4.4 Solving Problems UsingObtuse Triangles

Now that we know that we can solve obtuse triangles using ***law of sines*** *and* ***law of cosines****, lets solve problems*

Example

In ΔQRS, q = 8.9 cm, r = 3.8 cm, and s = 7.2 cm. Solve DQRS by determining the measure of each angle to the nearest degree. Show your work.

When given SSS always solve for longest angle first.

$$\cos Q = \frac{r^2 + s^2 - q^2}{2rs}$$

$$\cos Q = \frac{(3.8)^2 + (7.2)^2 - (8.9)^2}{2(3.8)(7.2)}$$

$$\cos Q = -0.2363$$

$$Q = 104^\circ$$

$$\frac{\sin Q}{q} = \frac{\sin R}{r}$$

$$\frac{\sin 104}{8.9} = \frac{\sin R}{3.8}$$

$$\angle S = 52^\circ$$

$$\sin R = 0.4143$$

$$R = 24^\circ$$

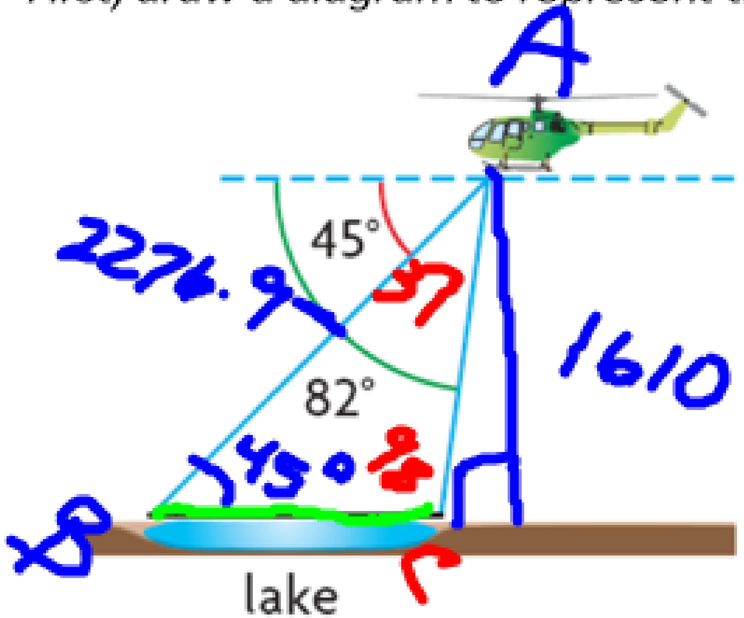
Example 1 (p. 188)

$$\frac{BC}{\sin 37^\circ} = \frac{2276.9}{\sin 98^\circ}$$

A surveyor in a helicopter would like to know the width of Garibaldi Lake in British Columbia. When the helicopter is hovering at 1610 m above the forest, the surveyor observes that the angles of depression to two points on opposite shores of the lake measure 45° and 82°. The helicopter and the two points are in the same vertical plane.

$$BC = 1384\text{ m}$$

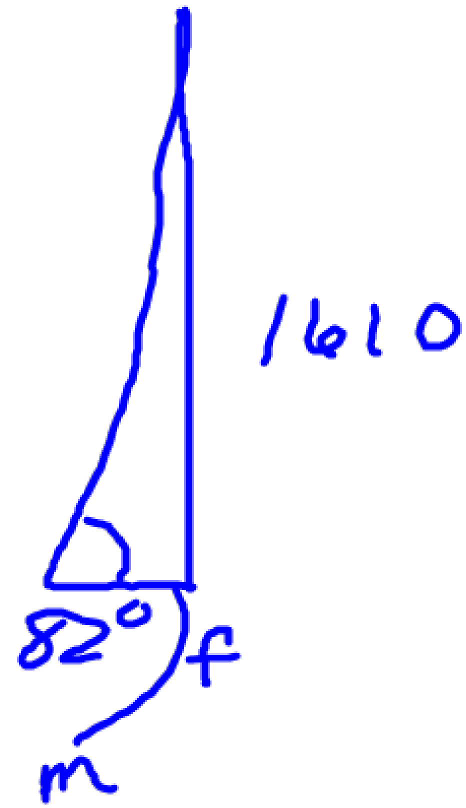
First, draw a diagram to represent the situation using triangles



$$\sin 45^\circ = \frac{1610}{AB}$$

$$AB = \frac{1610}{\sin 45^\circ}$$

$$AB = 2276.9\text{ m}$$



$$\tan 82^\circ = \frac{1610}{m}$$

$$m = \frac{1610}{\tan 82^\circ}$$

$$m = 226.3\,m$$

$$\boxed{\text{width lake} = 1610 - 226.3}$$

$$\simeq 1384\,m$$

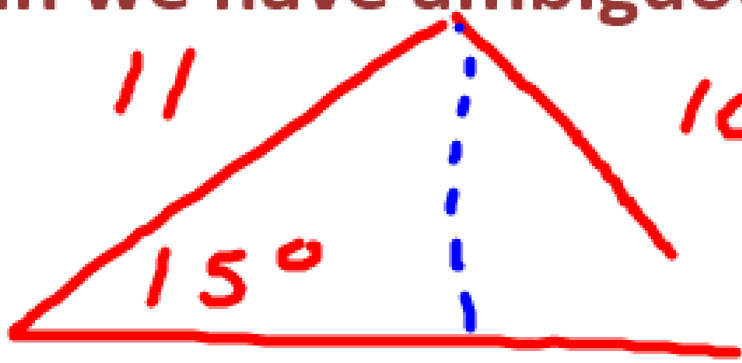
Example 1 (p. 188) cont’d

Do we need to worry about the ambiguous case when using the sine law in this situation?

Example

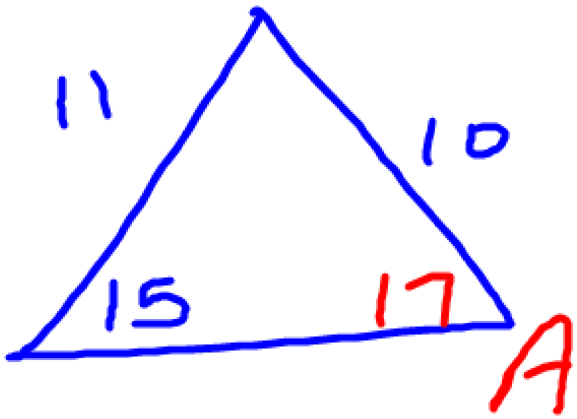
An obtuse triangle has two known side lengths: 10 cm and 11 cm. The angle opposite the shorter side measures 15°. Calculate the measure of <*A*, the obtuse angle in the triangle, to the nearest degree. Show your work.

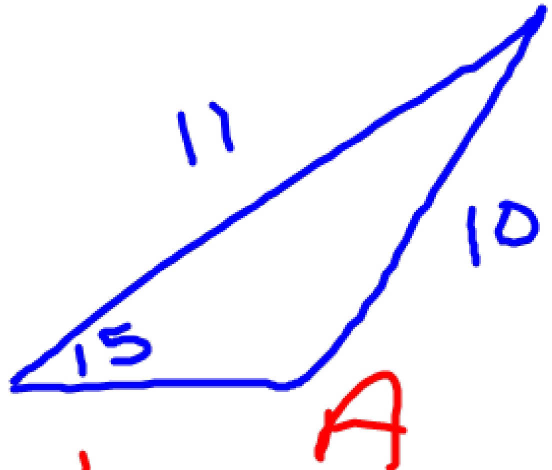
Can we have ambiguous case here?



$h = 11\sin 15°$

$h = 2.84$





$$\frac{\sin 15}{10} = \frac{\sin A}{11}$$

$$\sin A = 0.2847$$

$$A = 17^\circ$$

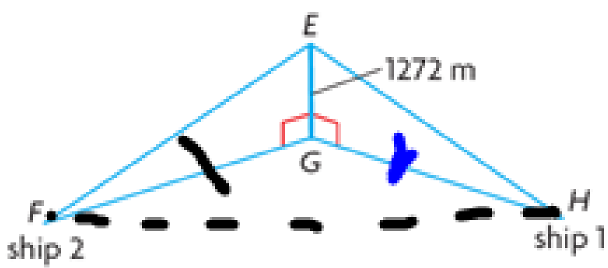
$$180 - 17$$

$$A = 163^\circ$$

Example 2 (p. 191)

A wind turbine called the Eye of the Wind is located at the top of Grouse Mountain in Vancouver. Rae is standing in the viewing pod at an altitude of 1272 m above sea level. She observes two ships in the harbour below. The first ship is at S3.3°E, with an angle of depression that measures 6.9°. The second ship is at S15.5°E, with an angle of depression that measures 7.3°. Determine the distance between the two ships, to the nearest metre.

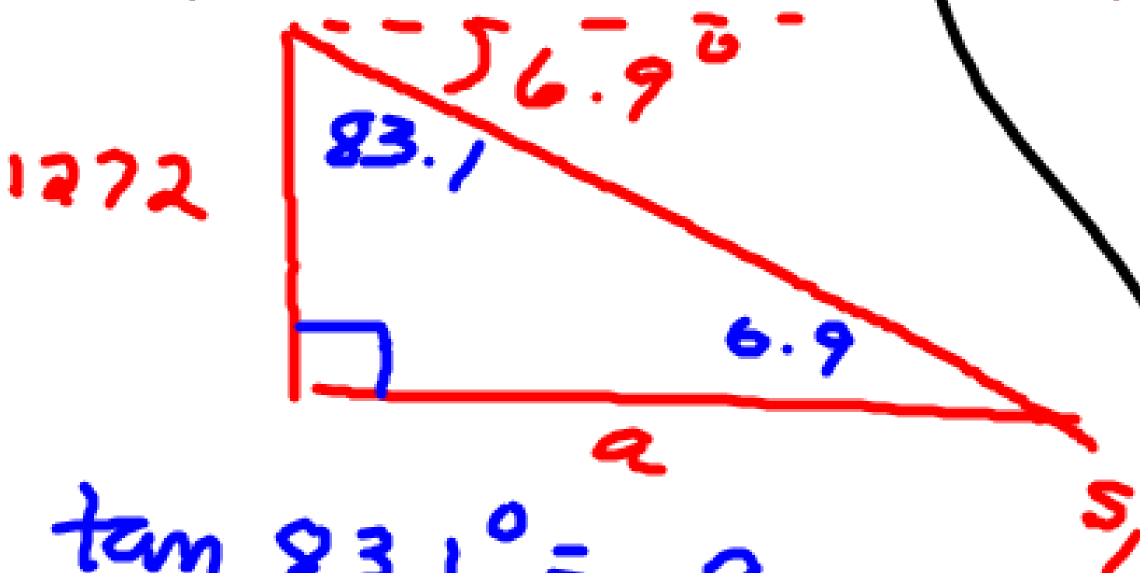
Who thinks they'll be able to do this in one step?



Break it up into parts. Given the information you have, what can you solve?

Example 2 (p. 191) cont'd

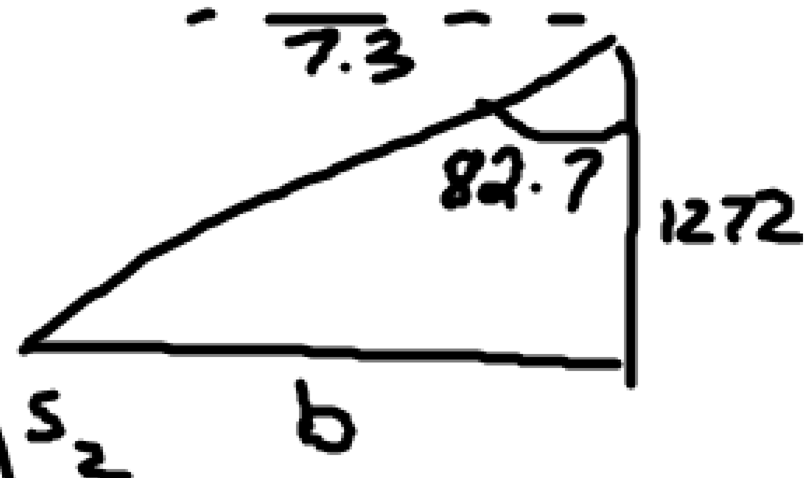
Make a triangle representation to solve for ship 1



$$\tan 83.1^\circ = \frac{a}{1272}$$

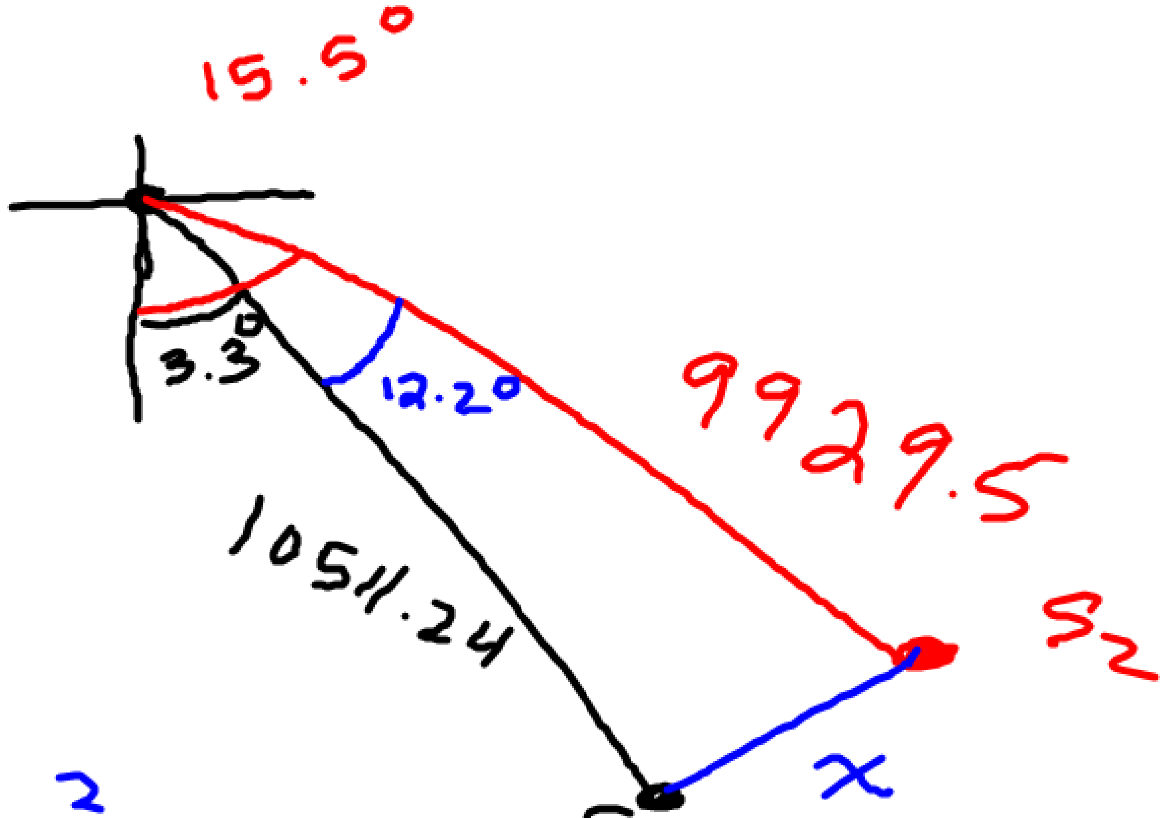
$$a = 10511.24$$

Make a triangle representation to solve for ship 2



$$\tan 82.7^\circ = \frac{b}{1272}$$

$$b = 9929.5\,m$$

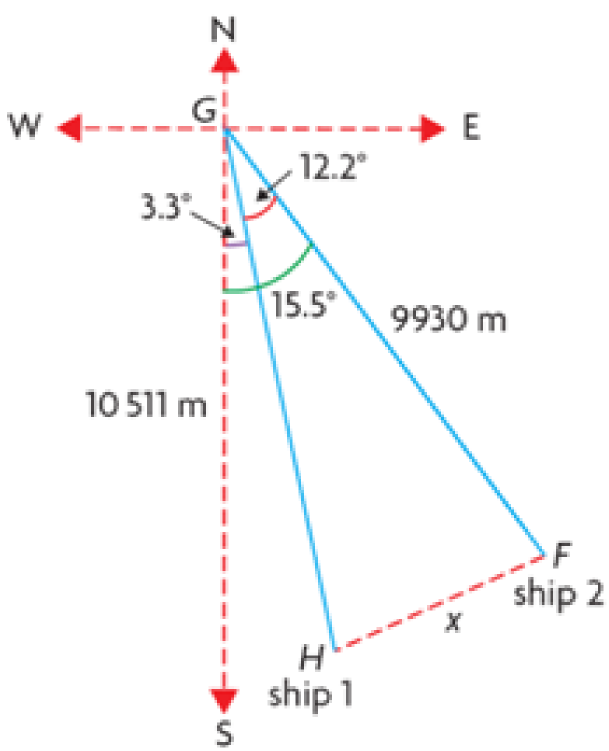


$$x^2 = (10511.24)^2 + (9929.5)^2 - 2(10511.24)(9929.5)\cos 12.2^\circ$$

$$x = 2248$$

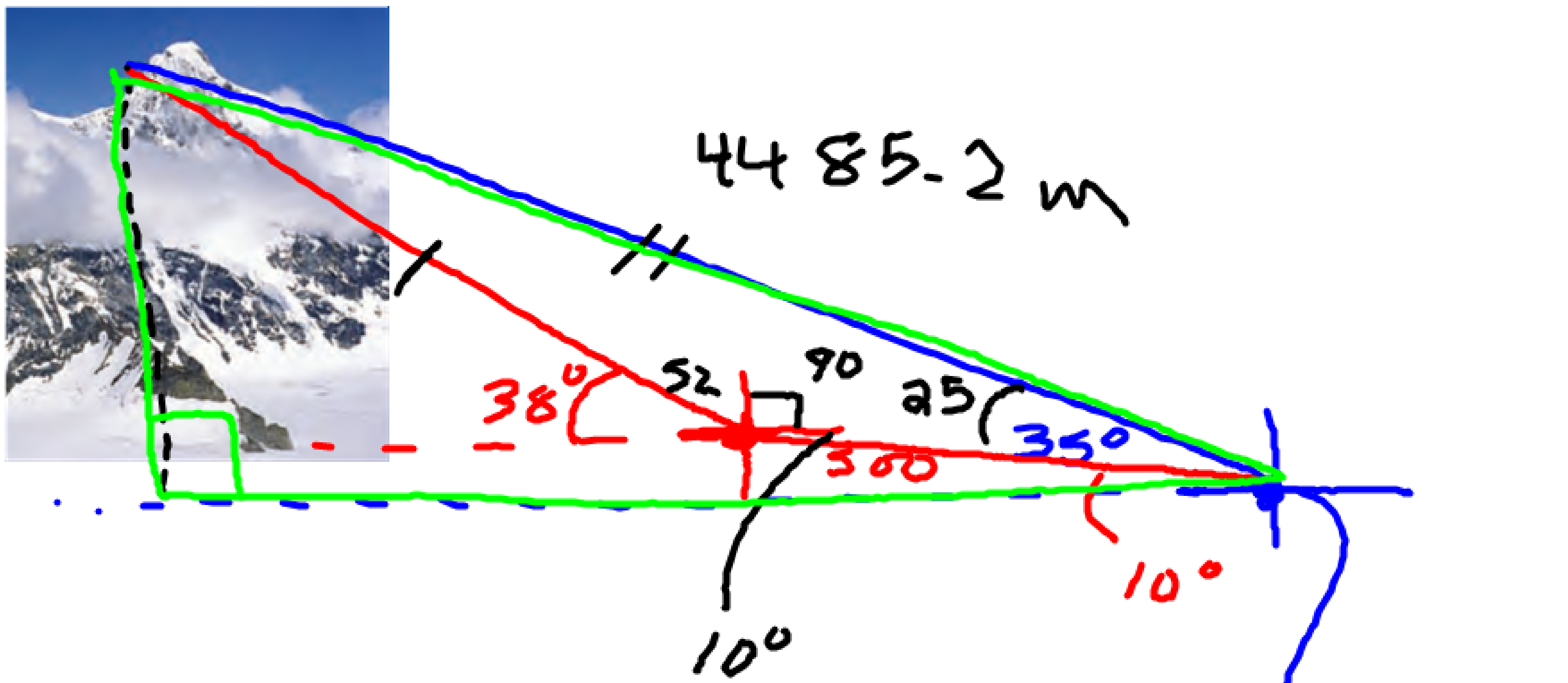
Example 2 (p. 191) cont'd

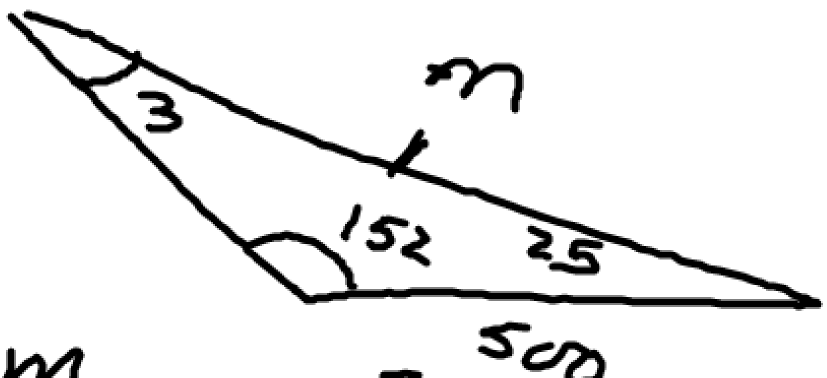
*Once we know the horizontal distances, use a **birds eye view** with the **given directions** to solve how far apart they are*



Example 11 (p. 196)

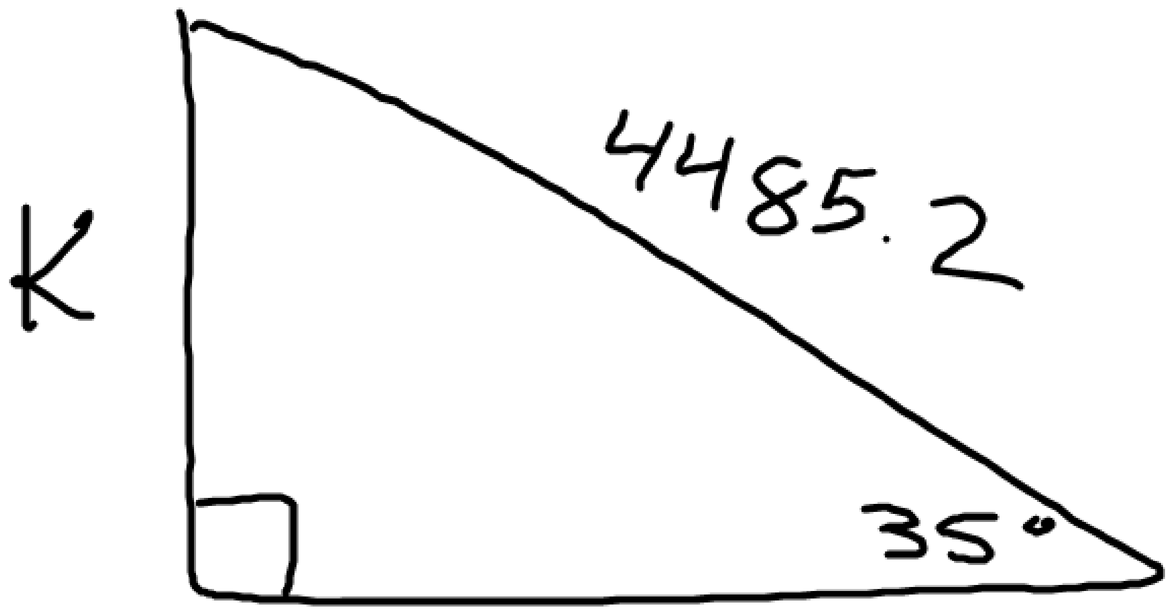
Mount Logan, in Yukon Territory, is Canada's highest peak. In North America, it is second in height only to Mount McKinley. An amateur climber is trying to calculate the height of Mount Logan. From her campsite, the angle of elevation to the summit measures 35°. She walks 500 m closer, up a 10° inclined slope, and measures the new angle of elevation as 38°. Her campsite is at an altitude of 1834 m. Determine the height of Mount Logan, to the nearest 10 m.





$$\frac{m}{\sin 52} = \frac{500}{\sin 3}$$

$$m = 4485.2\,m$$



$$\sin 35^\circ = \frac{K}{4485.2}$$

$K = 2573$

Total Height

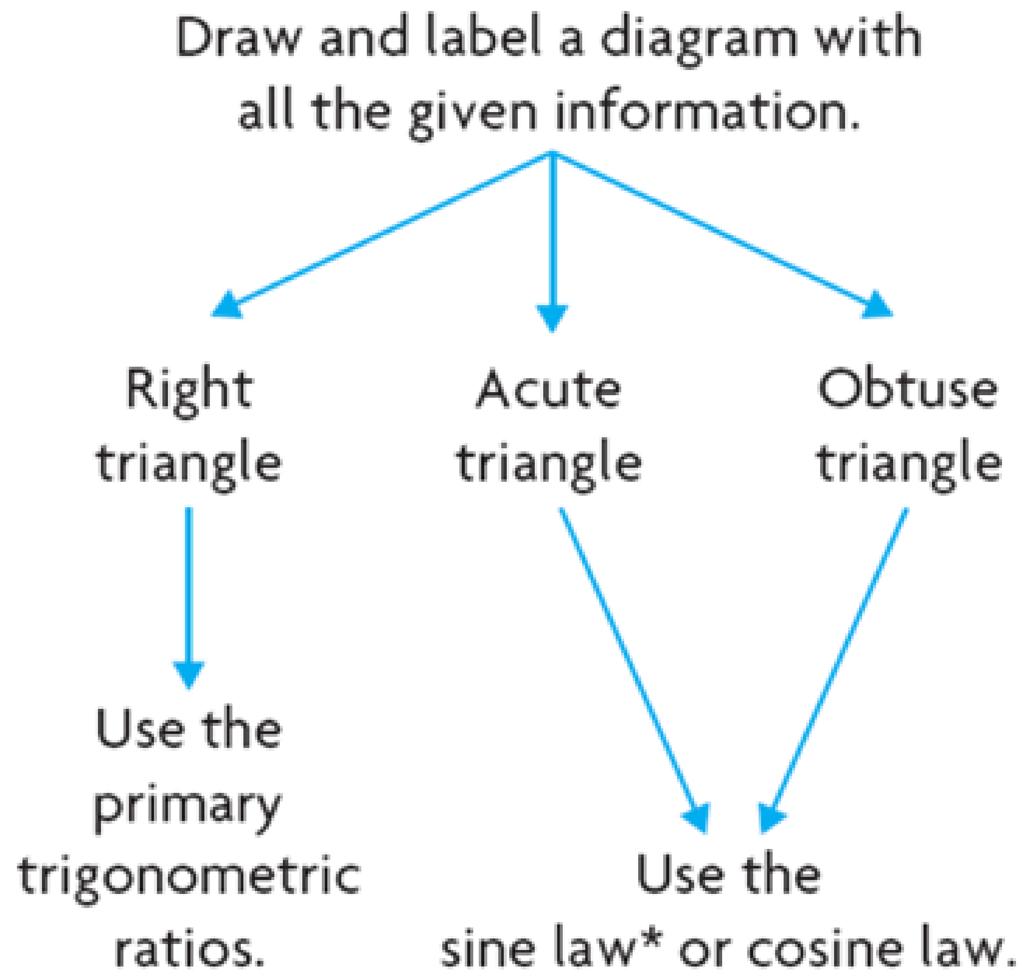
$2573 + 1834 = 4407\,m$

Key Idea

*The **sine law**, the **cosine law**, the **primary trigonometric ratios** and the **sum of the measures of the angles in a triangle** may all be useful when solving problems that can be modelled using obtuse triangles.*

Need to Know

Use the following decision tree to help decide a strategy when solving problems



*when given SSA beware of ambiguous case

Don't make an an ASS of yourself

Homework

P. 193-197

2, 3, 5, 6, 8*, 9, 10, 12*

**check your notes from example 2, p. 191*

You will need a similar diagram