Boardwork

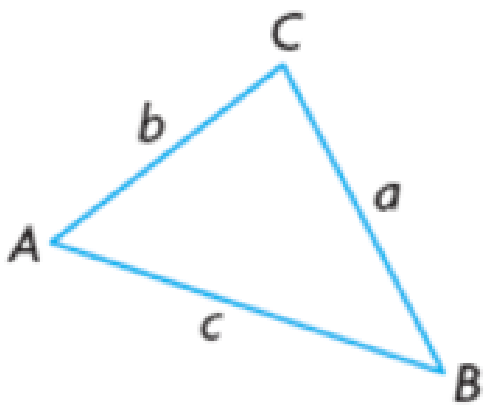
Two planes leave an airport on different runways at the same time. One heads S35°W and the other heads S50°E. After an hour, the first plane has flown 127 km and the second plane flew 148 km. How far apart are the planes?

Unit 3: Acute Triangle Trigonometry

Reminder – SIN LAW

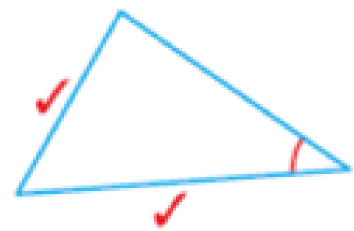
In any acute triangle,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



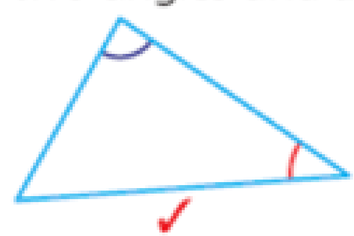
SSA

- two sides and the angle opposite a known side.

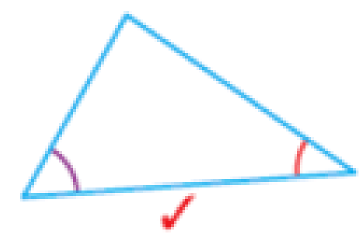


AAS

- two angles and any side.



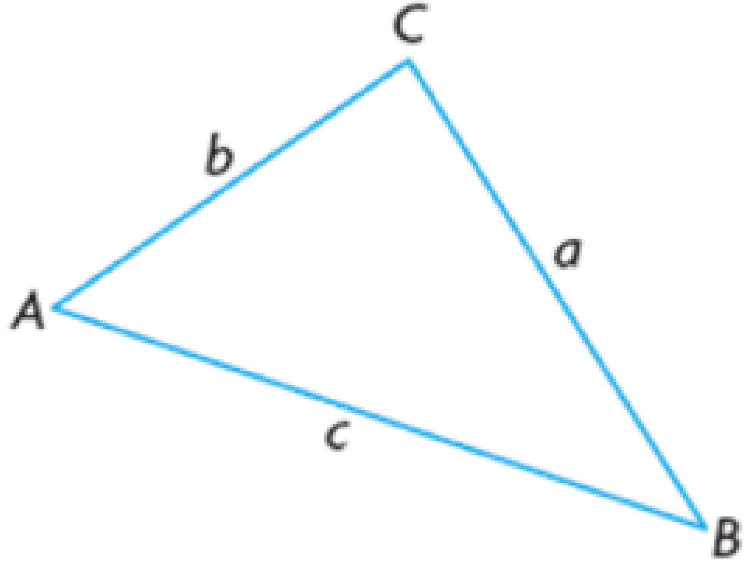
or



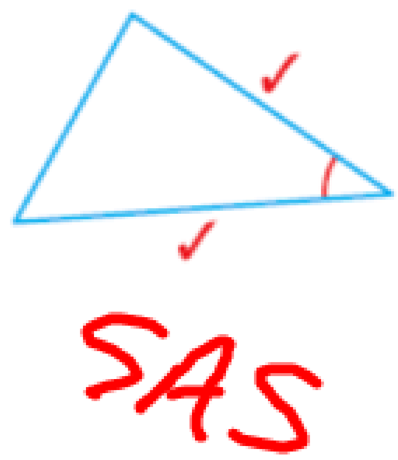
Reminder – COSINE LAW

In any acute triangle,

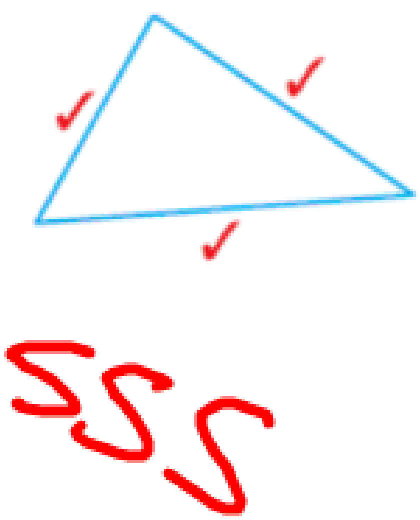
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cos C$$



two sides and the contained angle.



– all three sides.



3.4 Solving Problems Using Acute Triangles

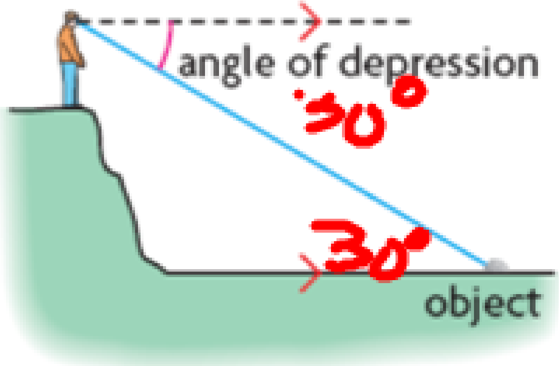
When given situations, you can use triangles to help solve problems

Key to this is the correctly input the given information into a triangle

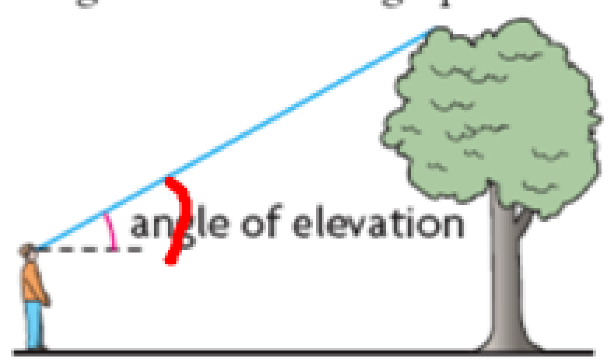
DRAW A DIAGRAM, THEN VERIFY THAT THE PICTURE IS CORRECT ***TWICE!!***

Angle Names

angle of depression: The angle between a horizontal line and the line of sight when looking down at an object.

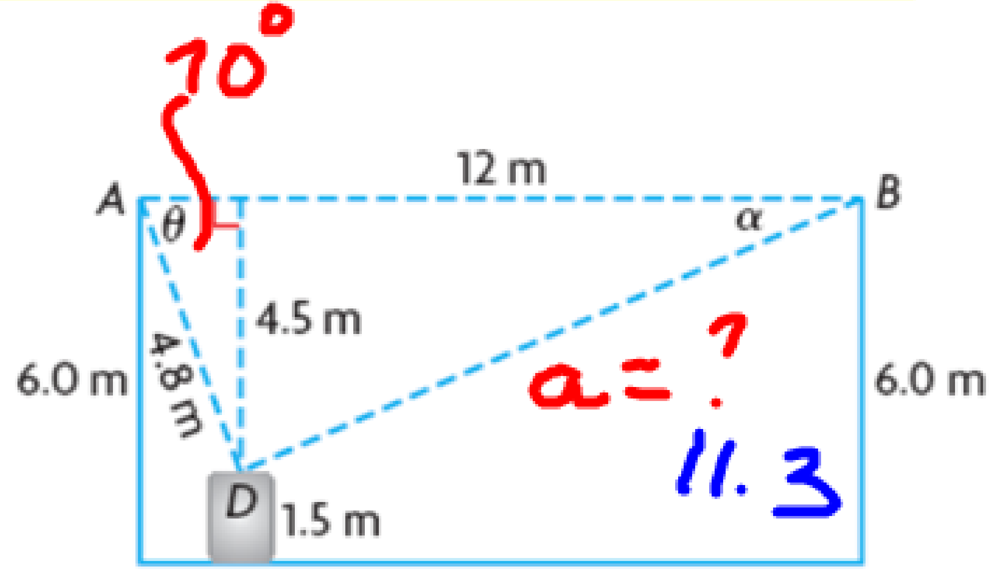


angle of elevation: The angle between a horizontal line and the line of sight when looking up at an object.



Example 1 (p.140)

Two security cameras in a museum must be adjusted to monitor a new display of fossils. The cameras are mounted 6 m above the floor, directly across from each other on opposite walls. The walls are 12 m apart. The fossils are displayed in cases made of wood and glass. The top of the display is 1.5 m above the floor. The distance from the camera on the left to the centre of the top of the display is 4.8 m. Both cameras must aim at the centre of the top of the display.



Determine the **angles of depression,** to the nearest degree, for each camera.

$$\sin\theta = \frac{4.5}{4.8}$$

$$\theta = \sin^{-1}\left(\frac{4.5}{4.8}\right)$$

$$\theta = 70^\circ$$

$$a^2 = (4.8)^2 + (12)^2 - 2(4.8)(12)\cos 70°$$

$$a^2 = 127.639$$

$$a = 11.3\text{ cm}$$

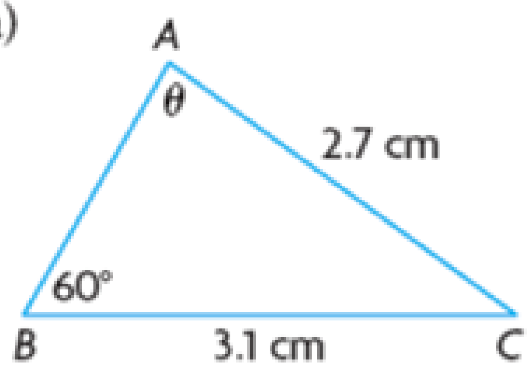
$$\sin\alpha = \frac{4.5}{11.3}$$

$$\alpha = \sin^{-1}\left(\frac{4.5}{11.3}\right) = 23°$$

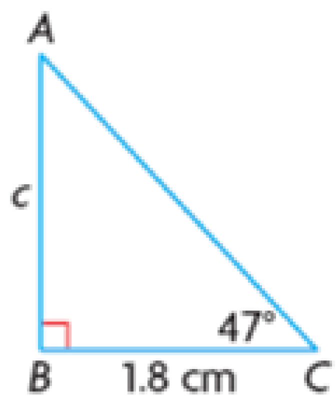
Example 1 (p. 147)

1. Explain how you would determine the indicated angle measure or side length in each triangle.

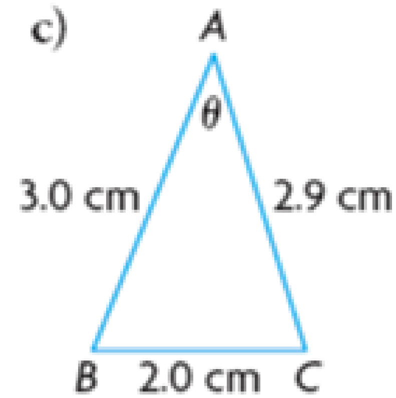
a)



b)



c)



Law of Sines

tangent ratio

Law of Cosines

Example 2 (p. 143)

The world's tallest free-standing totem pole is located in Beacon Hill Park in Victoria, British Columbia. It was carved from a single cedar log by noted carver Chief Mungo Martin of the Kwakiutl (Kwakwaka'wakw), with a team that included his son David and Henry Hunt. It was erected in 1956.

While visiting the park, Manuel wanted to determine the height of the totem pole, so he drew a sketch and made some measurements:

- I walked along the shadow of the totem pole and counted 42 paces, estimating each pace was about 1 m.
- I estimated that the **angle of elevation** of the Sun was about 40°.
- I observed that the shadow ran uphill, and I estimated that the angle the hill made with the horizontal was about 5°.

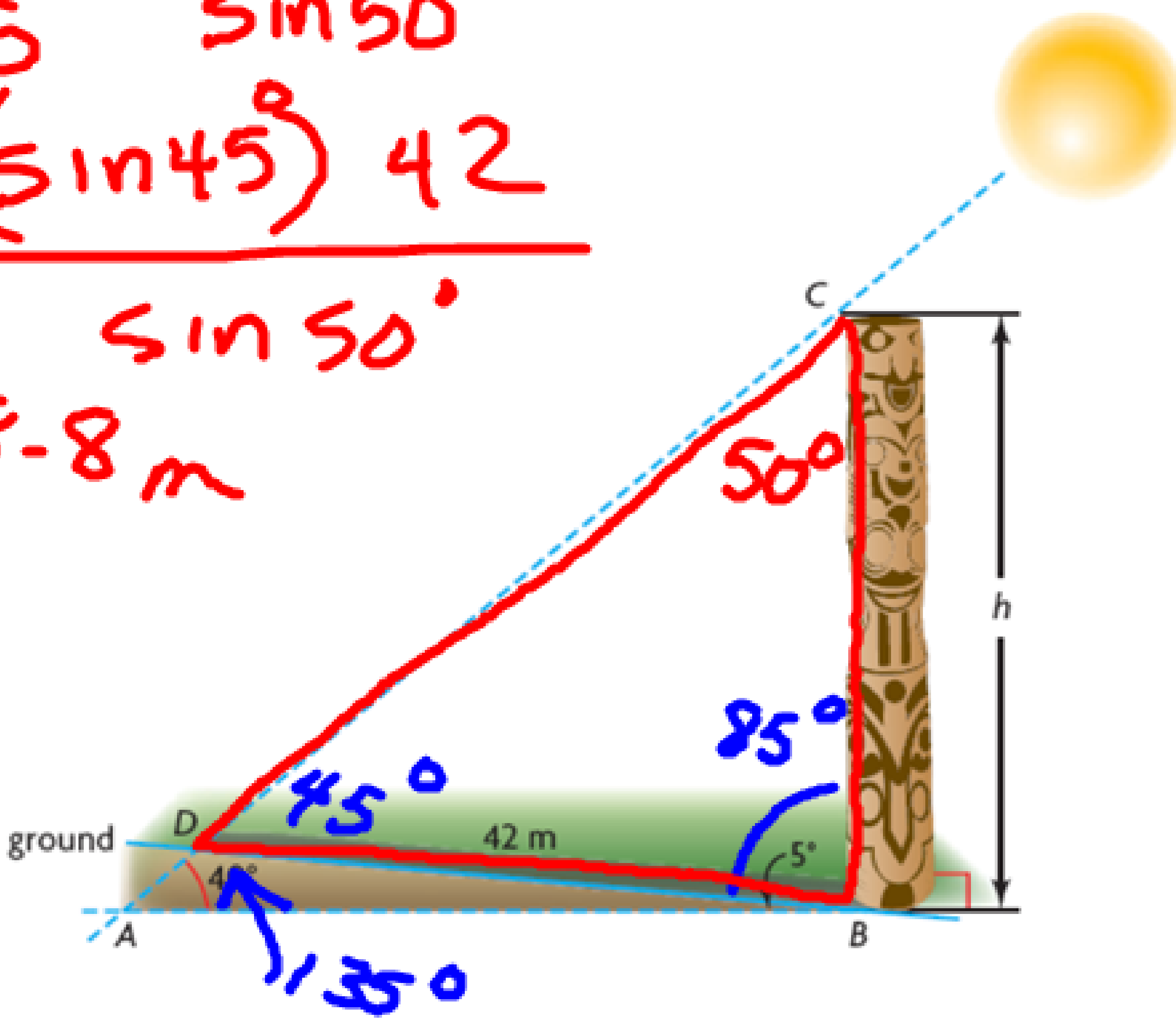
How can Manuel determine the height of the totem pole to the nearest metre?

Example 2 cont'd (p.143)

$$\frac{h}{\sin 45} = \frac{42}{\sin 50}$$

$$h = \frac{(\sin 45°)\, 42}{\sin 50°}$$

$$h = 38.8\ m$$



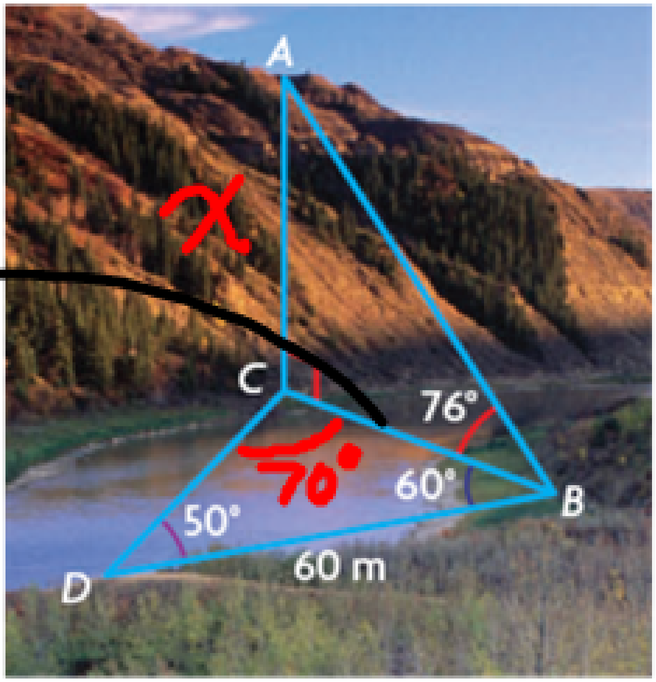
Example 3 (p. 145)

Solving a 3D problem

Brendan and Diana plan to climb the cliff at Dry Island Buffalo Jump, Alberta. They need to know the height of the climb before they start. Brendan stands at point B, as shown in the diagram. He uses a clinometer to determine $\angle ABC$, the angle of elevation to the top of the cliff. Then he estimates $\angle CBD$, the angle between the base of the cliff, himself, and Diana, who is standing at point D. Diana estimates $\angle CDB$, the angle between the base of the cliff, herself, and Brendan.

Determine the height of the cliff to the nearest metre.

Example 3 cont'd (p. 145)



$$\frac{BC}{\sin 50^\circ} = \frac{60}{\sin 70^\circ}$$

$$BC = \frac{60(\sin 50^\circ)}{\sin 70^\circ}$$

$$BC = 48.9\text{ m}$$

$$\tan 76 = \frac{x}{48.9}$$

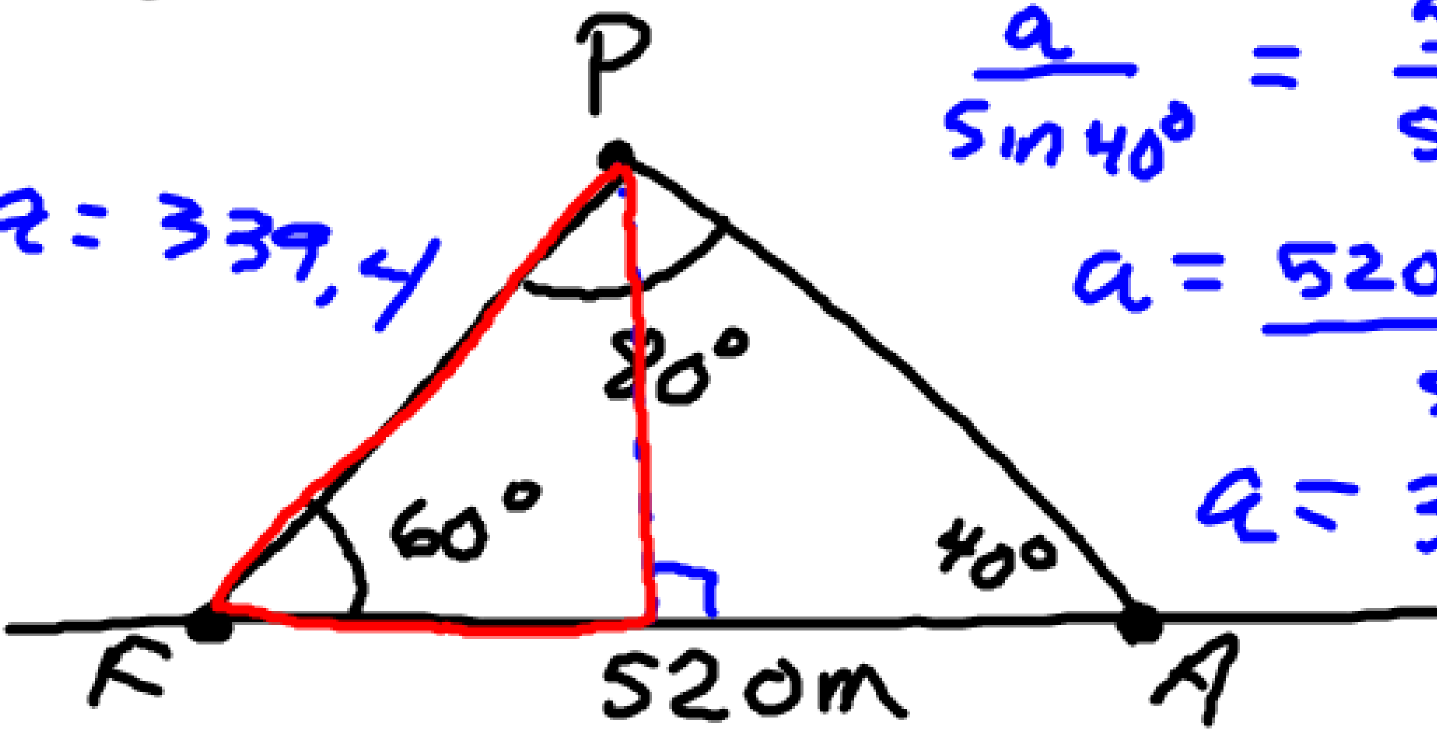
$$x = 196.1\text{ m}$$

Example 8 (p. 148)

$\sin 60^\circ = \frac{h}{339.4}$

$h = 293.9\text{ m}$

Fred and Agnes are 520 m apart. As Brendan flies overhead in an airplane, they estimate the angle of elevation of the airplane. Fred, looking south, estimates the angle of elevation to be 60°. Agnes, looking north, estimates it to be 40°. What is the altitude of the airplane, to the nearest tenth of a metre?



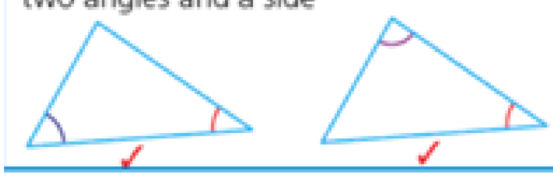
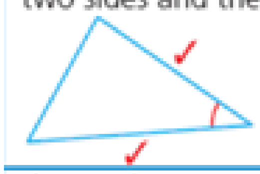
$a = 339.4$

$\frac{a}{\sin 40^\circ} = \frac{520}{\sin 80^\circ}$

$a = \frac{520 \sin 40^\circ}{\sin 80^\circ}$

$a = 339.4\text{ m}$

Need to Know

Information Given	Measurement to be Determined	Use
two sides and the angle opposite one of the sides 	angle	sine law
two angles and a side 	side	sine law
two sides and the contained angle 	side	cosine law
three sides 	angle	cosine law

Drawing a clearly labelled diagram makes it easier to select a strategy for solving a problem.

Homework

P. 146-148

3, 4, 5, 6, 7, 9, 11, 13, *16 (won’t be easy, THINK)*