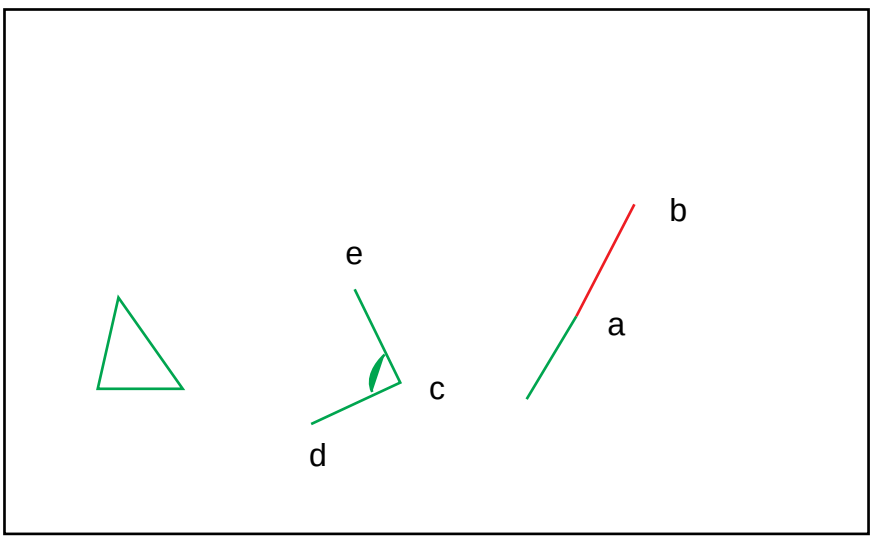
As an alternatifve to the construction #12A, suggested by Euclid's call to [I.42] before the instuction to place BE in line with AB, we will (A) move the angle D to the point B, with one side in line with AB. Then we must (B) move triangle C into the moved angle, before calling I.42.

Move the angle D in line with AB. [I.23]

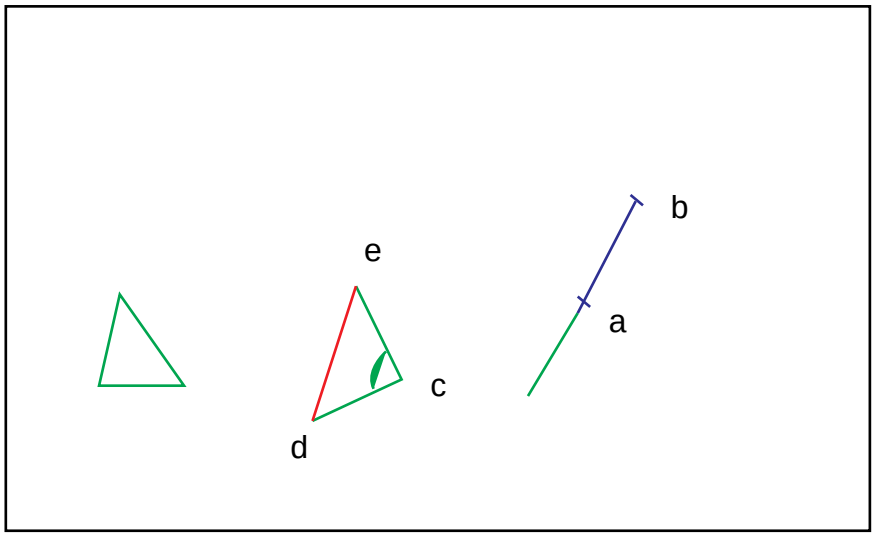


Extend the line AB upwards.

GOSUB I.23. Relabel.

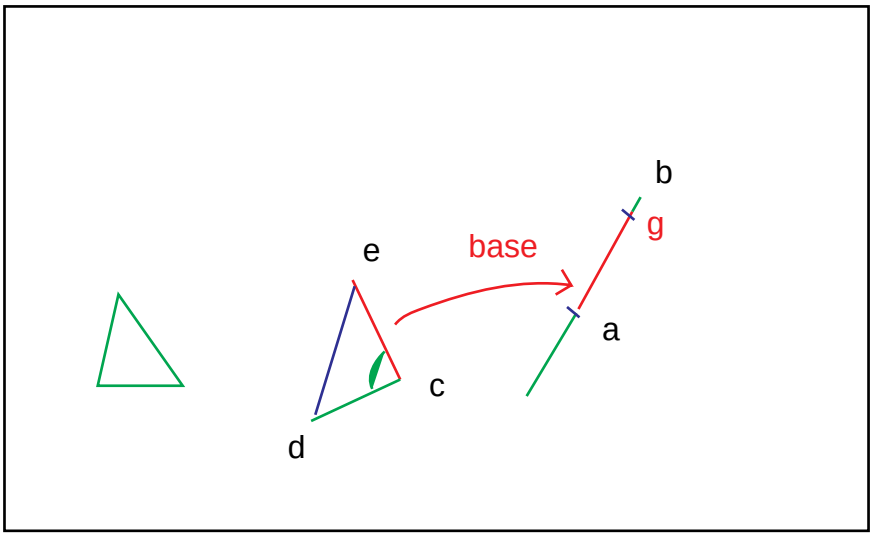


I.23:8. On the straight lines cd, ce respectively let the points d, e be taken at random; let de be joined.

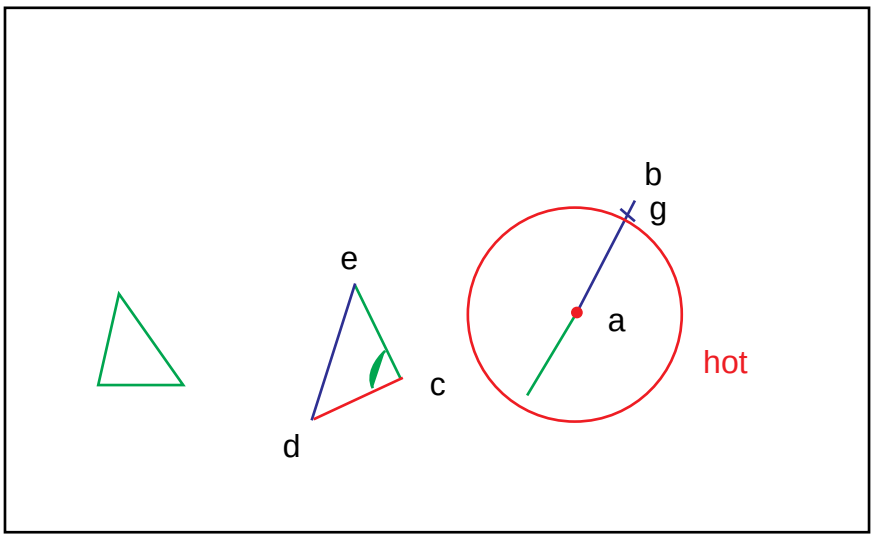


I.23:11. and out of three straight lines which are equal to the three straight lines cd, de, ce let the triangle afg be constructed in such a way that cd is equal to af, ce to ag, and further de to fg. [I.22]. In addition we want ag on ad, so we must call upon [I.22P], not [I.22]. Move the base ce to ag on ab.

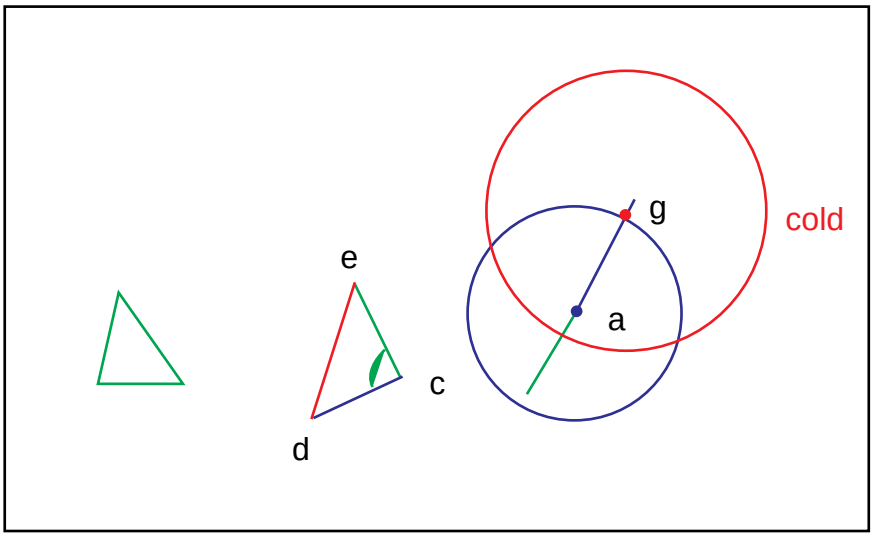
GOSUB I.22P.



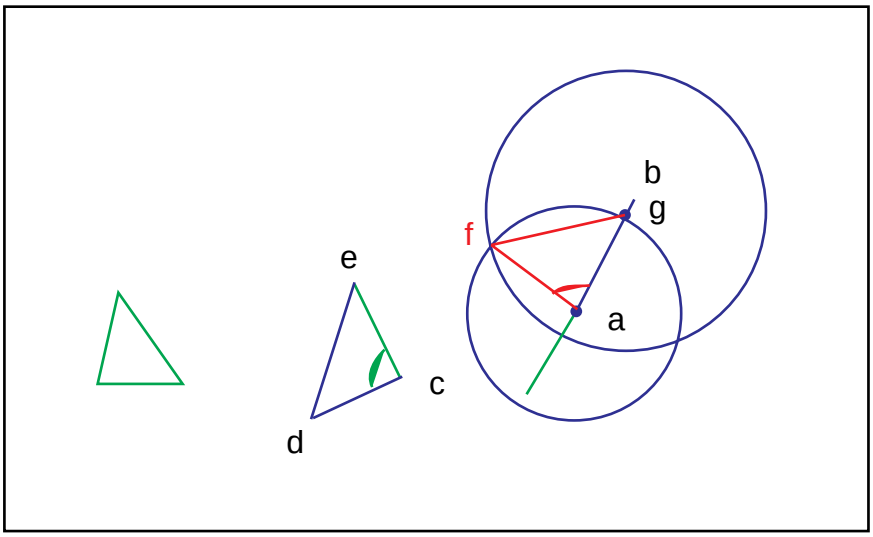
Move the hot arm, cd, swing it around the hot end of the moved base, a.



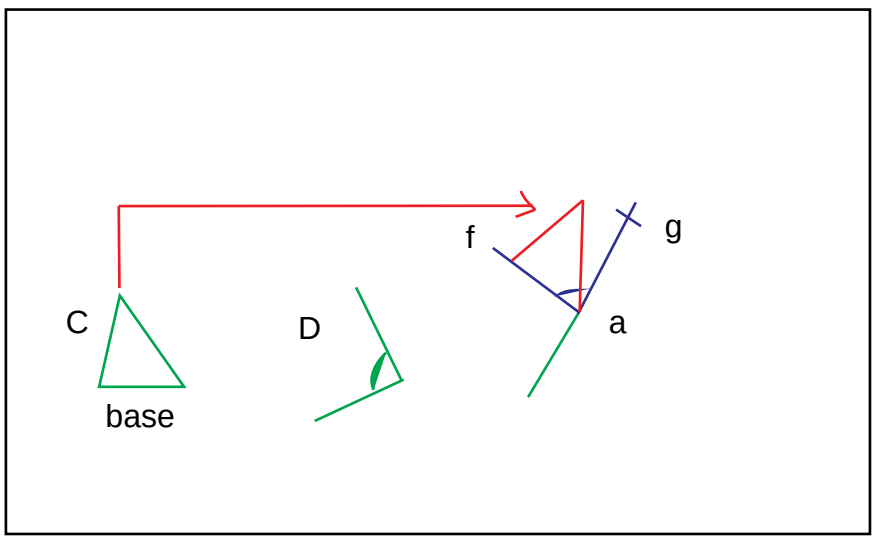
Move the cold arm, de, and swing it around the cold end, g, of the moved base.



Locate the crossing point of the two circles on the left side of ab, f, and complete the moved triangle.

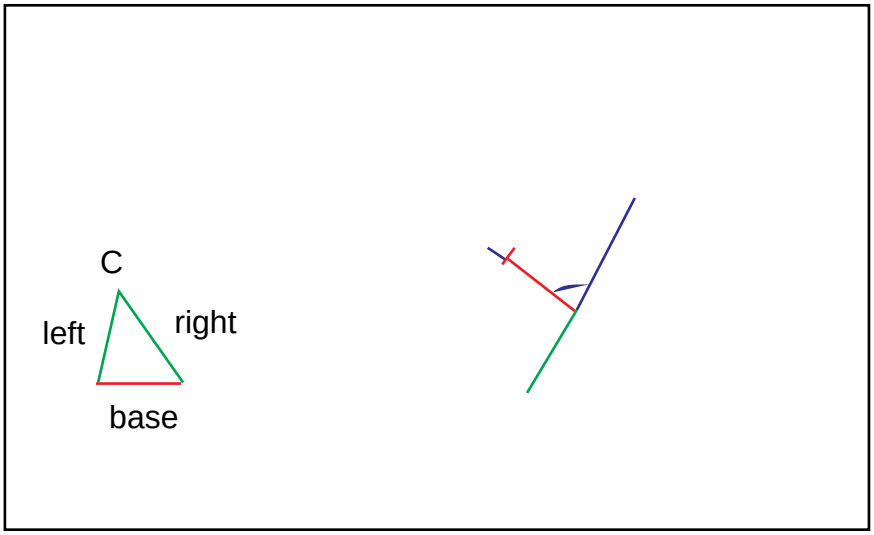


Cleanup, and return. Step A) is done. Now B): move the given triangle C, into the moved angle fag, to sit on the base, fa.

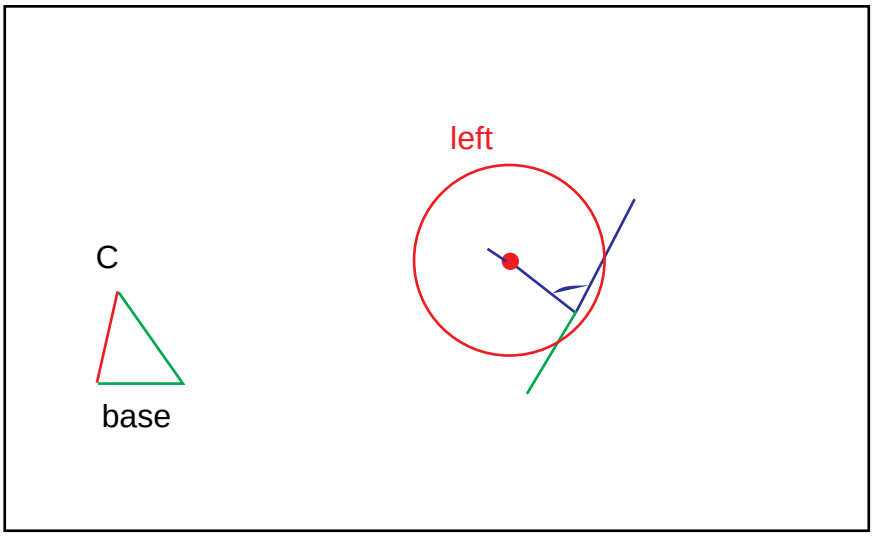


GOSUB I.22P.

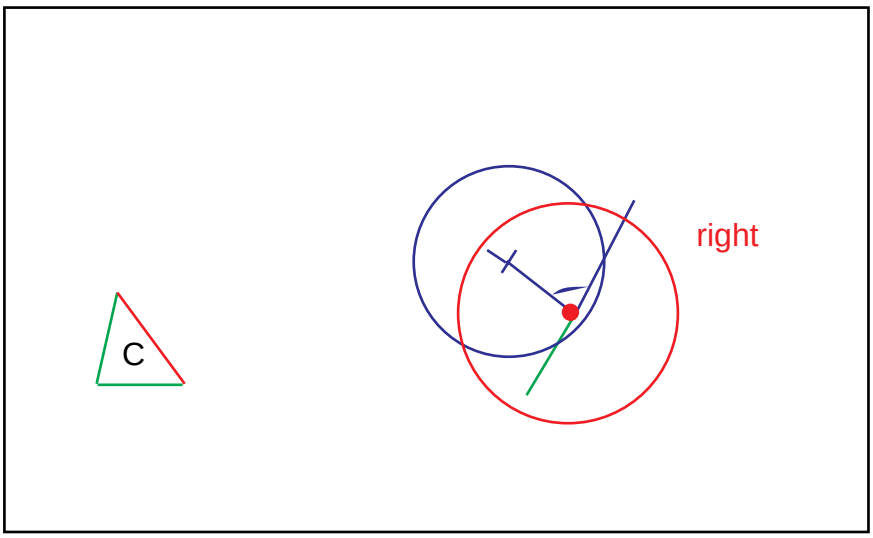
Extend af and move the base.



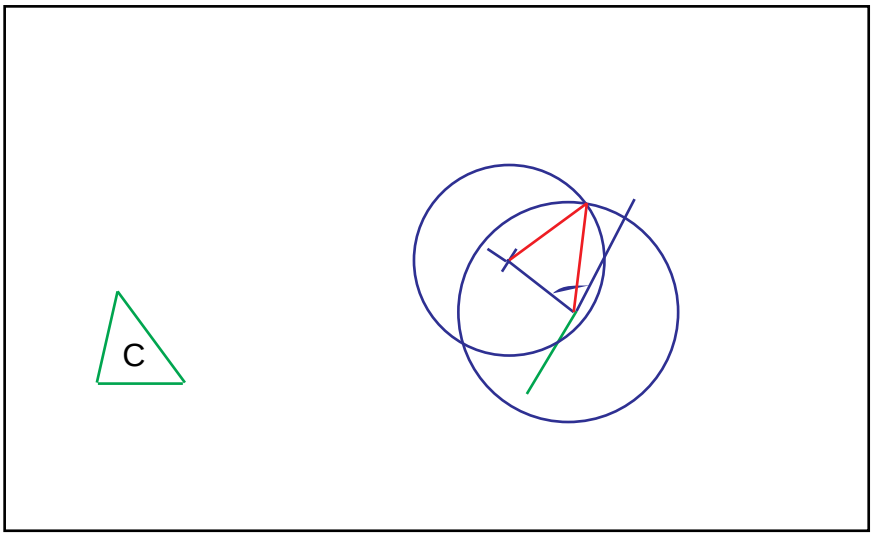
Swing the left arm of C around the left end of the moved base.



Swing the right arm of C around the right end of the moved base.

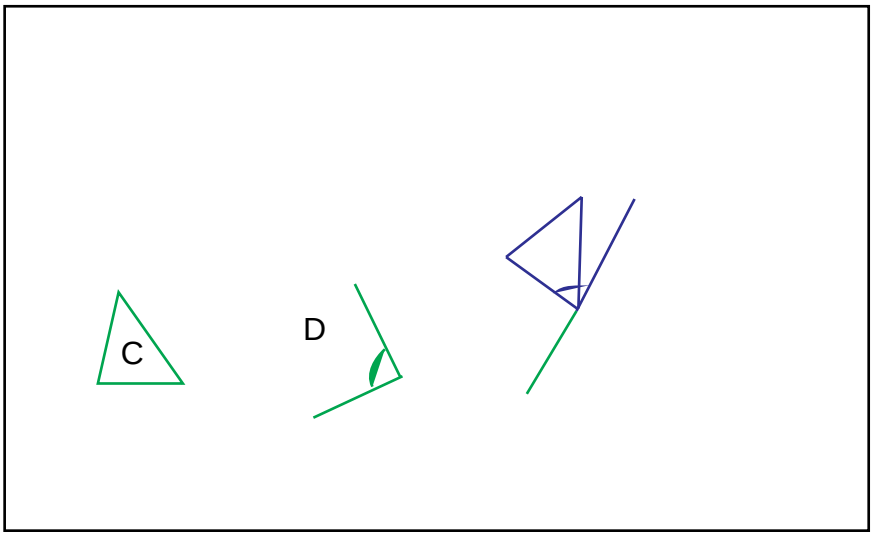


Select the upper crossing point and connect to each end of the moved base.

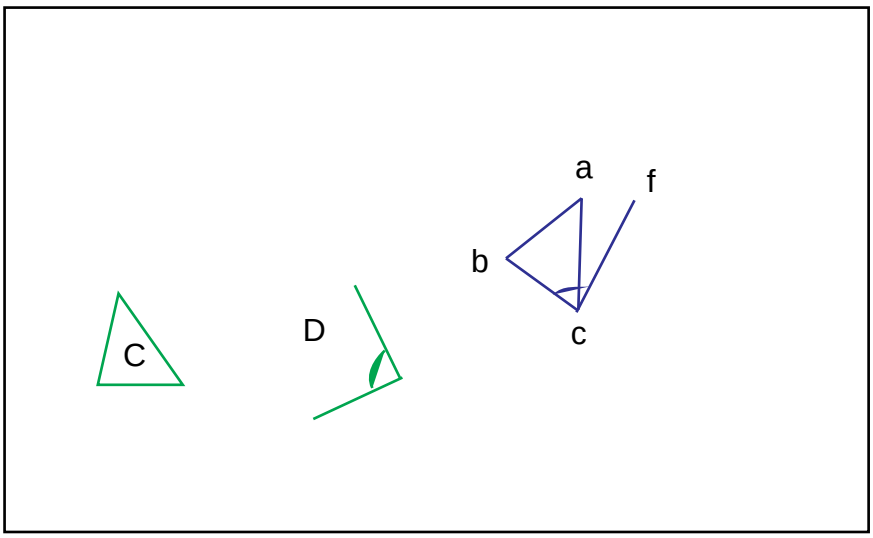


Step B is done. Cleanup and RETURN. Both C and D have been moved.

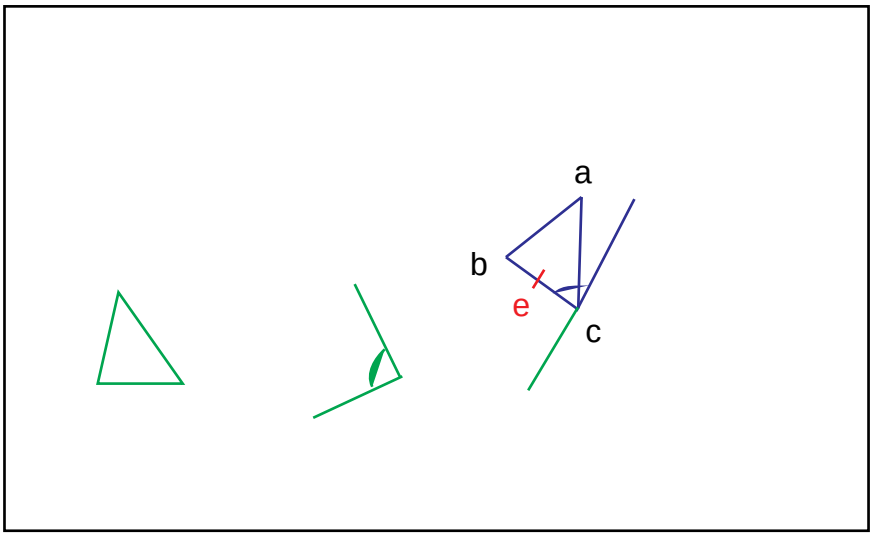
We now return to I.44 at line 8, and GOSUB I.42 to construct the parallelogram in the copy of the given triangle. Relabel for I.42.



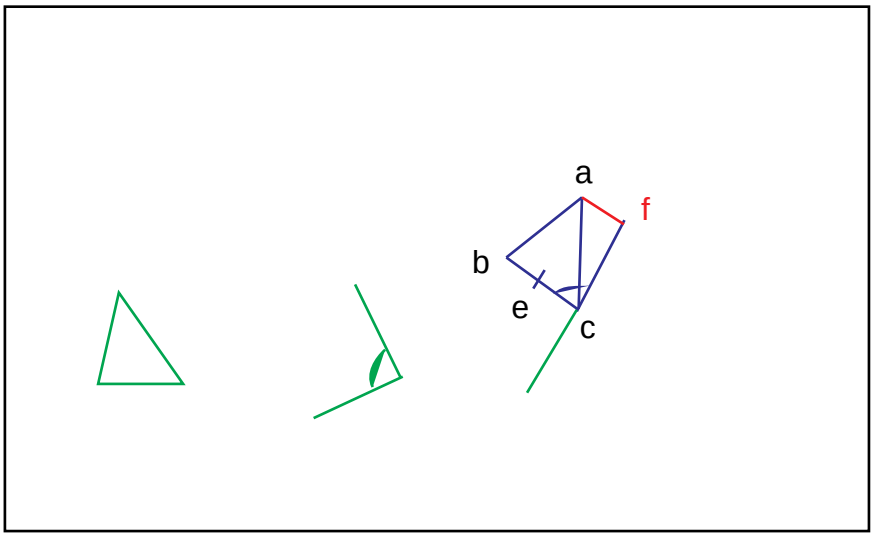
As in C#12A, we need a slight variation of I.42 as D is obtuse.



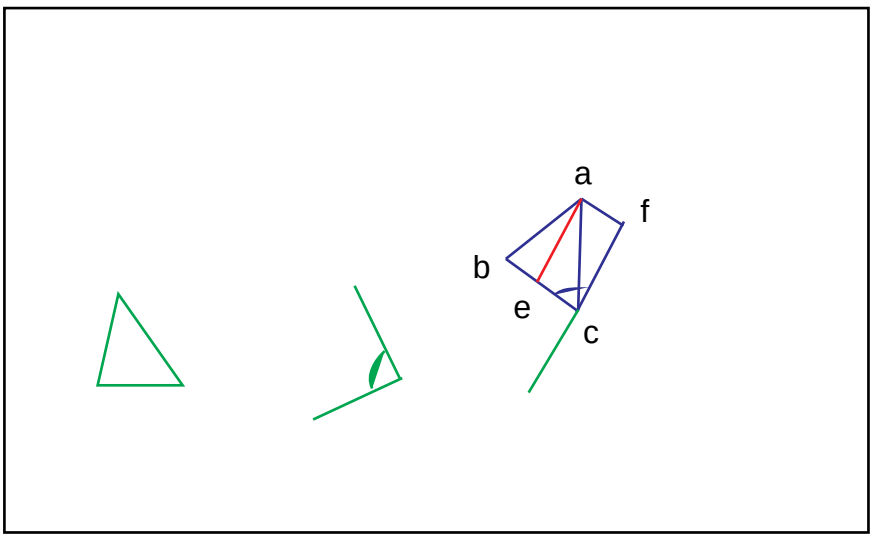
Bisect the base, bc. (3 steps)



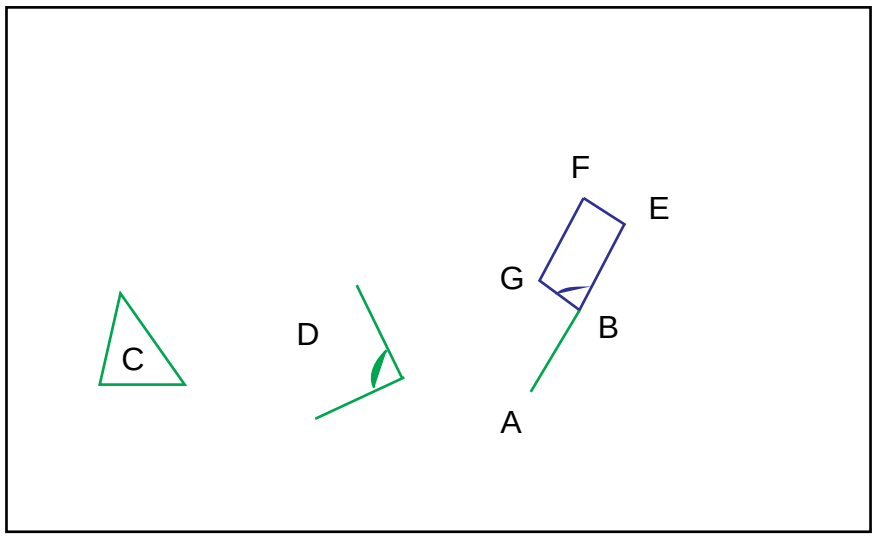
Line through a parallel to bc. (3 steps)



Line through e parallel to cf. (3 steps)



Relabel, cleanup. Return to I.44 at line 8.



Now follow C#12 at step 10.