

Problem No. 318 Answer

Calculate the distances JM and AM based on the angle KJH being $101^{\circ}05'59''$:
 $JM = 100/\cos 11^{\circ}05'59'' = 101.906$ & $AM = 66/\cos 11^{\circ}05'59'' = 67.258$.

Assign a coordinate to point J, say North 500, East 0, and calculate coordinates for points M, A, and H: M = North 593.039, East 39.738, A = North 556.179, East 95.464, and H = North 173.881, East 482.567. Inverse from H to A to get $N 45^{\circ}21'28'' W 544.060$.

Angle AHL = $\arcsin[(169.41 + 33)/544.060] = 21^{\circ}50'28''$ yielding a bearing for line HK of $N 45^{\circ}21'28'' W - 21^{\circ}50'28'' = N 23^{\circ}31'00'' W$. A bearing-bearing or azimuth-azimuth intersection of JK and HK gives a coordinate of N 896.743, East 168.008 for point K with a distance of 430.850 for JK and 788.338 for HK.

Calculate the distances KC, CB, and CD: $KC = 66/\cos 43^{\circ}31'56'' = 91.036$, $BC = CD = 33/\cos 43^{\circ}31'56'' = 45.518$. Using these values to calculate coordinates, C = N 813.268, E 204.333, B = N 771.353, East 186.583 & D = N 855.182, E 222.082.

Calculate the distances HF, FE, and FG: $HF = 100/\cos 57^{\circ}34'03'' = 186.461$ and $FE = FG = 33/\cos 57^{\circ}34'03'' = 61.532$. Using these values to calculate coordinates, F = N 344.855, E 408.166, E = N 310.402, E 459.148 & G = N 379.309, E 357.184.

Inverse to obtain ED = N $23^{\circ}31'00'' W 594.126$, FC = N $23^{\circ}31'00'' W 510.842$, GB = N $23^{\circ}31'00'' W 427.555$, AB = N $22^{\circ}233.672$, and GA = N $55^{\circ}56'57'' W 315.881$.

The areas can be calculated by cross multiplication of coordinates or using simple trapezoid and triangle formulae:

$$Area_{CDEF} = \frac{594.126 + 510.841}{2} \cdot 33 = 18,231.96 sq.ft.$$

$$Area_{BCFG} = \frac{510.841 + 427.555}{2} \cdot 33 = 15,483.53 sq.ft.$$

$$Area_{ABG} = \frac{1}{2} \cdot 233.672 \cdot 315.881 \cdot \sin 101^{\circ}05'59'' = 36,215.89 sq.ft.$$

$$Area_{ACF} = \frac{1}{2} \cdot (233.672 + 45.518) \cdot (315.881 + 61.532) \cdot \sin 101^{\circ}05'59'' = 51,699.42 sq.ft.$$