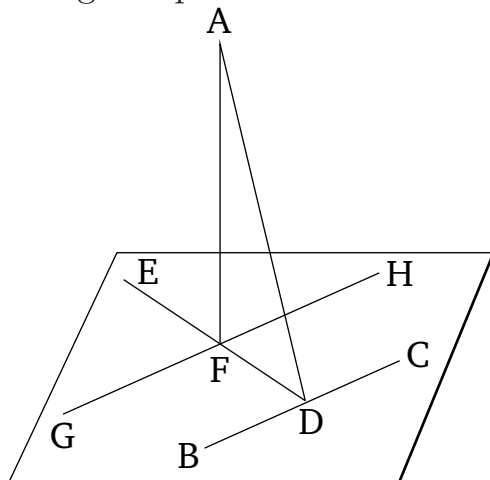


# Book 11

## Proposition 11

To draw a perpendicular straight-line from a given raised point to a given plane.



Let  $A$  be the given raised point, and the given plane the reference (plane). So, it is required to draw a perpendicular straight-line from point  $A$  to the reference plane.

Let some random straight-line  $BC$  have been drawn across in the reference plane, and let the (straight-line)  $AD$  have been drawn from point  $A$  perpendicular to  $BC$  [Prop. 1.12]. If, therefore,  $AD$  is also perpendicular to the reference plane then that which was prescribed will have occurred. And, if not, let  $DE$  have been drawn in the reference plane from point  $D$  at right-angles to  $BC$  [Prop. 1.11], and let the (straight-line)  $AF$  have been drawn from  $A$  perpendicular to  $DE$  [Prop. 1.12], and let  $GH$  have been drawn through point  $F$ , parallel to  $BC$  [Prop. 1.31].

And since  $BC$  is at right-angles to each of  $DA$  and

$DE$ ,  $BC$  is thus also at right-angles to the plane through  $EDA$  [Prop. 11.4]. And  $GH$  is parallel to it. And if two straight-lines are parallel, and one of them is at right-angles to some plane, then the remaining (straight-line) will also be at right-angles to the same plane [Prop. 11.8]. Thus,  $GH$  is also at right-angles to the plane through  $ED$  and  $DA$ . And  $GH$  is thus at right-angles to all of the straight-lines joined to it which are also in the plane through  $ED$  and  $AD$  [Def. 11.3]. And  $AF$ , which is in the plane through  $ED$  and  $DA$ , is joined to it. Thus,  $GH$  is at right-angles to  $FA$ . Hence,  $FA$  is also at right-angles to  $HG$ . And  $AF$  is also at right-angles to  $DE$ . Thus,  $AF$  is at right-angles to each of  $GH$  and  $DE$ . And if a straight-line is set up at right-angles to two straight-lines cutting one another, at the point of section, then it will also be at right-angles to the plane through them [Prop. 11.4]. Thus,  $FA$  is at right-angles to the plane through  $ED$  and  $GH$ . And the plane through  $ED$  and  $GH$  is the reference (plane). Thus,  $AF$  is at right-angles to the reference plane.

Thus, the straight-line  $AF$  has been drawn from the given raised point  $A$  perpendicular to the reference plane. (Which is) the very thing it was required to do.