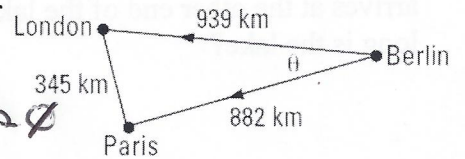


KEY

1. Two airplanes leave Berlin, one heading straight for London and the other straight for Paris. Use the Law of Cosines to estimate the measure of the angle,  $\theta$ , they will form.



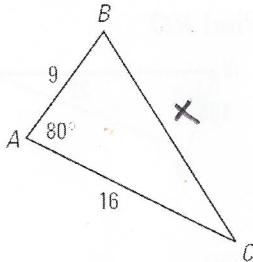
$$345^2 = 939^2 + 882^2 - 2(939)(882) \cos \theta$$

$$345^2 - 939^2 - 882^2 = -1,656,396 \cos \theta$$

$$\frac{-1,540,620}{-1,656,396} = \cos \theta \quad 0.9301 = \cos \theta$$

$$\theta \approx 21.5$$

2. Find BC

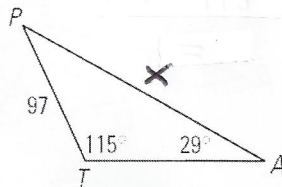


$$x^2 = 9^2 + 16^2 - 2(9)(16) \cos 80^\circ$$

$$x^2 \approx 286.99$$

$$x \approx 16.9$$

3. Find PA

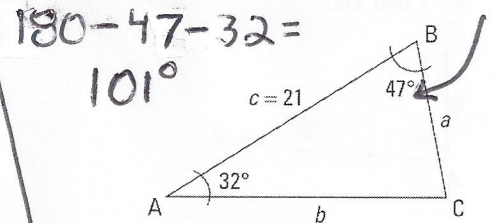


$$\frac{\sin 29^\circ}{97} = \frac{\sin 115^\circ}{x}$$

$$PA \approx 181.3$$

4. Find the length of side b

NOT TO SCALE

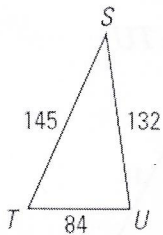


$$180 - 47 - 32 = 101^\circ$$

$$\frac{\sin 101^\circ}{21} = \frac{\sin 47^\circ}{b}$$

$$b \approx 15.6$$

5. Find  $m\angle S$ ,  $m\angle T$ , and  $m\angle U$



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$84^2 = 145^2 + 132^2 - 2(145)(132) \cos A$$

$$84^2 - 145^2 - 132^2 = -38,280 \cos A$$

$$\frac{-31,393}{-38,280} = \cos A$$

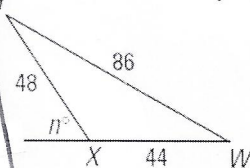
$$0.8201 \approx \cos A \quad m\angle S \approx 34.9$$

$$\frac{\sin 34.9}{84} = \frac{\sin T}{132}$$

$$m\angle T \approx 64.0$$

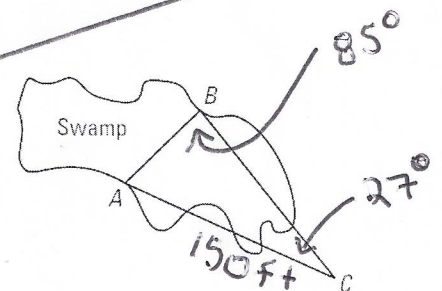
$$m\angle U \approx 81.0$$

6. Find n



$$n \approx 41.7$$

7. Some students in Geometry are assigned the task of measuring the distance between two trees separated by a swamp. The students determine that the angle formed by tree A, a dry point C, and tree B is  $27^\circ$ . They also know that  $m\angle ABC$  is  $85^\circ$ . If AC is 150 ft, how far apart are the trees?

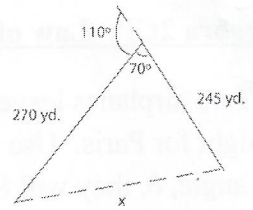


$$\frac{\sin 27^\circ}{AB} = \frac{\sin 85^\circ}{150}$$

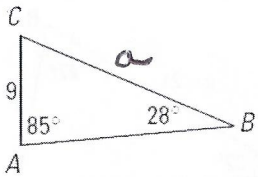
$$AB \approx 68.4$$

8. A surveyor starts at one end of the lake and walks 245 yards. He then turns  $110^\circ$  and walks 270 yards until he arrives at the other end of the lake. Approximately how long is the lake?

296 yd



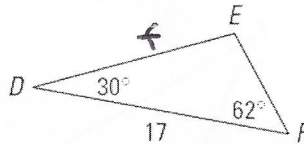
9. Find BC



$$\frac{\sin 85}{a} = \frac{\sin 28}{9}$$

$$\frac{\sin(85)(9)}{\sin(28)} = 19.1$$

10. Find DE

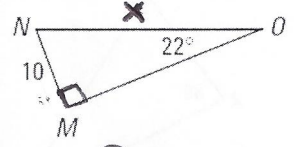


$$180 - 30 - 62 = 88$$

$$\frac{\sin 88}{17} = \frac{\sin 62}{f}$$

$$DE = 15.0$$

11. Find NO

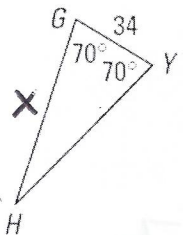


$$\sin 22 = \frac{10}{x}$$

$$x = \frac{10}{\sin 22}$$

$$x = 26.7$$

12. Find GH



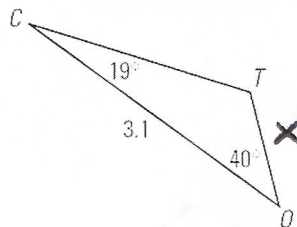
$$180 - 70 - 70 = 40$$

$$\frac{\sin 40}{34} = \frac{\sin 70}{x}$$

$$\frac{\sin 70 (34)}{\sin 40} = x$$

$$GH = 49.7$$

13. Find the length of the shortest side.



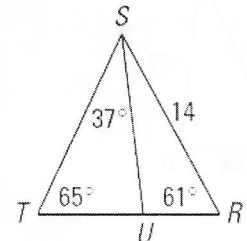
$$180 - 40 - 19 = 121$$

$$\frac{\sin 121}{3.1} = \frac{\sin 19}{x}$$

$$\frac{\sin 19 (3.1)}{\sin 121} = x$$

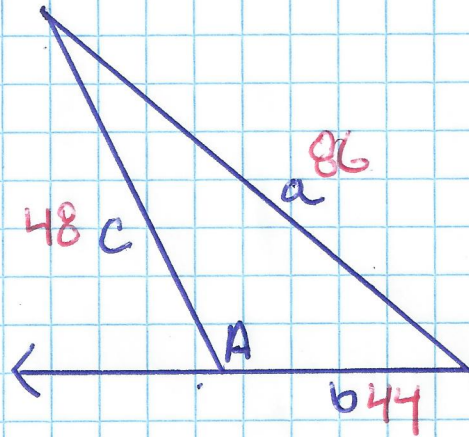
$$x = 1.02$$

14. Find TU



$$TU = 8.3$$

6)



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$86^2 = 44^2 + 48^2 - 2(44)(48) \cos A$$

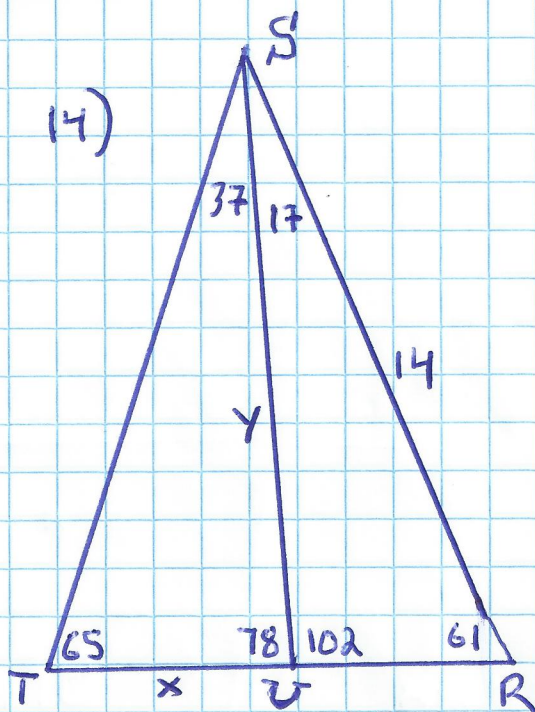
$$86^2 - 44^2 - 48^2 = -4224 \cos A$$

$$3156 = -4224 \cos A$$

$$-0.747159 = \cos A$$

$$138.3^\circ = A$$

$$n^\circ = 41.7^\circ$$



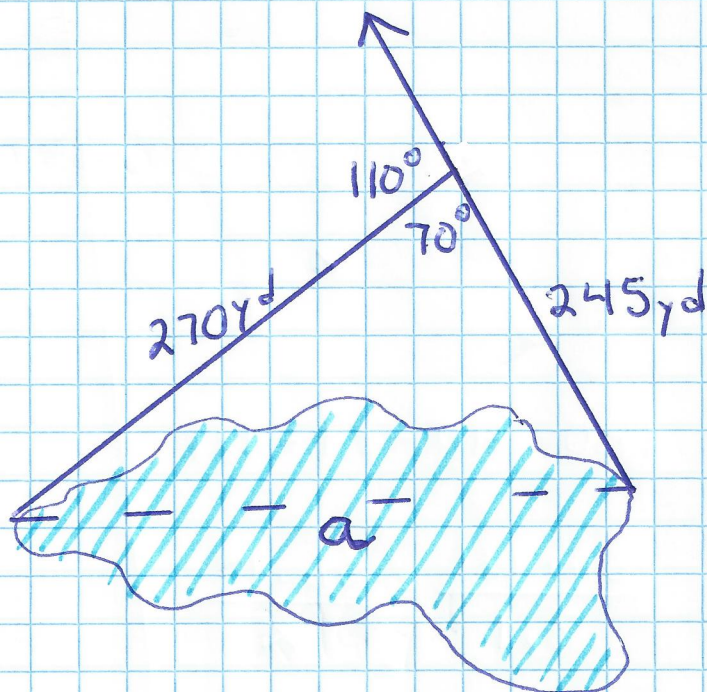
$$\frac{\sin 102}{14} = \frac{\sin 61}{y}$$

$$y = 12.51822924$$

$$\frac{\sin 65}{12.51822924} = \frac{\sin 37}{x}$$

$$x = 8.3$$

8)



$$a^2 = 270^2 + 245^2 - 2(270)(245)\cos 70^\circ$$

$$296 \text{ yd}$$