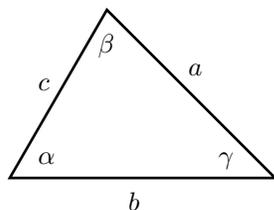


More problems for section 4.13 of *Essentials of Precalculus with Calculus Previews* by Zill and Dewar, 6e.

In all of these problems,  $a$ ,  $b$ , and  $c$  are the three sides of a triangle. The angle opposite side  $a$  is  $\alpha$ , the angle opposite side  $b$  is  $\beta$ , and the angle opposite side  $c$  is  $\gamma$ :



Hint: identify each group of problems as either SAS, SSA, AAS, or SSS.

1. Find  $c$ , given  $a$ ,  $b$ , and  $\gamma$ .

- |  |   |   |
|--|---|---|
| a. $a = 15$ , $b = 12$ , $\gamma = 70^\circ$ | b. $a = 10$ , $b = 5$ , $\gamma = 13^\circ$ | c. $a = 3$ , $b = 4$ , $\gamma = 105^\circ$   |
| d. $a = 3$ , $b = 4$ , $\gamma = 25^\circ$   | e. $a = 14$ , $b = 2$ , $\gamma = 35^\circ$ | f. $a = 13$ , $b = 13$ , $\gamma = 175^\circ$ |

2. Find  $\gamma$ , given  $a$ ,  $b$ , and  $c$ .

- |                                  |                                 |                                   |
|----------------------------------|---------------------------------|-----------------------------------|
| a. $a = 12$ , $b = 3$ , $c = 10$ | b. $a = 3$ , $b = 4$ , $c = 6$  | c. $a = 3$ , $b = 4$ , $c = 8$    |
| d. $a = 9$ , $b = 5$ , $c = 7$   | e. $a = 15$ , $b = 9$ , $c = 8$ | f. $a = 13$ , $b = 13$ , $c = 13$ |

3. Points A and B are on opposite sides of Lake Jake. From a third point C, the angle between the lines of sight to A and to B is  $46^\circ$ . If AC is 350 meters long and BC is 286 meters long, find AB.

4. The sides of a parallelogram are 4 cm and 6 cm. One angle is  $58^\circ$  while the other is  $122^\circ$ . Find the lengths of the diagonals of the parallelogram.

5. Two ships leave a harbor at the same time, each traveling in a straight line. If their courses have an angle of  $130^\circ$  between them and if they each travel 402 miles, how far apart are they?

6. Two ships leave a harbor at the same time, each traveling in a straight line. One ship travels 36 km/hr, while the other ship travels 45 km/hr. If the angle between their courses is  $54^\circ$ , find the distance between them after 3 hours.

7. Three boards measuring 13 ft, 16 ft, and 20 ft are nailed together to form a triangle. Find the angle between the 16 ft and the 20 ft long board.

8. A balloonist is directly above a straight and level road 1.5 miles long between two towns. She finds that her angle of depression to the nearer town is  $35^\circ$ , while her angle of depression to the farther town is  $31^\circ$ . What is the altitude of the balloon?

9. The town of Bryan lies 7 miles directly south of the town of West Jefferson. A balloonist is floating directly south of Bryan. If the angle of depression from the balloon to Bryan is  $60^\circ$ , and if the angle of depression from the balloon to West Jefferson is  $17^\circ$ , find the distance from the balloon to West Jefferson.

10. Find the altitude of the balloon in Problem 9.

11. Surveyors use a tool called a **theodolite** to measure angles of elevation and depression. A surveyor standing 50 meters from the base of a building finds that the angle of elevation from her theodolite to the top of the building is  $37^\circ$ , and the angle of elevation from her theodolite to the top of an antenna on top of the building is  $39^\circ$ . If the theodolite is 2 meters above the ground, find the length of the antenna.

12. A building stands on the side of a hill that slopes downward at an angle of  $12^\circ$ . The sun is uphill from the building with a  $50^\circ$  angle of elevation. If the building casts a shadow 35 m long down the slope of the hill, find the building's height.

Answers

1a.  $c = 15.680$  1b.  $c = 5.250$  1c.  $c = 5.586$  1d.  $c = 1.802$  1e.  $c = 12.414$  1f.  $c = 25.975$  2a.  $\gamma = 42.598^\circ$  2b.  $\gamma = 117.279^\circ$  2c. no such triangle exists. 2d.  $\gamma = 50.703^\circ$  2e.  $\gamma = 26.324^\circ$  2f.  $\gamma = 60^\circ$  3. 255.392 m 4. 5.154 cm and 8.799 cm 5. 728.671 miles 6. 112.912 km 7.  $40.453^\circ$  8. 4.851 miles 9. 8.889 miles 10. 2.599 miles 11. 2.811 m 12. 33.523 m