

UNIT 15 *Trigonometry*

Activities

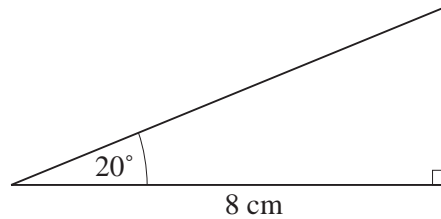
Activities

- 15.1 Trigonometric Values
- 15.2 Clinometers
- 15.3 Exact Values
- 15.4 Wheelchair Ramps
- 15.5 Radar (2 pages)
- 15.6 Trigonometric Puzzle
- Notes and Solutions (2 pages)

ACTIVITY 15.1

Trigonometric Values

1. Accurately draw a right-angled triangle with an angle of 20° , as shown below.



Measure the lengths of the other sides of your triangle.

Use the lengths to calculate:

$$\sin 20^\circ, \cos 20^\circ \text{ and } \tan 20^\circ.$$

2. Accurately draw other triangles to enable you to fill in the results on a table.
Record your results in a table like the one below.

Angle	sin		cos		tan	
	measure	calc	measure	calc	measure	calc
20°						
30°						
40°						
50°						
60°						
70°						

4. Use a calculator to check the values in the table.

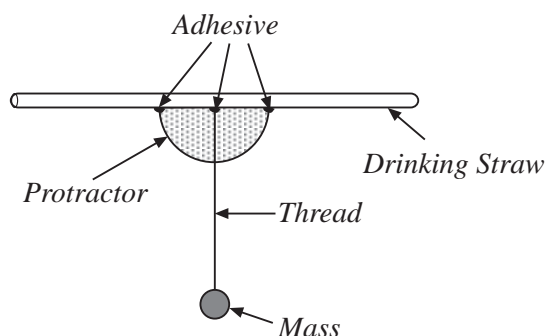
ACTIVITY 15.2

Clinometers

A *clinometer* is an instrument for measuring the angle of an incline (slope).

To make your clinometer you need a drinking straw, a protractor, some adhesive, a small mass and a piece of thread.

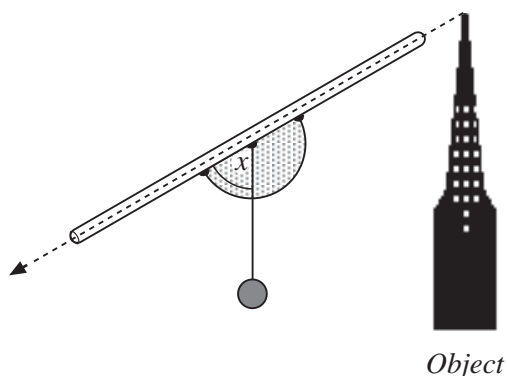
Use adhesive to attach the straw to the protractor, as shown in the diagram. The thread with a mass at its end will serve as a plumb line (to hang vertically).



You can now use your clinometer to determine the height of an object such as a building or a tree.

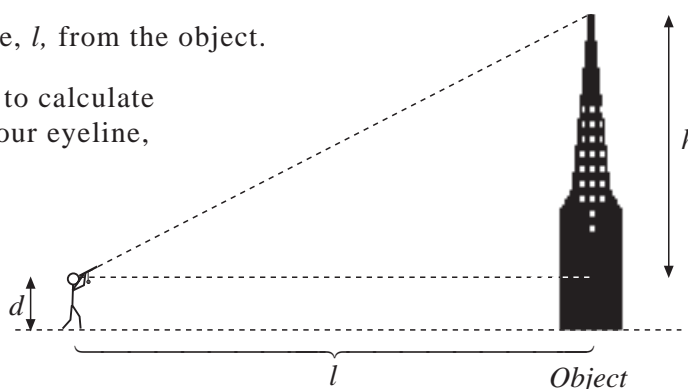
Follow this method.

1. Choose your object.
2. Standing some distance away from the object, view the top of it through the drinking straw. Read and record the value of angle x .



3. Measure and record your distance, l , from the object.
4. Use the readings you have taken to calculate the height of the object, above your eyeline, from the formula

$$\tan x = \frac{l}{h} \Rightarrow h = \frac{l}{\tan x}$$



5. The height, H , of the object is now given by

$$H = \frac{l}{\tan x} + d$$

where d is the height of your eyes from the ground.

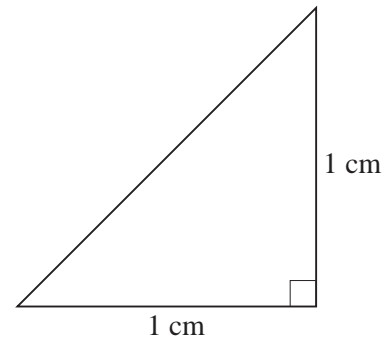
ACTIVITY 15.3

Exact Values

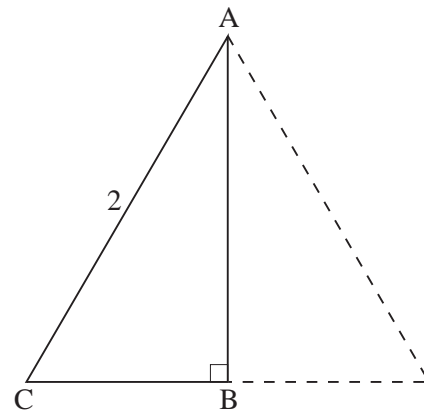
For some angles we can determine exact values, using fractions and square roots instead of just decimal approximations.

For example, the *exact* value of $\cos 30^\circ = \frac{\sqrt{3}}{2}$. These exact values do not contain any rounding errors and can be very useful.

1. The diagram shows an isosceles triangle.
 - (a) Calculate the sizes of the angles in the triangle.
 - (b) Calculate the length of the hypotenuse.
 - (c) Determine exact values for $\sin 45^\circ$, $\cos 45^\circ$ and $\tan 45^\circ$ using this triangle.



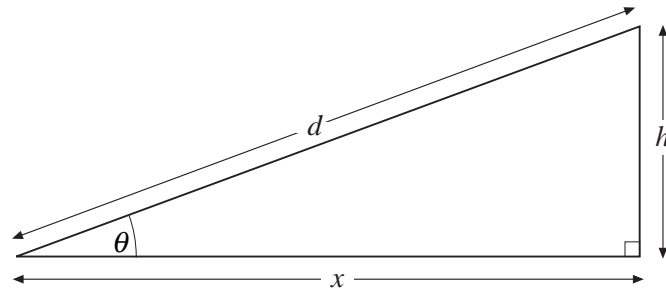
2. The diagram shows an equilateral triangle that has been cut in half to form the right-angled triangle ABC.
 - (a) What is the size of each of the angles in this triangle?
 - (b) What are the lengths of BC and AB ?
 - (c) Determine exact values for $\sin 60^\circ$, $\cos 60^\circ$ and $\tan 60^\circ$.
 - (d) Determine exact values for $\sin 30^\circ$, $\cos 30^\circ$ and $\tan 30^\circ$.



ACTIVITY 15.4

Wheelchair Ramps

Wheelchair ramps are provided for many buildings. In this activity we will investigate how steep they are.



For a number of ramps, measure the distance d and the height h . If it is difficult to measure h , measure x instead.

You can record your results in a table like this one:

d	h	x	θ
2 m	25 cm	-	
1.5 m	-	1.45 m	

1. Calculate the angle θ for the sample values given in the table.
2. Collect data of your own and calculate the angles of the slopes.
3. Present your data using a statistical diagram. What conclusions can you make?

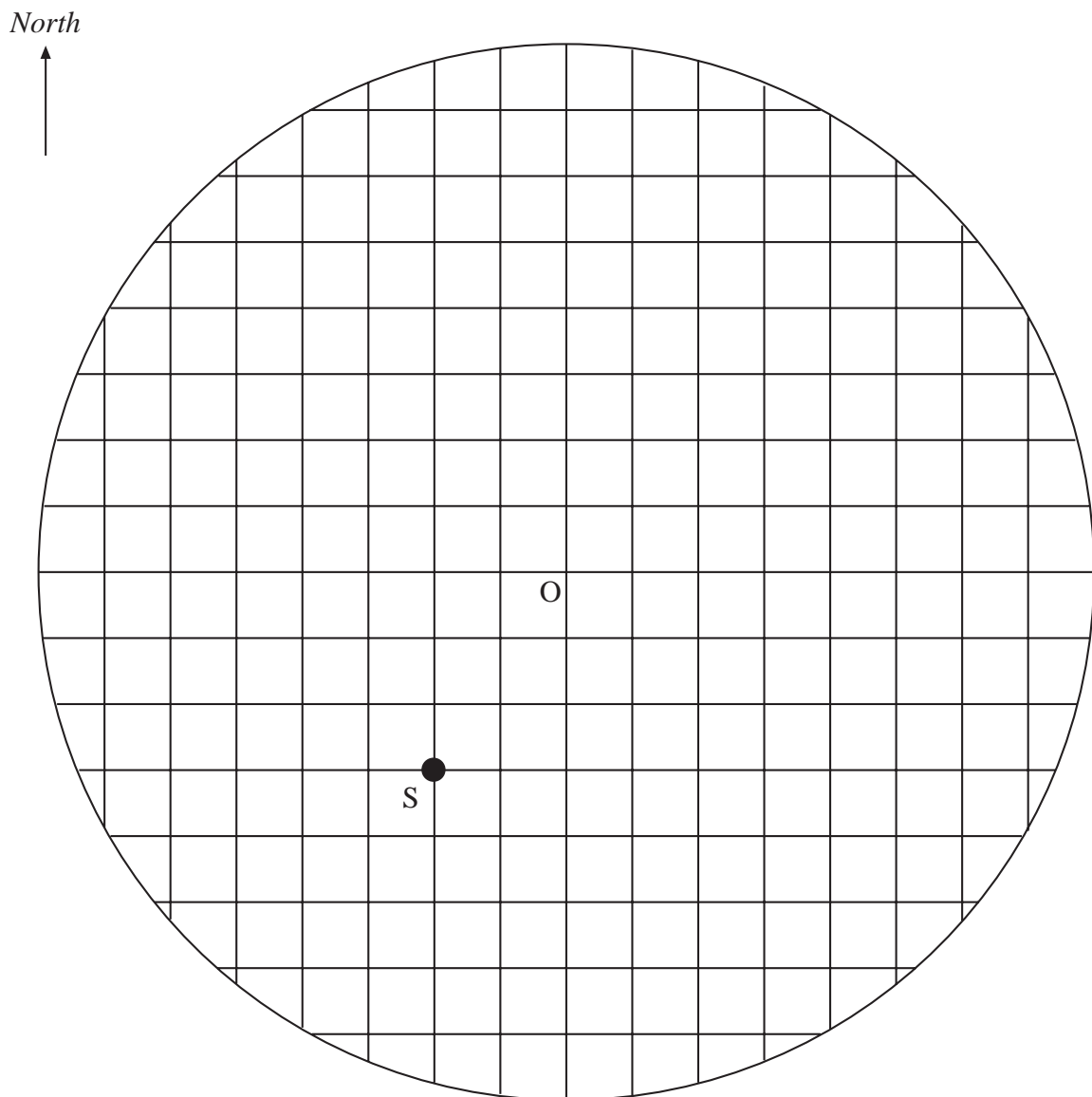
Extension

Find out about any government or council regulations or advice regarding the sizes of angles for ramps.

ACTIVITY 15.5.1

Radar

A ship is anchored at sea. The following diagram represents the circular screen of the ship's radar display. The screen is divided into squares with each side of a square representing 10 km. The centre of the screen, O, represents the ship's own position. Another ship, S, is anchored at $(-2, -3)$. Its position is indicated by a blip on the screen. (In the diagram, we use a dot to represent the blip.)



ACTIVITY 15.5.2

Radar

1. What is the distance between the two ships, correct to the nearest km?

 2. At 0600 hours, another blip appears at (5, 6) with respect to O, travelling on a bearing of 200° at an estimated speed of 40 km/h.
 - (a) Use a dot to indicate the position of this unidentified vessel on the screen.
At 0600 hours, what is its distance from the ship at O, correct to the nearest km?
 - (b) Draw a line clearly on the screen to show the course of navigation taken by this unidentified vessel.
 - (c) If this unidentified vessel continues with the same course and the ship at O remains stationary, what will be the shortest distance between it and the ship at O ? Estimate your answer from the screen and then calculate the answer, giving it to the nearest km.
 - (d) At what time will the unidentified vessel move out of the radar display? How far will it then be from O ? Estimate your answers and then calculate them.
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Extension

If the ship at S remains at anchor, what is the shortest distance of the moving ship from S, and at what time will it be in this position ?

