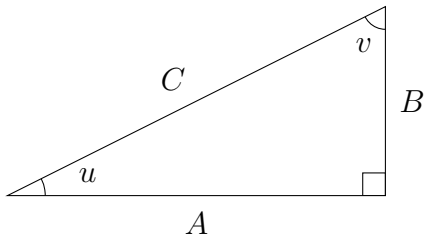
# Trigonometry of Surveying Worksheet

*Recall:* For a right triangle,



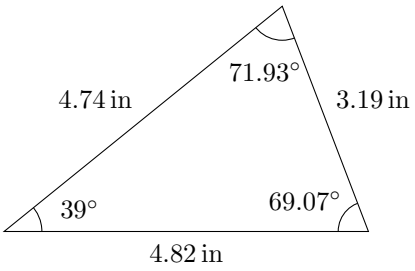

sine and cosine relate the angles and sides as follows:

$$\cos u = \sin v = \frac{A}{C}$$
$$\sin u = \cos v = \frac{B}{C},$$

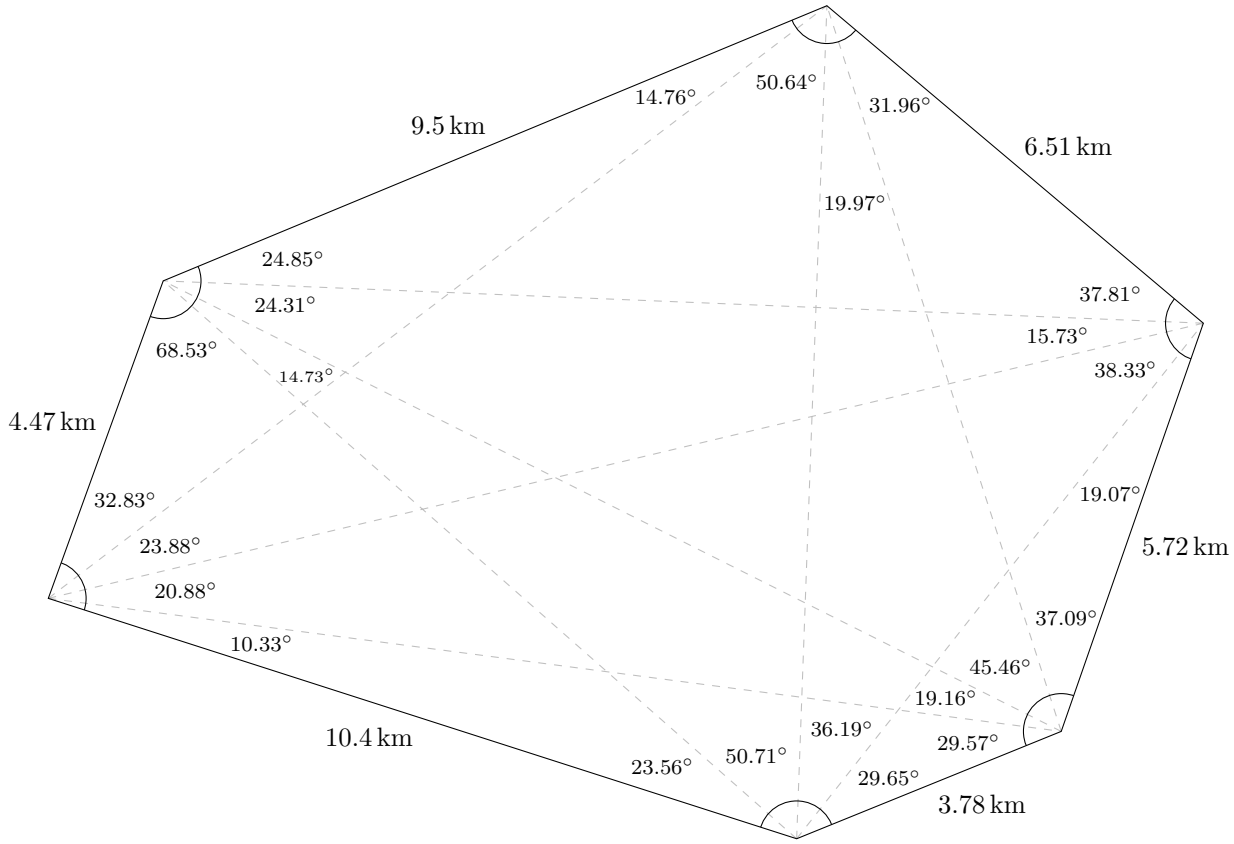
or equivalently

$$B = C\cos u = C\sin v$$
$$A = C\sin u = C\cos v.$$

1. *Warm-up:* Find the area of the following triangle:

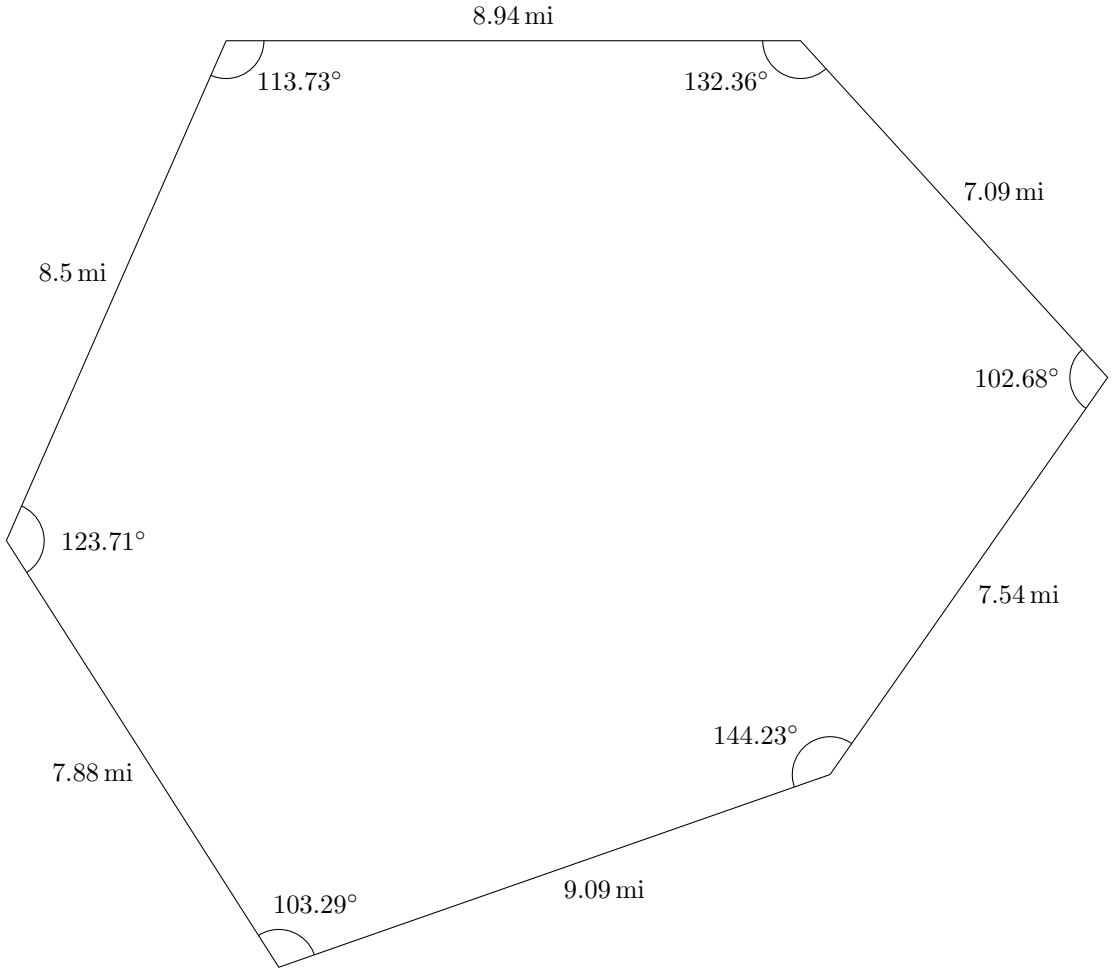


2. *Surveying a canyon:* Suppose you are surveying the area around the Grand Canyon. Unfortunately, because of the uneven terrain, you can't measure accurate lengths within the region—only around the borders. Your team measures each segment of the border, and also sights the angles between each corner.



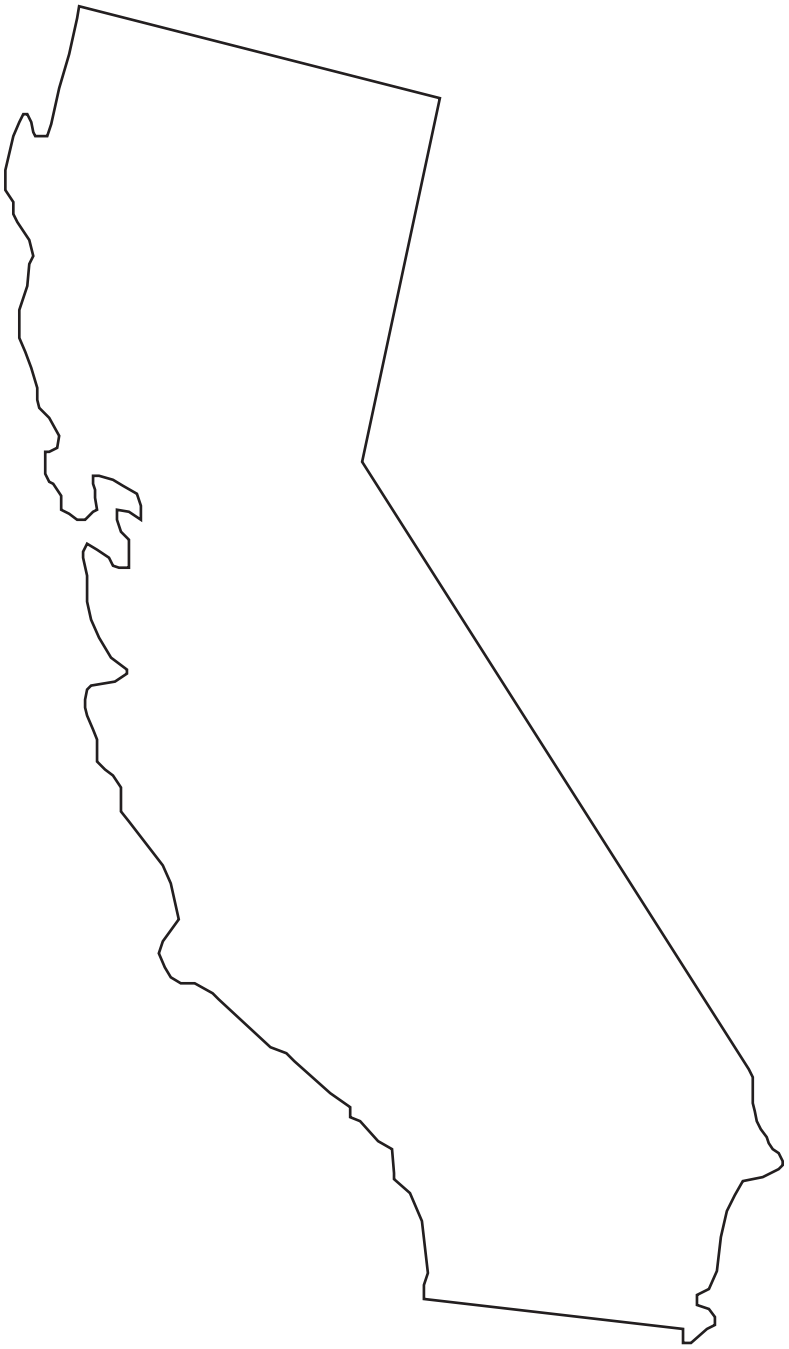

Find the area of the region.

3. *Surveying a mountain:* You've been hired again, but this time you're surveying the region surrounding not a canyon but a mountain. Unfortunately, this makes it impossible to measure the angles between points on the far side—you can't see through the mountain, after all. The only thing you can measure are the angles between adjacent corners.




Can you still find the area? *(Hint: it may help to use triangles whose legs are aligned with one of the sides.)*

4. *Approximation:* Using any method you would like, obtain an approximation for the area of California. (At this scale, $1\,\text{in}^2 = 22{,}888\,\text{km}^2$.)



5. *Bonus:* What other ways can you think of to calculate these areas?