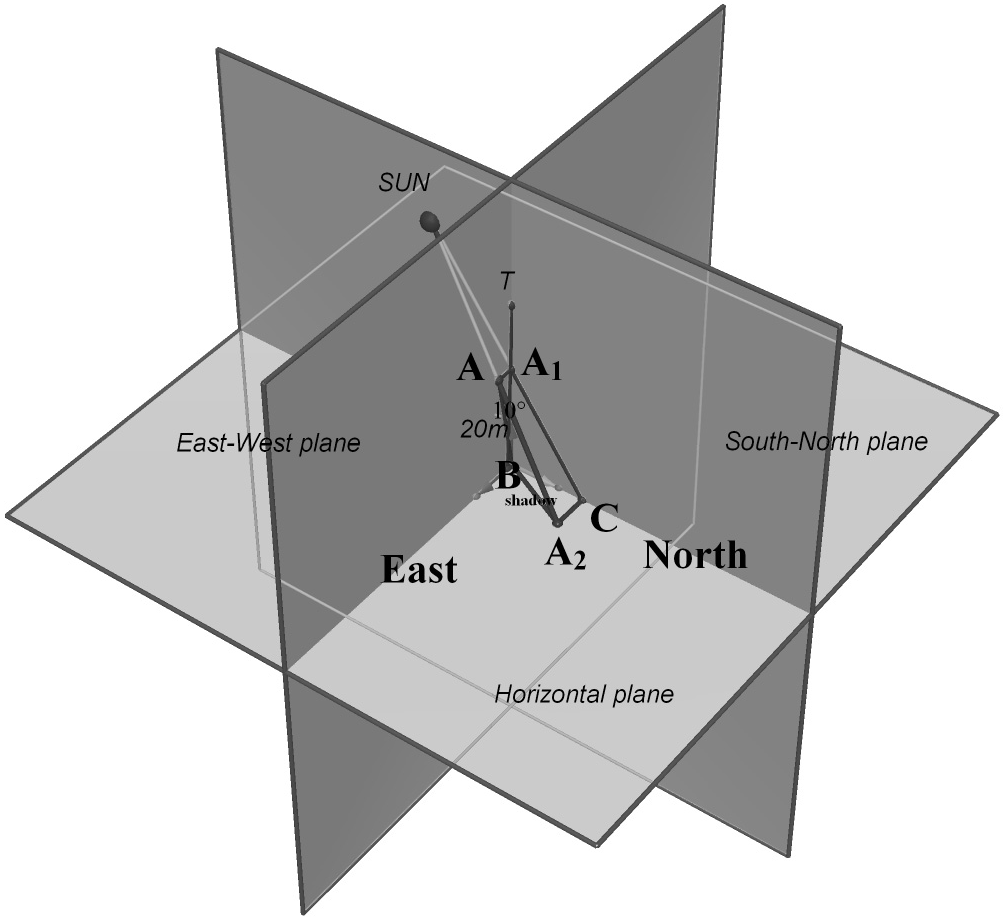
3D problem 2 edited by Mr. Francis Hung on 20070818

Reference: Certificate Amalgamated Mathematics by W. K. Chow 1981 p.265Q16

A 20-metre pole AB with one end (B) on level ground is inclined at 10° to the vertical towards the East. At noon one day the angle of elevation of the sun was 70° due south of the pole. What was the length of the shadow of the pole at this time?



Construct two imaginary planes which are perpendicular to the horizontal. One plane is across the South-North direction and the other is across the East-West direction.

The foot of the pole, B, is at the intersection of these two imaginary planes.

TB is a vertical line on the intersection of these two planes.

The pole AB lies on the East of the East-West plane such that $\angle ABT = 10°$.

The sun lies on the South of the South-North plane.

A_2B is the shadow of the pole AB on the horizontal ground.

On BT, construct a point A_1 such that AA_1 is parallel to the horizontal, $\angle AA_1B = 90°$.

The sun cast a shadow BC on A_1B with $\angle A_1CB = 70°$, $\angle A_2CB = 90°$.

$A_1B = AB \cos 10° = 20 \cos 10°$ m

$BC = A_1B \cot 70° = 20 \cos 10° \cot 70°$ m

$A_2C = AA_1 = 20 \sin 10°$ m

$A_2B = \sqrt{A_2C^2 + BC^2} = \sqrt{(20\sin 10°)^2 + (20\cos 10° \cot 70°)^2}$ m = 7.97 m (correct to 3 sig. figures.)