

Find the indicated part of  $\triangle ABC$ .

1.  $a = 16$ ;  $\angle A = 35^\circ$ ;  $\angle B = 65^\circ$ ;  $b = ?$
2.  $c = 10$ ;  $\angle A = 48^\circ$ ;  $\angle C = 63^\circ$ ;  $a = ?$
3.  $b = 2.1$ ;  $\angle A = 110^\circ$ ;  $\angle C = 40^\circ$ ;  $a = ?$
4.  $a = 2.5$ ;  $\angle B = 50^\circ$ ;  $\angle C = 100^\circ$ ;  $c = ?$
5.  $c = 30$ ;  $\angle A = 42^\circ$ ;  $\angle C = 98^\circ$ ;  $b = ?$
6.  $b = 120$ ;  $\angle B = 105^\circ$ ;  $\angle C = 25^\circ$ ;  $a = ?$
7.  $a = 18$ ;  $b = 15$ ;  $\angle A = 110^\circ$ ;  $\angle B = ?$
8.  $b = 8.5$ ;  $c = 6.4$ ;  $\angle B = 115^\circ$ ;  $\angle C = ?$

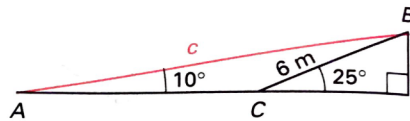
In Exercises 9 and 10, find the exact values of the indicated parts of  $\triangle ABC$ .

9.  $b = 2\sqrt{6}$ ;  $\angle A = 60^\circ$ ;  $\angle B = 45^\circ$ ;  $a = ?$
10.  $a = 6\sqrt{6}$ ;  $\angle B = 45^\circ$ ;  $\angle C = 15^\circ$ ;  $b = ?$

In Exercises 11–14, find the exact value of  $\frac{a}{b}$  in  $\triangle ABC$ . (Recall that  $\sin^2 \theta + \cos^2 \theta = 1$ .)

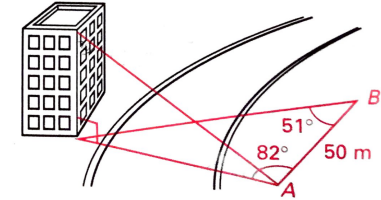
11.  $\sin A = \frac{2}{3}$ ;  $\cos B = \frac{3}{5}$
12.  $\cos A = \frac{4}{5}$ ;  $\sin B = \frac{4}{5}$
13.  $\cos A = \frac{12}{13}$ ;  $\cos B = -\frac{4}{5}$
14.  $\cos A = \frac{15}{17}$ ;  $\cos B = -\frac{8}{17}$

15. Two angles of a triangle measure  $72^\circ$  and  $61^\circ$ . If the longest side is 30 m long, how long is the shortest side?
16. Two angles of a triangle measure  $37^\circ$  and  $48^\circ$ . If the shortest side is 10.5 m long, how long is the longest side?
17. To find the distance between two points,  $A$  and  $B$ , on opposite sides of a swamp, a surveyor laid off a base line  $\overline{AC}$  25 m long and found that  $\angle BAC = 82^\circ$  and  $\angle BCA = 69^\circ$ . Find  $AB$ .

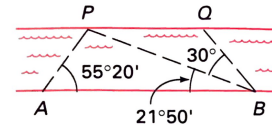


18. A six-meter long loading ramp that makes a  $25^\circ$  angle with the horizontal is to be replaced by a ramp whose angle of inclination is only  $10^\circ$ . How long will the new ramp be?
19. A pilot approaching a 3000-meter runway finds that the angles of depression of the ends of the runway are  $14^\circ$  and  $20^\circ$ . How far is the plane from the nearer end of the runway?
20. From the top of a building 25 m high the angle of elevation of a weather balloon is  $54^\circ$  and from the bottom of the building it is  $61^\circ$ . How high is the balloon above the ground?

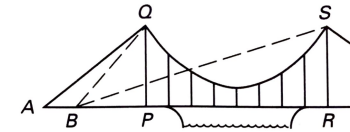
25. A tree stands on an  $18^\circ$  slope. From a point 20 m down the slope, the angle of elevation of the top of the tree is  $32^\circ$ . How tall is the tree?
26. The skipper of a sailboat 6 km from the nearer of two towers on shore 10 km apart finds that the angle between the lines of sight to the towers is  $35^\circ$ . How far is the boat from the farther tower?
27. To find the height of a building across a canal, Lee laid off a base line,  $\overline{AB}$ , 50 m long and measured the angles shown. Lee then found the angle of elevation of the top of the building from  $A$  to be  $20^\circ$ . How tall is the building?



28. Points  $P$  and  $Q$  on the far bank of a river are sighted from points  $A$  and  $B$  on the near bank as shown at the right. The banks of the river are parallel and  $AB = 25$  m. Find  $PQ$ .



Exercise 28



Exercise 29

29. Find the distance  $PR$  between the equally-tall support towers of the suspension bridge shown at the right. Use these measurements:  $AB = 50$  m,  $\angle PAQ = 40^\circ$ ,  $\angle PBQ = 52^\circ$ , and  $\angle RBS = 18^\circ$

Exercises 30 and 31 refer to triangulation (Figure 4-4, page 133). In each case  $AB = 120$  m. Find  $PQ$  given the following angles.

30.  $\angle PAQ = 80^\circ$ ,  $\angle QAB = 35^\circ$ ,  $\angle ABP = 28^\circ$ , and  $\angle PBQ = 85^\circ$
31.  $\angle PAQ = 75^\circ$ ,  $\angle PAB = 102^\circ$ ,  $\angle ABQ = 127^\circ$ , and  $\angle PBQ = 81^\circ$
32. A tree stands on a  $15^\circ$  slope. Diana, standing directly down the slope from the tree, finds that the angle of elevation of its top is  $35^\circ$ . When she moves 50 m closer to the tree, the angle of elevation of its top is  $45^\circ$ . How tall is the tree?
33. A pilot of a transoceanic jet flying at 11,500 m finds that a stationary ship is in the same vertical plane as the jet's course. He measures the ship's angle of depression to be  $16^\circ$  and two minutes later finds it to be  $46^\circ$ . Find the speed of the jet.