

**55** The (rectangular) flag of the Philippines is divided into three sections. The hoist (the edge nearest to the flagpole) is the base of an equilateral triangle. The rest of the flag is divided horizontally into two equal sections.

With the top twice the length of the hoist, make an accurate drawing of the flag.

**56** A mansard roof has steep lower sections and shallow upper sections. Try drawing this cross-section of a mansard roof.

With scale 1 cm to 1 m (1:100) draw a horizontal line AD to represent 15 m. Divide the line into 3 equal parts with  $AB = BC = CD$ .

Construct an equilateral triangle ABG with base AB. Construct an equilateral triangle CDE with base CD. Both G and E should be above the line AD.

Construct the perpendicular bisector of BC and mark F on this line 7 m above the mid-point of BC. Join GF and join EF.

**57** (a) Draw a circle with centre O and radius 60 mm. Draw a diameter from the top to the bottom of the circle, marking the top N and the bottom S.

(b) From O, construct the perpendicular bisector of NS. Where this meets the circumference of the circle, mark E on the left and Q on the right.

(c) Construct two chords parallel to EQ and 24 mm from EQ.

(d) L, C, A and T are points on the circumference of the circle. In the top right-hand quarter of the circle, draw radii so that angle QOL =  $52^\circ$ , angle QOC =  $40^\circ$  and angle QOA =  $6^\circ$ .

In the bottom left-hand quarter of the circle, draw a radius so that  $EOT = 18^\circ$ .

Your drawing is a cross-section of the Earth (scale 1:106 000 000), as if sliced in half from pole to pole through London (L). C, A and T represent Castellon (Spain), Accra (Ghana) and Taveuni (Fiji). The angles QOL, QOC, QOA and EOT are latitudes.

(e) What do N and S represent?

(f) What does line EQ represent?

(g) What do the lines parallel to EQ represent?

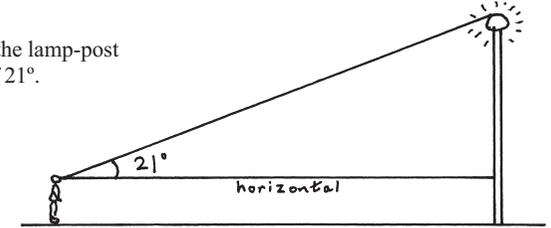
(h) What does the circumference of the circle represent (apart from representing the surface of the Earth)?

(i) The circumference of the Earth is 40 000 km. What is the length of the arc TE? (Clue. All the way round is  $360^\circ$ .)

## ELEVATION AND DEPRESSION

**ELEVATION** (or angle of elevation) is the angle between the horizontal and an object above the horizontal.

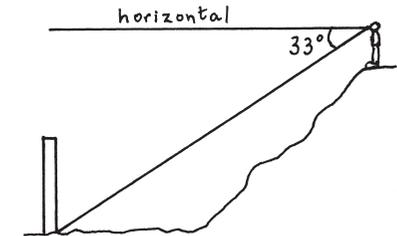
**\*\*Example.** The person sees the top of the lamp-post at an elevation (or angle of elevation) of  $21^\circ$ .



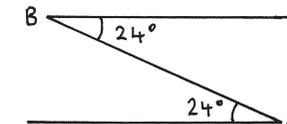
Elevation can also mean a drawing of the outside face of a building (The drawings of the bungalow on page 4 and the house on page 8 are elevations.).

**DEPRESSION** (or angle of depression) is the angle between the horizontal and an object below the horizontal.

**\*\*Example.** The person sees the bottom of the wall at a depression (or angle of depression) of  $33^\circ$ .



The angle of elevation of B from A equals the angle of depression of A from B.



**\*\*Example.**

Paul is 15 metres from the bottom of a vertical tree on level ground. The angle of elevation of the top of the tree from Paul is  $36^\circ$ .

Using a scale of 1 cm to represent 2 m (1:200), make a scale drawing and find the height of the tree.

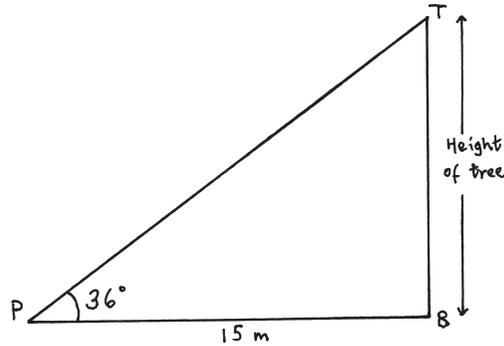
1. Draw a horizontal line and mark on it P (for Paul). From P, measure 7.5 cm and mark B (the bottom of the tree).

2. Construct a perpendicular (vertical line) from B to represent the tree.

3. Draw an angle of  $36^\circ$  from P to meet the vertical line at T (the top of the tree).

4. Measure length BT. This is 5.5 cm.

The height of the tree is 11 metres.



**\*\*Example.**

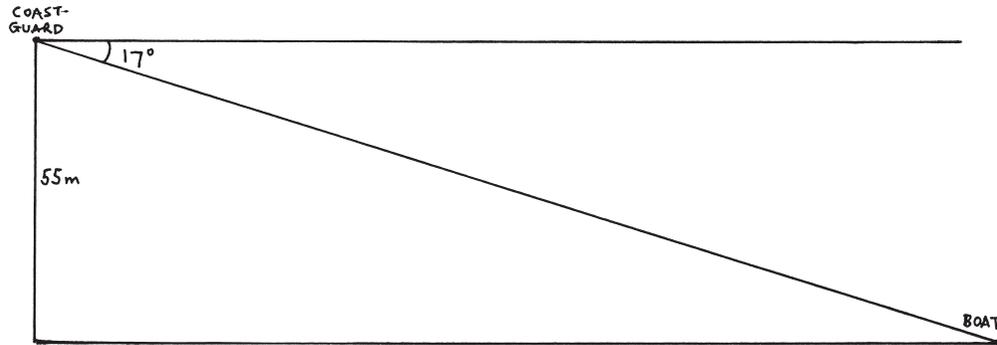
A coastguard on the top of a vertical cliff 55 metres above sea level observes a boat on the sea at an angle of depression of  $17^\circ$ .

Draw an accurate diagram, using a scale of 1 cm : 10 m (1:1000).

How far is the boat from the bottom of the cliff?

- (1) Draw lines to represent the vertical cliff and the horizontal sea.
- (2) Draw a horizontal line from the coastguard and an angle of  $17^\circ$  below the line.
- (3) See where the resulting line meets the sea, and hence measure the distance from the bottom of the cliff to the boat. This is 18 cm.

The boat is 180 metres from the bottom of the cliff.



**58** The base of a wind turbine tower is 34 m from an observer on level ground. The angle of elevation of the top of the tower from the observer is  $34^\circ$ .

Draw an accurate diagram to find the height of the tower.

**59** A police helicopter is hovering directly above a crossroads at a height of 150 m. An observer in the helicopter spots a runaway criminal on the (level) ground at an angle of depression of  $29^\circ$ .

Make an accurate drawing to find out how far the criminal is from the crossroads. [Suggested scale 1 cm : 20 m (1:2000).]

**60** The top of a ladder is 2.8 m up a vertical wall. The angle between the top of the ladder and the wall is  $10^\circ$ . The ground between the wall and the bottom of the ladder is level.

- (a) Using a scale of 5 cm to represent 1 m (1:20), make an accurate drawing to show these measurements.
- (b) What angle does the ladder make with the ground?
- (c) How far is the bottom of the ladder from the wall.

**61** Hazelbank Farm is 1250 m on level ground from the bottom of a vertical cliff. The angle of elevation from the farm to the top of the cliff is  $9^\circ$ .

- (a) Draw an accurate diagram to show the farm, the bottom of the cliff and the top of the cliff.
- (b) The farm is 80 m above sea level. At what height above sea level is the cliff top?

**62** A certain Egyptian pyramid has a base approximately 230 m long. Its sloping sides make an angle of approximately  $52^\circ$  with the ground.

(a) Using a scale of 1:2000 (1 cm to represent 20 m), draw an isosceles triangle to show the dimensions of (a cross-section of) the pyramid.

(b) From your drawing, find the approximate height of the pyramid.

(c) A tourist stands on level ground 130 m away from where the sloping part of the pyramid meets the ground. What is the angle of elevation of the top of the pyramid from where the tourist is standing?

**63** The diagram shows a rough sketch of the end of a greenhouse whose base is 180 cm long and whose vertical sides are each 120 cm long. The angle between the sloping roof and the sides is  $132^\circ$ .

(a) Using a suitable scale, draw an accurate version of the sketch.

From your drawing, measure (b) the length of each side of the sloping roof; (c) the height of the greenhouse at its highest point.

