Practise

Where necessary, round lengths to the nearest tenth of a unit and angle measures to the nearest degree.

1. Solve for the unknown side or angle in each.
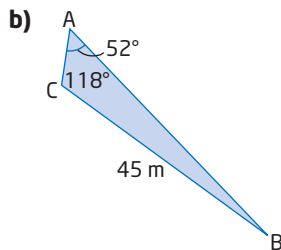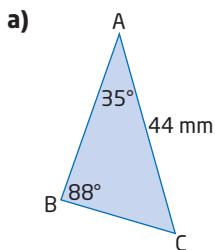
a) $\dfrac{a}{\sin 35°} = \dfrac{10}{\sin 40°}$

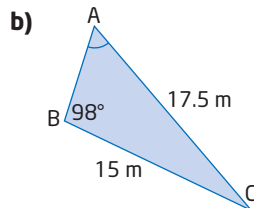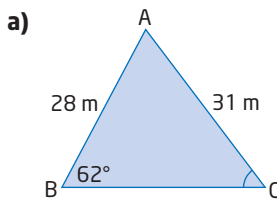**b)** $\dfrac{b}{\sin 48°} = \dfrac{65}{\sin 75°}$

c) $\dfrac{\sin \theta}{12} = \dfrac{\sin 50°}{65}$

d) $\dfrac{\sin A}{25} = \dfrac{\sin 62°}{32}$

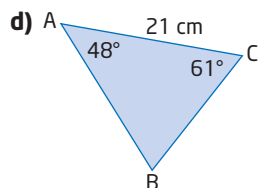**2.** Determine the length of AB in each.

a)

b)

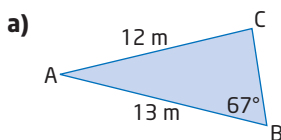**3.** Determine the value of the marked unknown angle in each.

a)

b)

4. Determining the lengths of all three sides and the measures of all three angles is called solving a triangle. Solve each triangle.

a)

b)

c)

d)
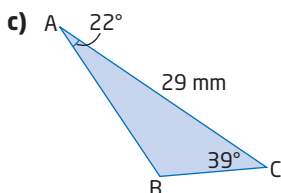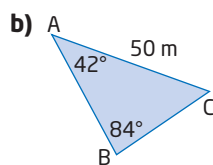
5. Sketch each triangle. Determine the measure of the indicated side.

a) In △ABC, ∠A = 57°, ∠B = 73°, and AB = 24 cm. Find the length of AC.

b) In △ABC, ∠B = 38°, ∠C = 56°, and BC = 63 cm. Find the length of AB.

c) In △ABC, ∠A = 50°, ∠B = 50°, and AC = 27 m. Find the length of AB.

d) In △ABC, ∠A = 23°, ∠C = 78°, and AB = 15 cm. Find the length of BC.

6. For each triangle, determine whether there is no solution, one solution, or two solutions.

a) In △ABC, ∠A = 39°, a = 10 cm, and b = 14 cm.

b) In △ABC, ∠A = 123°, a = 23 cm, and b = 12 cm.

c) In △ABC, ∠A = 145°, a = 18 cm, and b = 10 cm.

d) In △ABC, ∠A = 124°, a = 1 cm, and b = 2 cm.

7. In each diagram, h is an altitude. Describe how ∠A, sides a and b, and h are related in each diagram.

a)

b)

c)

d)
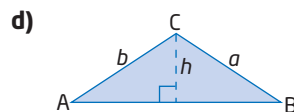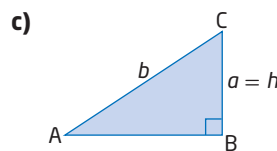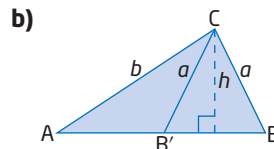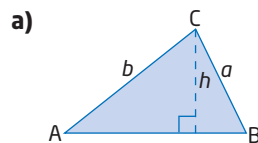
8. Determine the unknown side and angles in each triangle. If two solutions are possible, give both.

   **a)** In $\triangle$ABC, $\angle$C = 31°, a = 5.6 cm, and c = 3.9 cm.

   b) In $\triangle$PQR, $\angle$Q = 43°, p = 20 cm, and q = 15 cm.

   c) In $\triangle$XYZ, $\angle$X = 53°, x = 8.5 cm, and z = 12.3 cm.

9. In $\triangle$ABC, $\angle$A = 26° and b = 120 cm. Determine the range of values of a for which there is

   a) one oblique triangle

   b) one right triangle

   **c)** two oblique triangles

   d) no triangle

Apply

10. A hot-air balloon is flying above BC Place Stadium. Maria is standing due north of the stadium and can see the balloon at an angle of inclination of 64°. Roy is due south of the stadium and can see the balloon at an angle of inclination of 49°. The horizontal distance between Maria and Roy is 500 m.

   a) Sketch a diagram to represent the given information.

   b) Determine the distance that the hot air balloon is from Maria.

11. The Canadian Coast Guard Pacific Region is responsible for more than 27 000 km of coastline. The rotating spotlight from the Coast Guard ship can illuminate up to a distance of 250 m. An observer on the shore is 500 m from the ship. His line of sight to the ship makes an angle of 20° with the shoreline. What length of shoreline is illuminated by the spotlight?
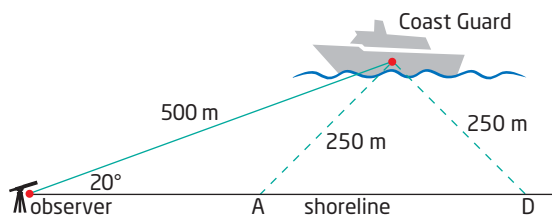
12. A chandelier is suspended from a horizontal beam by two support chains. One of the chains is 3.6 m long and forms an angle of 62° with the beam. The second chain is 4.8 m long. What angle does the second chain make with the beam?
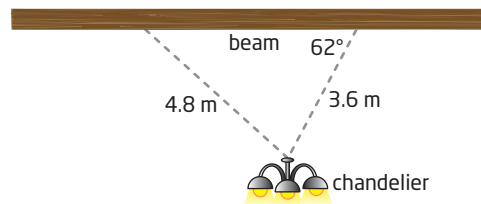
13. Nicolina wants to approximate the height of the Francophone Monument in Edmonton. From the low wall surrounding the statue, she measures the angle of elevation to the top of the monument to be 40°. She measures a distance 3.9 m farther away from the monument and measures the angle of elevation to be 26°. Determine the height of the Francophone Monument.
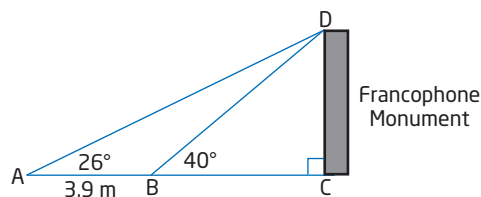
Did You Know?

The Francophone Monument located at the Legislature Grounds in Edmonton represents the union of the fleur de lis and the wild rose. This monument celebrates the contribution of francophones to Alberta's heritage.

b) The sine and cosine ratios are the same when A is at approximately (3.5355, 3.5355) and (−3.5355, −3.5355). This corresponds to 45° and 225°.

c) The sine ratio is positive in quadrants I and II and negative in quadrants III and IV. The cosine ratio is positive in quadrant I, negative in quadrants II and III, and positive in quadrant IV. The tangent ratio is positive in quadrant I, negative in quadrant II, positive in quadrant III, and negative in quadrant IV.

d) When the sine ratio is divided by the cosine ratio, the result is the tangent ratio. This is true for all angles as A moves around the circle.
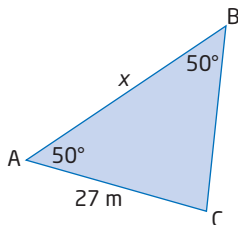
2.3 The Sine Law, pages 108 to 113

1. a) 8.9   **b)** 50.0
c) 8°   **d)** 44°
2. a) 36.9 mm   **b)** 50.4 m
3. a) 53°   **b)** 58°
4. a) ∠C = 86°, ∠A = 27°, a = 6.0 m or
∠C = 94°, ∠A = 19°, a = 4.2 m
b) ∠C = 54°, c = 40.7 m, a = 33.6 m
c) ∠B = 119°, c = 20.9 mm, a = 12.4 mm
d) ∠B = 71°, c = 19.4 cm, a = 16.5 cm
5. a) AC = 30.0 cm
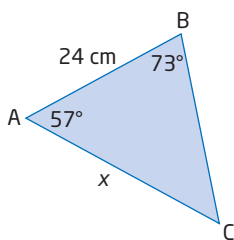
b) AB = 52.4 cm
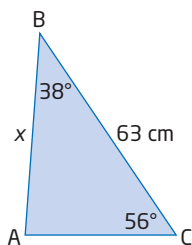
c) AB = 34.7 m

d) BC = 6.0 cm
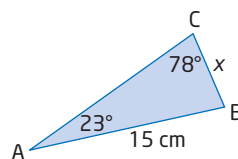
6. a) two solutions   **b)** one solution
c) one solution   **d)** no solutions
7. a) $a > b$ sin A, $a > h$, $b > h$
b) $a > b$ sin A, $a > h$, $a < b$
c) $a = b$ sin A, $a = h$
d) $a > b$ sin A, $a > h$, $a \geq b$
8. a) ∠A = 48°, ∠B = 101°, b = 7.4 cm or
∠A = 132°, ∠B = 17°, b = 2.2 cm
b) ∠P = 65°, ∠R = 72°, r = 20.9 cm or
∠P = 115°, ∠R = 22°, r = 8.2 cm
c) no solutions
9. a) $a \geq 120$ cm   **b)** $a = 52.6$ cm
c) 52.6 cm $< a <$ 120 cm
d) $a < 52.6$ cm
10. a)
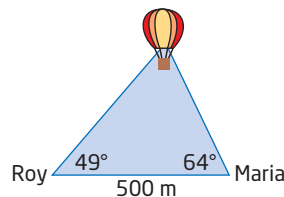
b) 409.9 m
11. 364.7 m
12. 41°
13. 4.5 m
14. a)
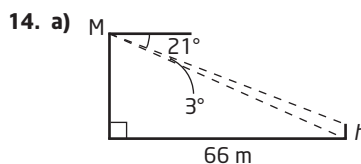
b) 4.1 m   **c)** 72.2 m
15. a) 1.51 Å   **b)** 0.0151 mm
16. least wingspan 9.1 m, greatest wingspan 9.3 m
17. a) Since $a < b$ (360 < 500) and $a > b$ sin A (360 > 500 sin 35°), there are two possible solutions for the triangle.
b)