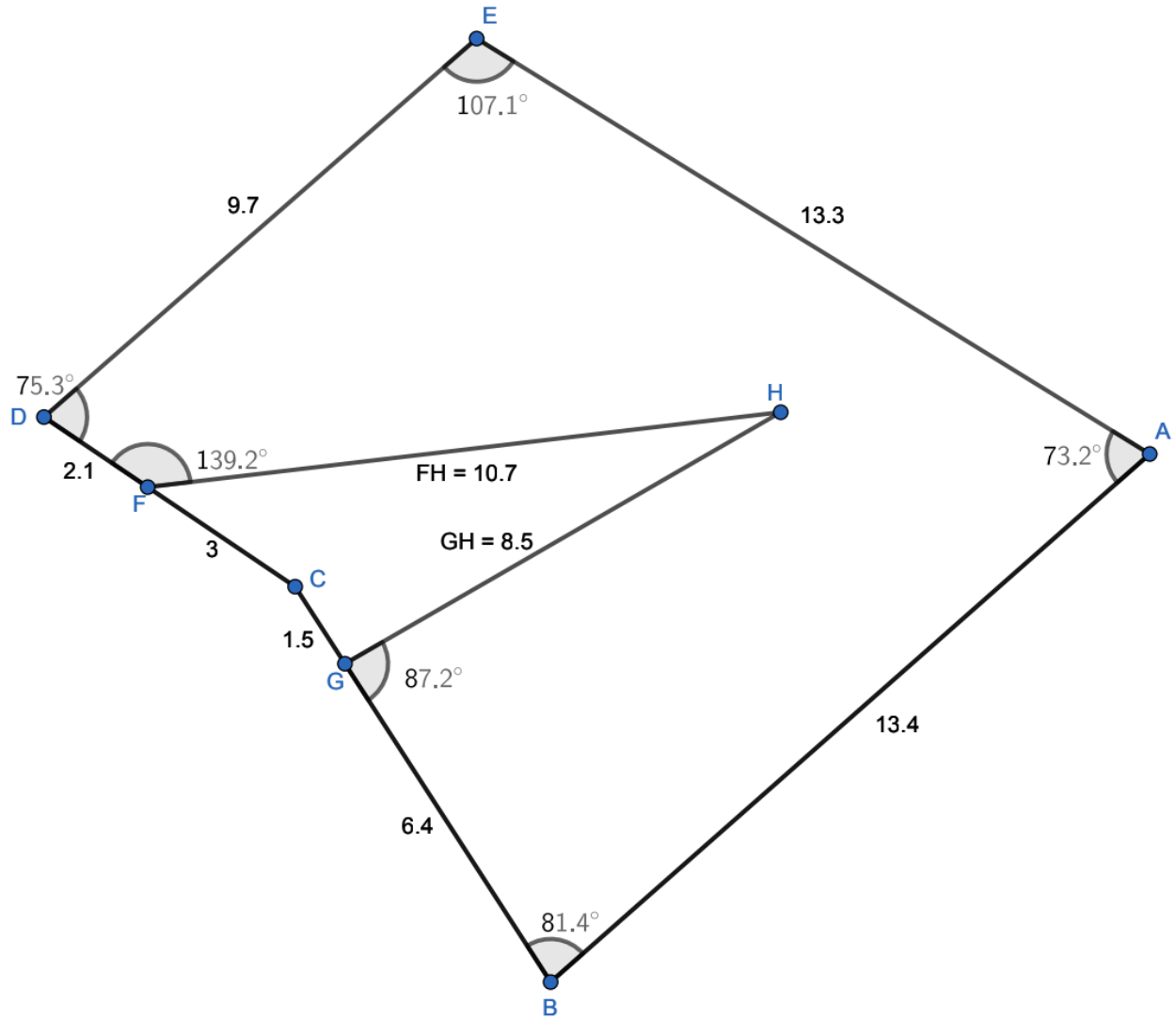
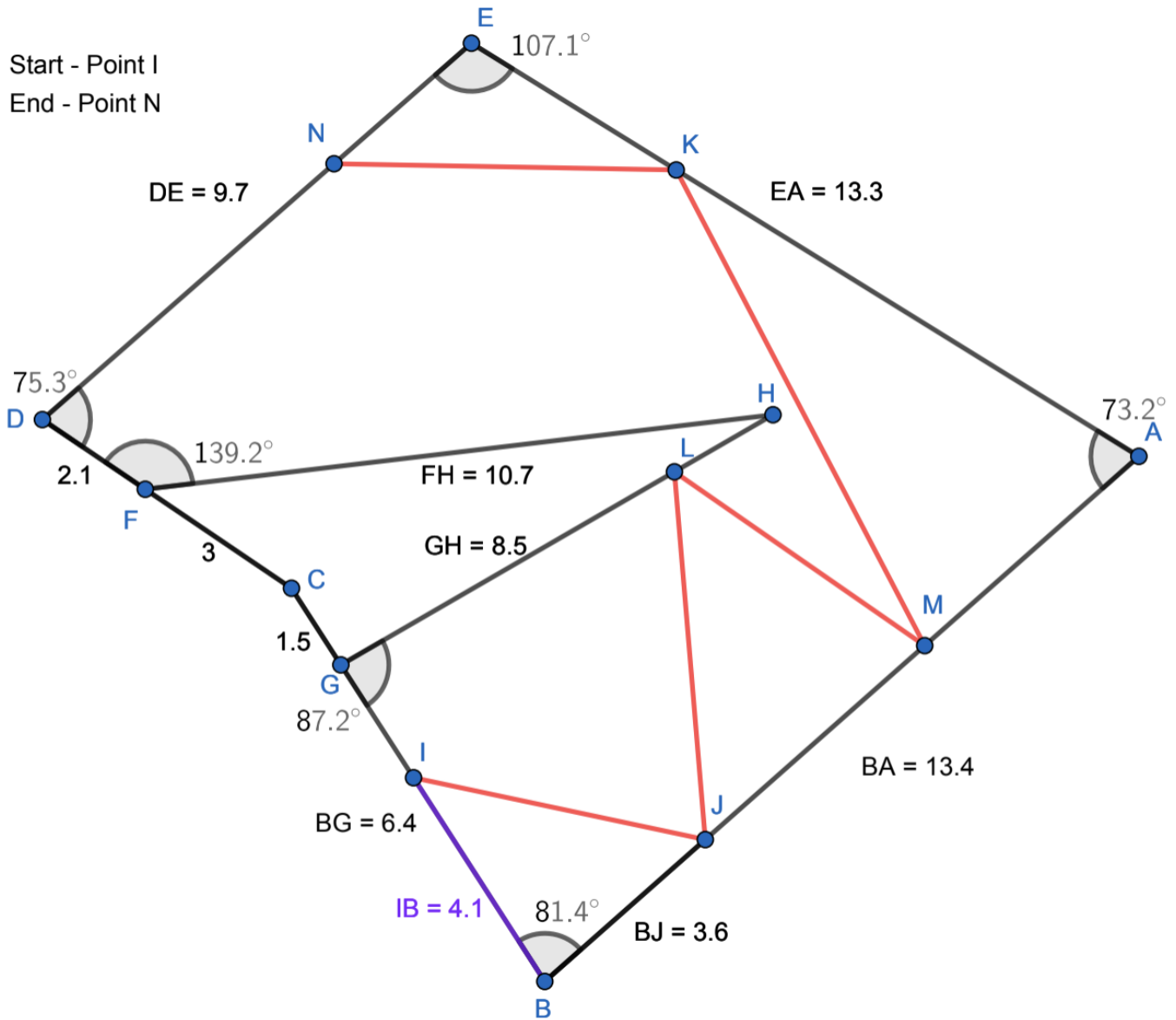


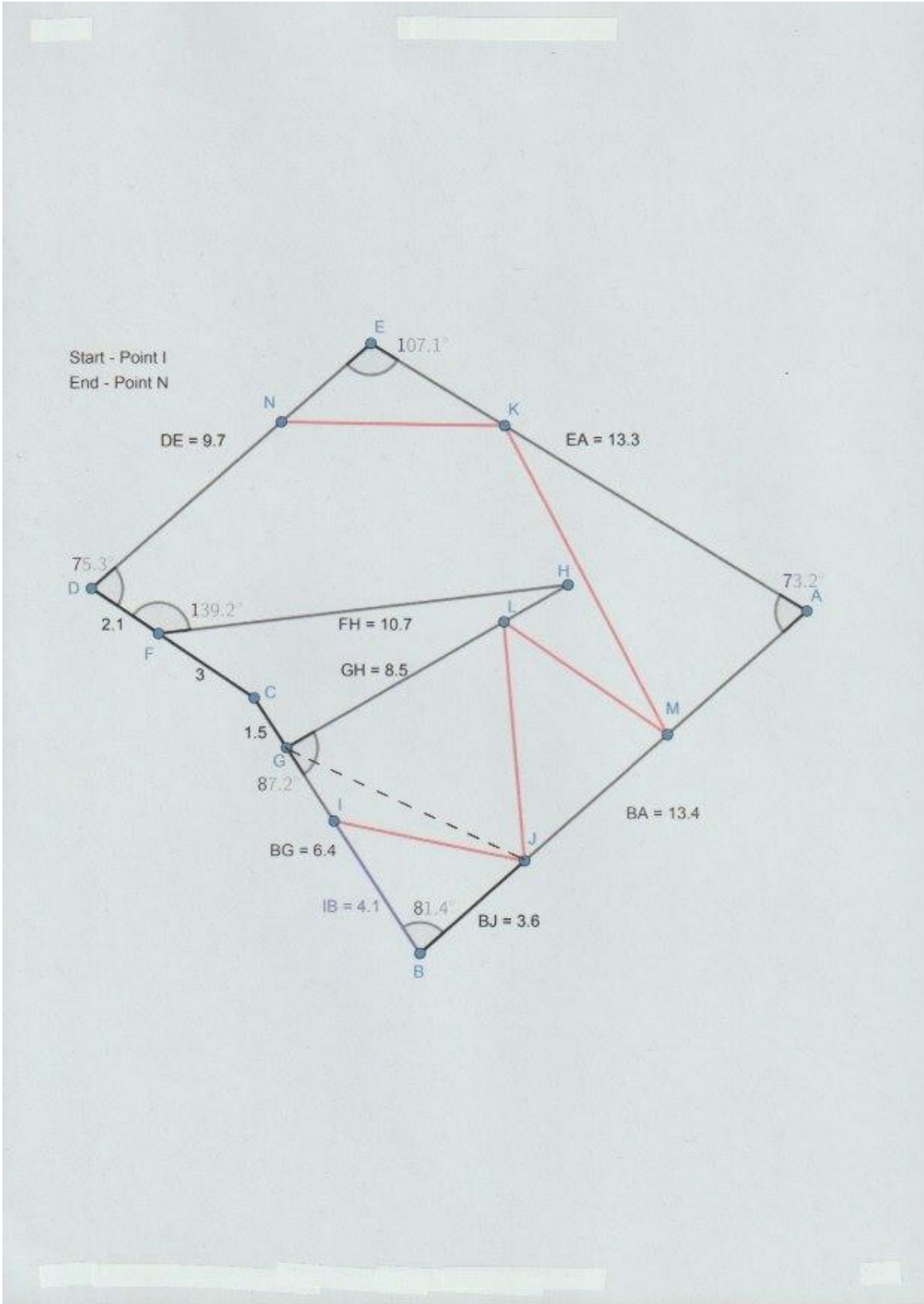
Golf Course Layout without ball path



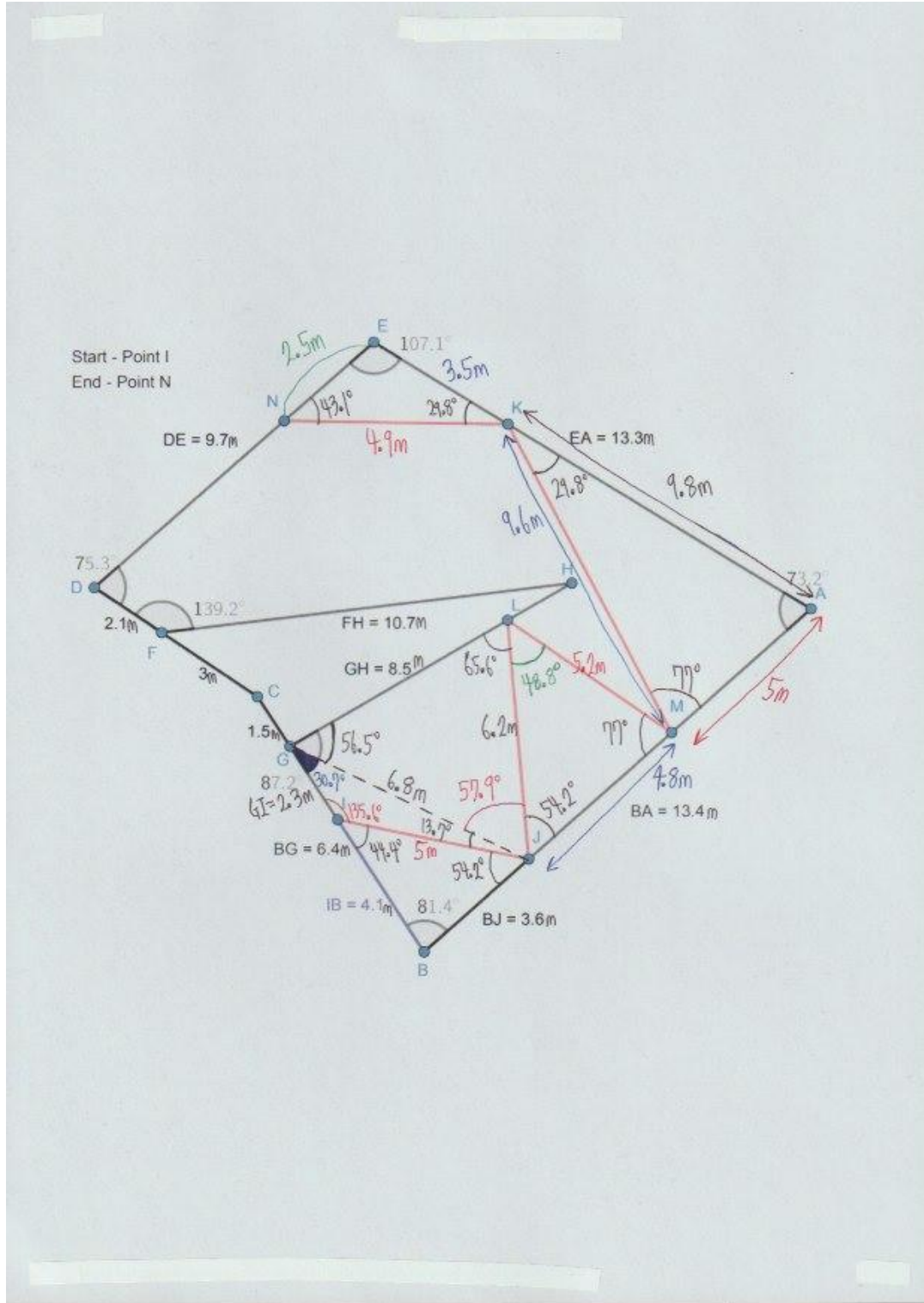
Golf Course Layout with ball path



Golf Course Layout with Ball Path + Auxiliary Lines



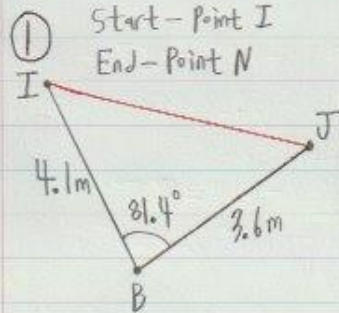
Golf Course Layout with Ball Path + Auxiliary Lines with Found Lengths and Found Angle Measures



Golf Course Layout Calculations (Pg 1)

Mini golf project Calculations

Jake Choi
Honors Geometry (PI)
March 12, 2021



Law of Cosines

$$IJ^2 = IB^2 + BJ^2 - 2 \cdot (IB) \cdot (BJ) \cdot \cos(\angle IBJ)$$

$$IJ^2 = (4.1)^2 + (3.6)^2 - 2 \cdot (4.1) \cdot (3.6) \cdot \cos 81.4^\circ$$

$$IJ = \sqrt{(4.1)^2 + (3.6)^2 - 2 \cdot (4.1) \cdot (3.6) \cdot \cos 81.4^\circ}$$

$$\approx 5.0$$

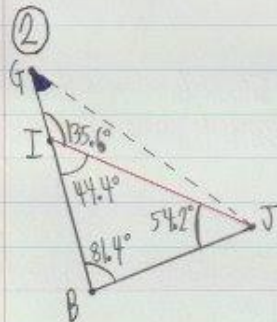
Law of Sines

$$\frac{\sin \angle IBJ}{IJ} = \frac{\sin \angle IJB}{IB} \rightarrow \frac{\sin 81.4^\circ}{5} = \frac{\sin \angle IJB}{4.1}$$

$$\sin \angle IJB = \frac{4.1 \times \sin 81.4^\circ}{5}$$

$$\angle IJB = \sin^{-1}\left(\frac{4.1 \times \sin 81.4^\circ}{5}\right) \approx 54.2^\circ$$

$$\angle BIJ = 180^\circ - \angle IBJ - \angle IJB = 180^\circ - 81.4^\circ - 54.2^\circ = 44.4^\circ$$



$$\angle GIJ = 81.4^\circ + 54.2^\circ = 135.6^\circ$$

$$GI = BG - IB = 6.4 - 4.1 = 2.3$$

$$IJ = 5 \text{ (from ①)}$$

Law of Cosines

$$GJ^2 = GI^2 + IJ^2 - 2 \cdot (GI) \cdot (IJ) \cdot \cos(\angle GIJ)$$

$$GJ^2 = (2.3)^2 + (5)^2 - 2 \cdot (2.3) \cdot (5) \cdot \cos 135.6^\circ$$

$$GJ = \sqrt{(2.3)^2 + (5)^2 - 2 \cdot (2.3) \cdot (5) \cdot \cos 135.6^\circ}$$

$$\approx 6.8$$

Law of Sines

$$\frac{\sin \angle GIJ}{GJ} = \frac{\sin \angle IJG}{GI}$$

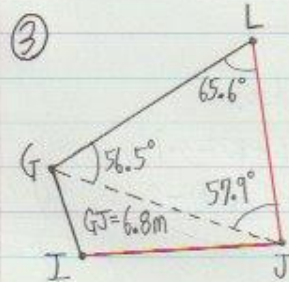
$$\frac{\sin 135.6^\circ}{6.8} = \frac{\sin \angle IJG}{2.3}$$

$$\sin \angle IJG = \frac{2.3 \times \sin 135.6^\circ}{6.8}$$

$$\angle IJG = \sin^{-1}\left(\frac{2.3 \times \sin 135.6^\circ}{6.8}\right) \approx 19.7^\circ$$

$$\angle IJG = 180^\circ - \angle GIJ - \angle IJG = 30.7^\circ$$

Golf Course Layout Calculations (Pg 2)



$$\begin{aligned}\angle GJL &= 180^\circ - \angle IJB - \angle LJA - \angle GJI \\ &= 180^\circ - (54.2^\circ + 54.2^\circ + 13.7^\circ) = 57.9^\circ\end{aligned}$$

$$\begin{aligned}\angle LGJ &= \angle LGI - \angle IGJ \\ &= 87.2^\circ - 30.7^\circ = 56.5^\circ\end{aligned}$$

$$\angle GLJ = 180^\circ - 56.5^\circ - 57.9^\circ = 65.6^\circ$$

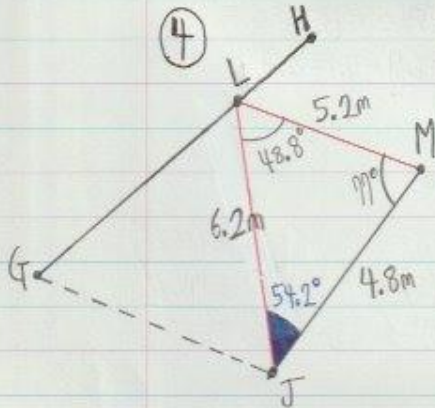
Law of Sines

$$\frac{\sin \angle GLJ}{GJ} = \frac{\sin \angle LGJ}{LJ} \rightarrow \frac{\sin 65.6^\circ}{6.8} = \frac{\sin 56.5^\circ}{LJ}$$

$$LJ = \frac{6.8 \times \sin 56.5^\circ}{\sin 65.6^\circ} = 6.2$$

$$\frac{\sin \angle GLJ}{GJ} = \frac{\sin \angle GJL}{LG} \rightarrow \frac{\sin 65.6^\circ}{6.8} = \frac{\sin 57.9^\circ}{LG}$$

$$LG = \frac{6.8 \times \sin 57.9^\circ}{\sin 65.6^\circ} = 6.3$$



$$\begin{aligned}\angle LJM &= \angle IJB = 54.2^\circ \text{ (Law of Reflection)} \\ \angle GLJ &= \angle HLM = 65.6^\circ \text{ (Law of Reflection)}\end{aligned}$$

$$\angle JLM = 180^\circ - \angle GLJ - \angle HLM = 180^\circ - (65.6^\circ \times 2) = 48.8^\circ$$

$$\angle LMJ = 180^\circ - \angle LJM - \angle JLM = 180^\circ - 54.2^\circ - 48.8^\circ = 77^\circ$$

Law of Sines

$$\frac{\sin \angle LMJ}{LJ} = \frac{\sin \angle LJM}{LM} = \frac{\sin \angle JLM}{MJ}$$

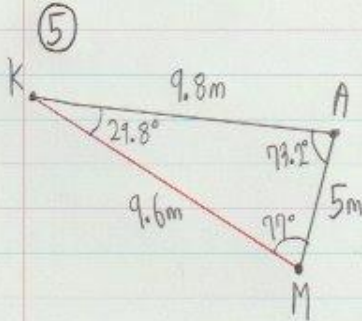
$$\frac{\sin 77^\circ}{6.2} = \frac{\sin 54.2^\circ}{LM} = \frac{\sin 48.8^\circ}{MJ}$$

$$LM = \frac{6.2 \times \sin 54.2^\circ}{\sin 77^\circ} = 5.2$$

$$MJ = \frac{6.2 \times \sin 48.8^\circ}{\sin 77^\circ} = 4.8$$

Golf Course Layout Calculations (Pg 3)

Jake Choi
Honors Geometry (P1)
March 12, 2021



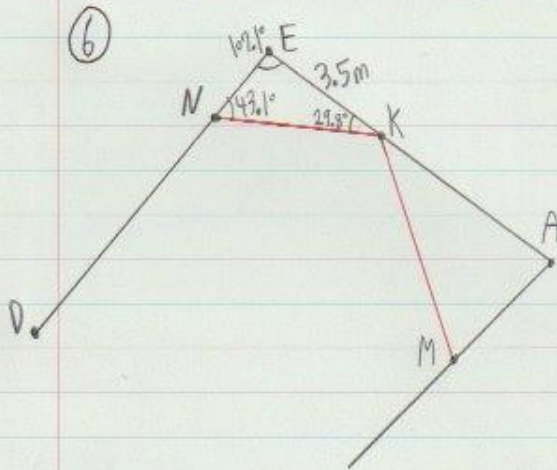
$\angle KAM = 73.2^\circ$ (Given)
 $\angle KMA = \angle LMJ = 77^\circ$ (Law of Reflection)
 $\angle MKA = 180^\circ - \angle KMA - \angle KAM = 180^\circ - 77^\circ - 73.2^\circ = 29.8^\circ$
 $MA = BA - BJ - MJ = 13.4 - 3.6 - 4.8 = 5$

Law of Sines

$$\frac{\sin \angle MKA}{MA} = \frac{\sin \angle KMA}{KA} = \frac{\sin \angle KAM}{KM}$$

$$\frac{\sin 29.8^\circ}{5} = \frac{\sin 77^\circ}{KA} = \frac{\sin 73.2^\circ}{KM}$$

$$KA = \frac{5 \times \sin 77^\circ}{\sin 29.8^\circ} = 9.8 \quad KM = \frac{5 \times \sin 73.2^\circ}{\sin 29.8^\circ} = 9.6$$



$\angle KEN = 109.1^\circ$ (Given)
 $\angle EKN = \angle MKA = 29.8^\circ$ (Law of Reflection)
 $\angle ENK = 180^\circ - \angle KEN - \angle EKN$
 $= 180^\circ - 109.1^\circ - 29.8^\circ = 43.1^\circ$

$$EK = EA - KA = 13.3 - 9.8 = 3.5$$

Law of Sines

$$\frac{\sin \angle ENK}{EK} = \frac{\sin \angle EKN}{EN} = \frac{\sin \angle KEN}{KN}$$

$$\frac{\sin 43.1^\circ}{3.5} = \frac{\sin 29.8^\circ}{EN} = \frac{\sin 109.1^\circ}{KN}$$

$$EN = \frac{3.5 \times \sin 29.8^\circ}{\sin 43.1^\circ} = 2.5 \quad KN = \frac{3.5 \times \sin 109.1^\circ}{\sin 43.1^\circ} = 4.9$$

The golf ball lands on point N on \overline{PE} which is 2.5m away from point E (or 4.9m away from point K).