

2.7 Solving Problems Involving More Than One Right Triangle

Lesson Focus

Use trigonometry to solve problems modelled by more than one right triangle

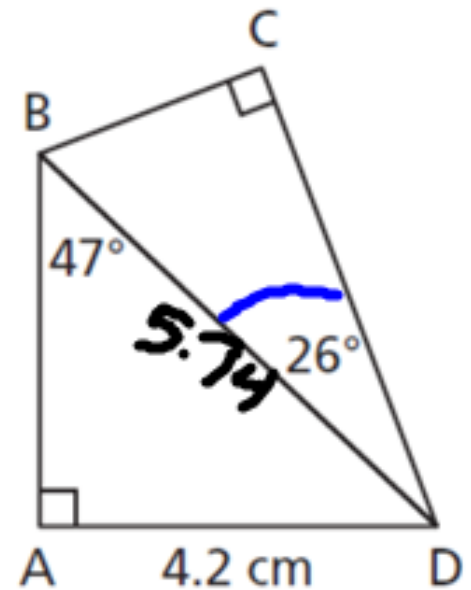
Example

Calculate the length of CD to the nearest tenth of a centimetre.

$$\sin 47^\circ = \frac{4.2}{BD}$$

$$BD = \frac{4.2}{\sin 47^\circ}$$

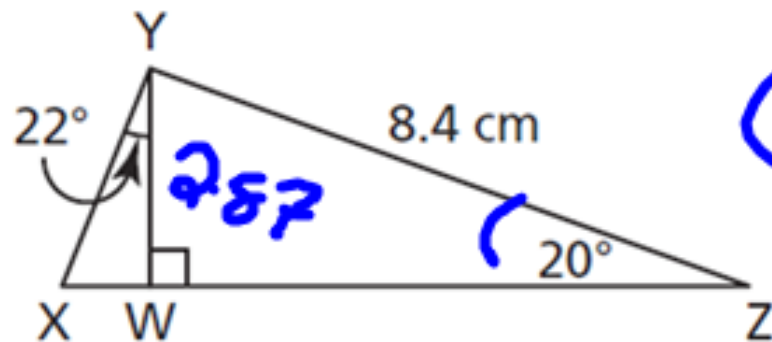
$$BD = 5.74$$



$$\cos 26^\circ = \frac{CD}{5.74}$$
$$(5.74) \cos 26^\circ = CD$$
$$5.2 \text{ cm} = CD$$

Example – Your Turn

Calculate the length of XY to the nearest tenth of a centimetre.



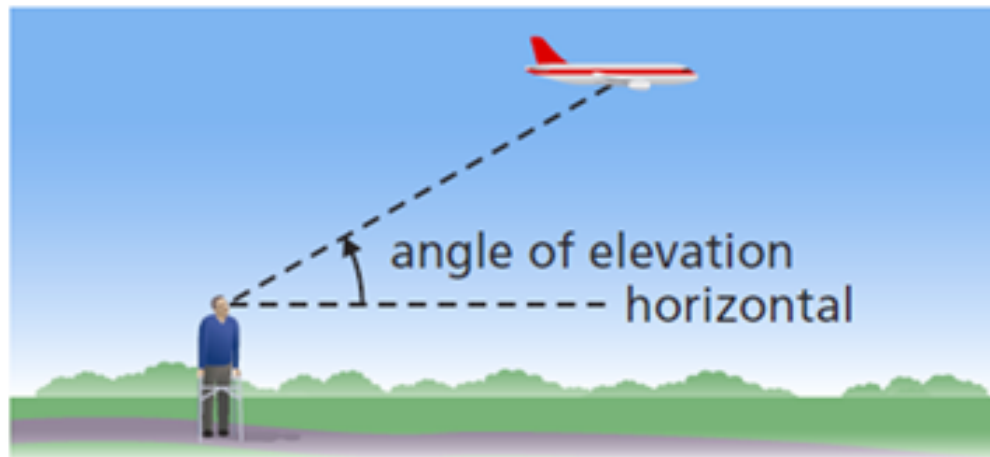
$$\sin 20^\circ = \frac{WY}{8.4}$$
$$(8.4) \sin 20^\circ = WY$$
$$2.87 = WY$$

$$\cos 22^\circ = \frac{2.87}{XY}$$

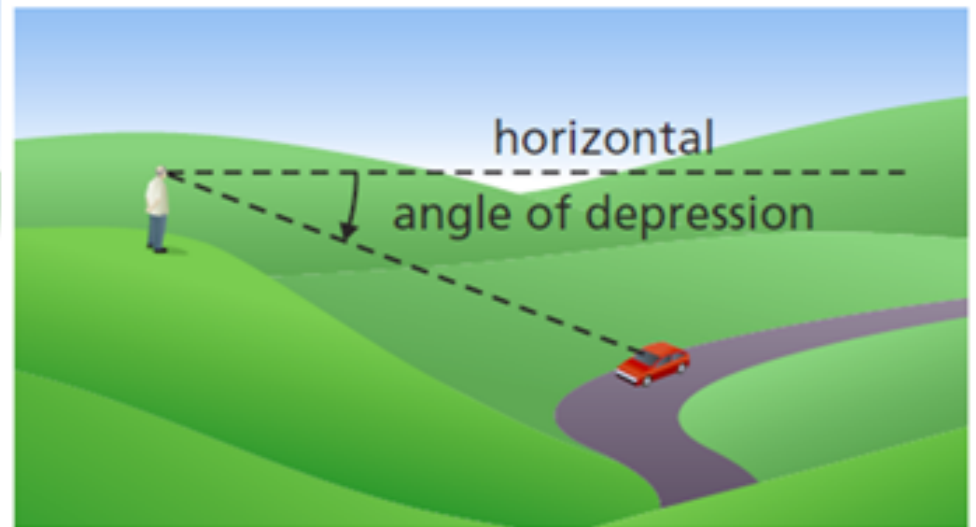
$$XY = \frac{2.87}{\cos 22^\circ} = 3.1 \text{ cm}$$

Different Types of Angles

The **angle of elevation** of an object above the horizontal is the angle between the horizontal and the line of sight from an observer.



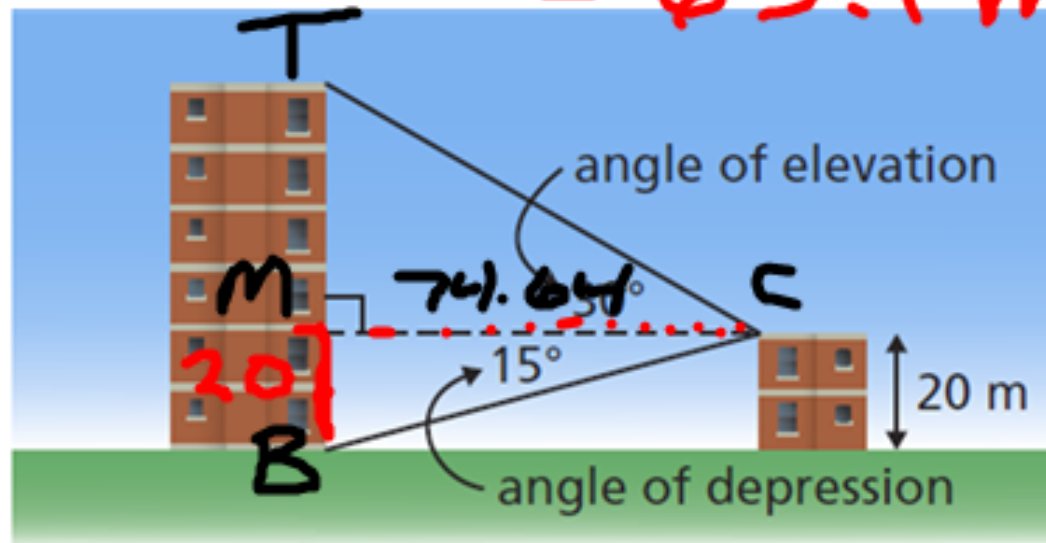
The **angle of depression** of an object below the horizontal is the angle between the horizontal and the line of sight from an observer.



Example

Final height is $43.09 + 20 = 63.1 \text{ m}$

From the top of a 20-m high building, a surveyor measured the angle of elevation of the top of another building and the angle of depression of the base of that building.



The surveyor sketched this plan of her measurements.

Determine the height of the taller building to the nearest tenth of a metre.

$$\tan 15^\circ = \frac{20}{MC}$$

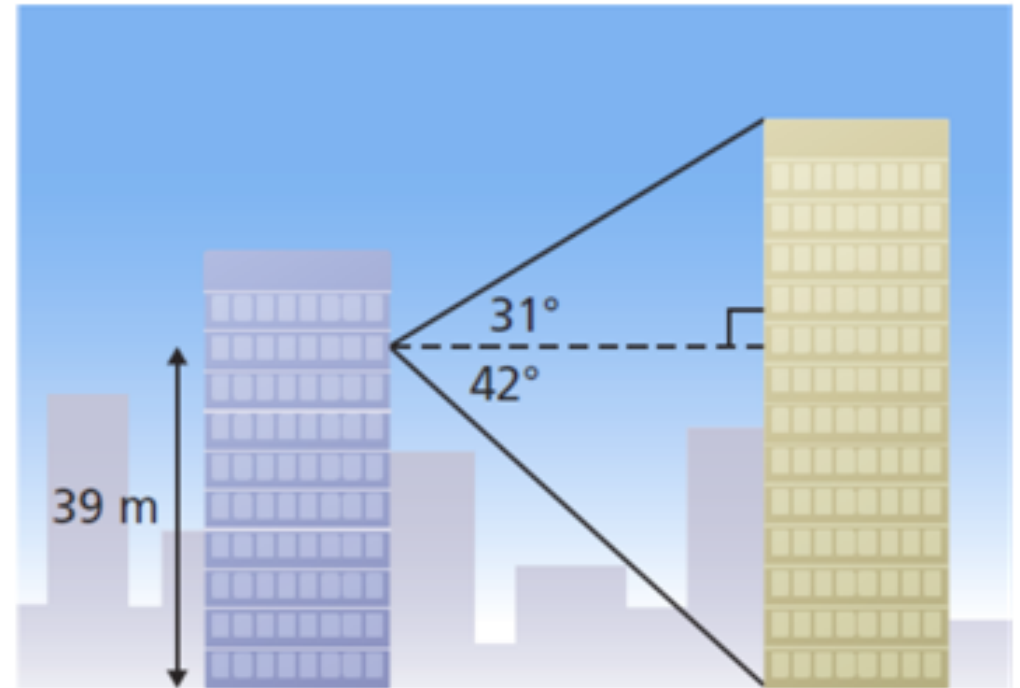
$$MC = \frac{20}{\tan 15^\circ} = 74.64$$

$$\tan 30^\circ = \frac{TM}{74.64}$$

$$TM = 43.09$$

Example – Your Turn

A surveyor stands at a window on the 9th floor of an office tower. He uses a clinometer to measure the angles of elevation and depression of the top and the base of a taller building. The surveyor sketches this plan of his measurements. Determine the height of the taller building to the nearest tenth of a metre.



Homework

$(3, 1, 4)$

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3 (a c), 4, 5 (a c), 6, 8



Using Right Triangles in 3D omit

The following problems are all modelled in 3-Dimensional space

There are different triangles *in different planes*

You must **read carefully** and visualize the scenario

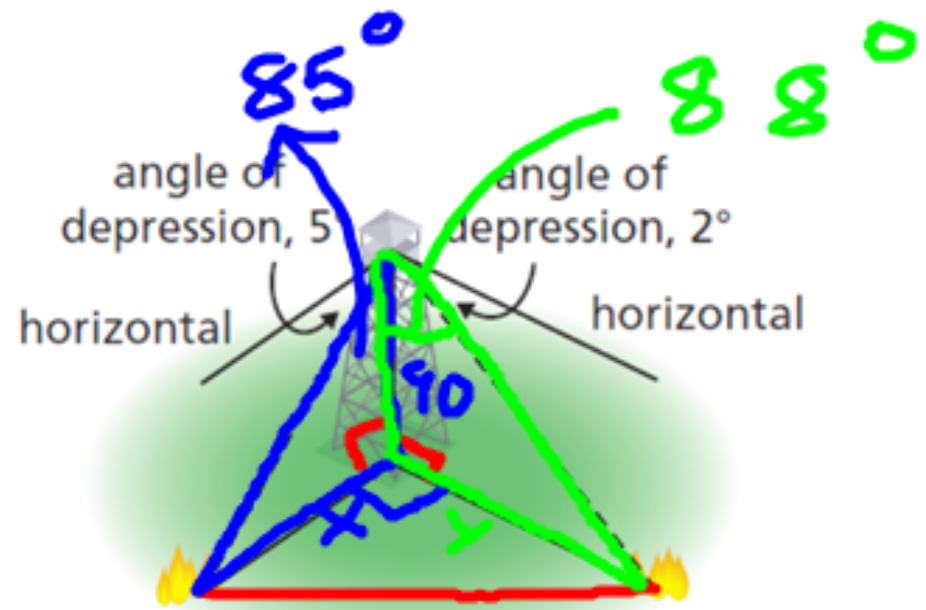
Then draw a picture to represent the scenario
It sometimes helps to break the problem down into individual pictures instead of one confusing picture

Example

From the top of a 90-ft. observation tower, a fire ranger observes one fire due west of the tower at an angle of depression of 5° , and another fire due south of the tower at an angle of depression of 2° .

How far apart are the fires to the nearest foot?

The diagram is *not* drawn to scale.



$$\begin{aligned}\tan 85^\circ &= \frac{x}{90} \\ (90) \tan 85 &= x \\ 1028.7\text{m} &= x\end{aligned}$$

$$\begin{aligned}\tan 88^\circ &= \frac{y}{90} \\ (90) \tan 88^\circ &= y \\ 2577.3\text{m} &= y\end{aligned}$$



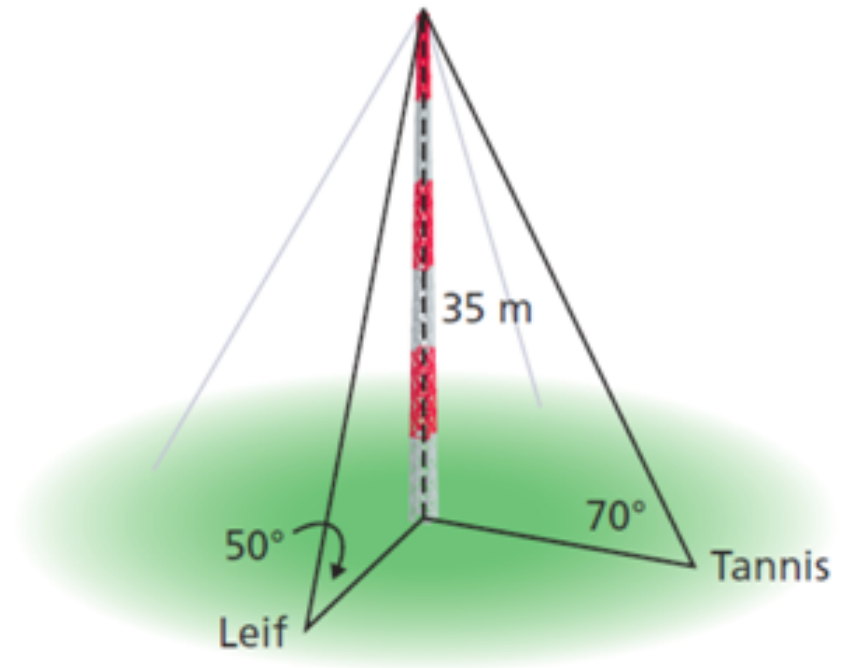
$$(1028.7)^2 + (2577.3)^2 = f^2$$

$$7700507.21 = f^2$$

$$2774.97 \text{ ft} = f$$

Example – Your Turn

A communications tower is 35 m tall. From a point due north of the tower, Tannis measures the angle of elevation of the top of the tower as 70° . Her brother Leif, who is due east of the tower, measures the angle of elevation of the top of the tower as 50° . How far apart are the students to the nearest metre?



Ex. 3 An aircraft controller standing at the top of his tower spots an airplane to his immediate left with an angle of depression of 22° . He spots a second plane to his immediate right at an angle of depression of 36° . If the distance between the planes is 400m, how high is the tower? (Assume the tower is perpendicular to the ground).

Homework

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12, 13, 19, 20(read carefully!)***