CABLE CAR

The Cape Town cable car takes tourists to the top of Table Mountain.

The cable is 1.2 kilometres in length and makes an angle of 40 degrees with the ground.

Draw a scale diagram and use it to find an approximate value of the vertical height (h) climbed by the cable car.

Use trigonometry to find the value of the vertical height (h).

The lower cable car station is 302 metres above sea level. What is the height of the upper cable car station? How much higher do you have to climb to reach the highest point of the mountain at 1085 metres

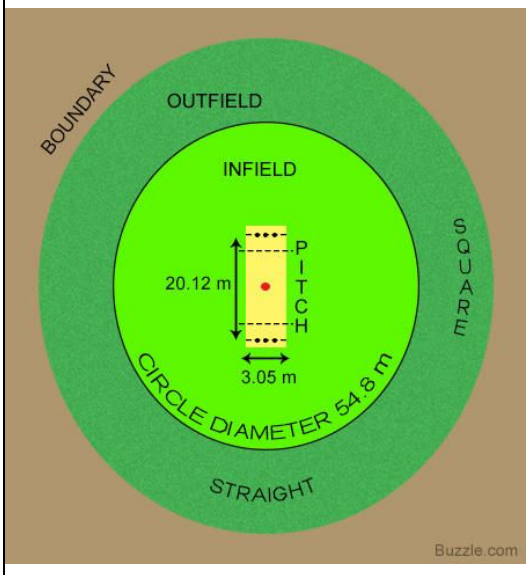
HELP

Work with the actual lengths and distances in metres. Choose a scale for the lengths in your scale drawing, that correspond to the actual lengths, so that you can draw your diagram with measurements in centimetres.

NEXT

Find the length of the third side of the triangle.

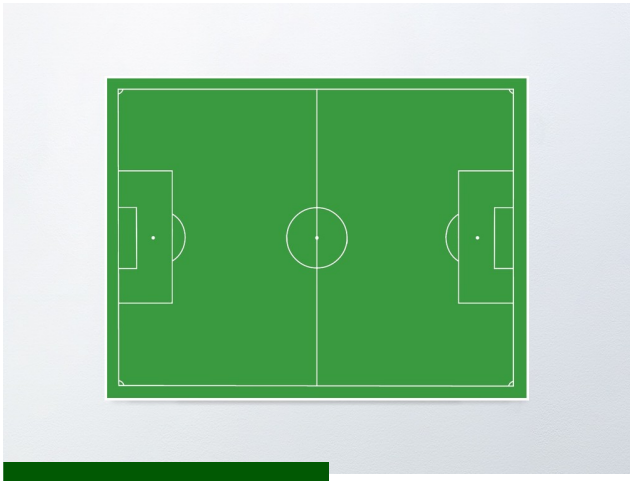
Draw scale drawings of some sports pitches 1 yard = 3 feet = 0.9144 metres



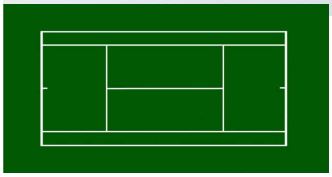
CRICKET FIELD: The **size** of the **field** on varies from **ground** to **ground** but the **pitch** is always a rectangular area of 20.12 metres (22 yards) in **length** and 3.05 metres (10 feet) in **width**. The popping (batting) crease is marked 1.22 metres in front of the stumps at either end, with the stumps set along the bowling crease. The boundary on a large professional cricket field is approximately 100 yards from the wicket. On a smaller ground it is about 70 yards from the wicket.

For sports enthusiasts: The distance between the batsman and bowler when the ball leaves the bowler's hand is 58 feet or approximately 1770 centimetres. A fast bowler can bowl at 140 kilometres per hour. The speed of the ball is between 50 kilometres per hour and 140 kilometres per hour.

After the ball has left the bowler's hands, how long does the batsman have to decide on his shot?



SOCCER PITCH: The **length** of a **pitch** must be between 90 metres (100 yards) and 120 metres (130 yards) and the **width** not less than 45 metres (50 yards) and not more than 90 metres (100 yards).



TENNIS COURT: The length of the court is 23.77 **metres (**78 feet). Its width is 8.23 **metres (**78 feet) for singles matches and 10.97 **metres** (36 feet) for doubles matches. The service line is 6.40 **metres** (21 feet) from the net.

INCLUSION AND HOME LEARNING GUIDE

Suggestions for Home Learning

Young children

Use a metre stick to measure the heights of members of the household and distance indoors and outdoors.

Make drawings of the household standing in a line in order of height, and make drawings of outdoor and indoor spaces.

Upper Primary

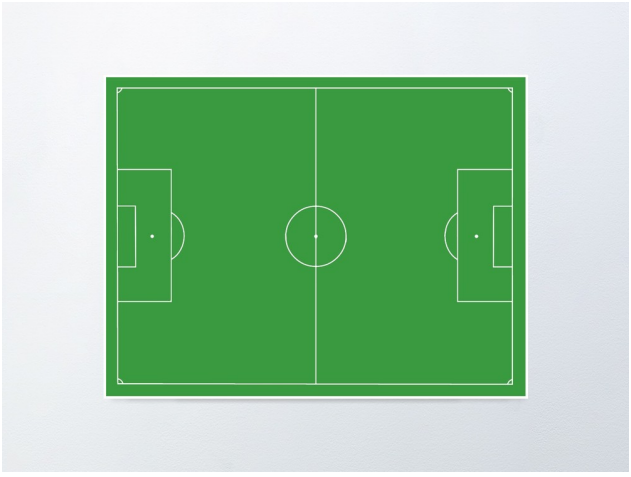
Use a metre stick to measure the heights of members of the household and distance indoors and outdoors.

Make **scale drawings** of people in the household standing in a line in order of height, and make scale drawings of outdoor and indoor spaces.

Lower Secondary

Resources needed: metre stick, (or tape measure if available), pencil and paper, rulers and protractors.

1. **Solve the Cable Car problem by scale drawing .** Review the choice of scale factors for drawing accurate scale diagrams. Learners should be able to solve the Cable Car problem copying the diagram on page 1 and drawing it accurately to scale. **A scale of 1 centimetre to 100 metres works well.** They should do this independently and then compare and check their answers in a group discussion.
2. **Measuring and scale drawing.** Take measurements and make scale drawings of people in the household standing in a line in order of height, and also make scale drawings of outdoor and indoor spaces.
3. **Draw scale drawings of some sports pitches**



1 yard = 3 feet = 0.9144 metres

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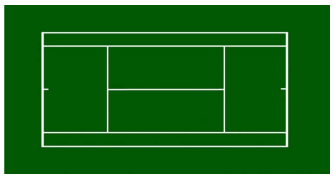

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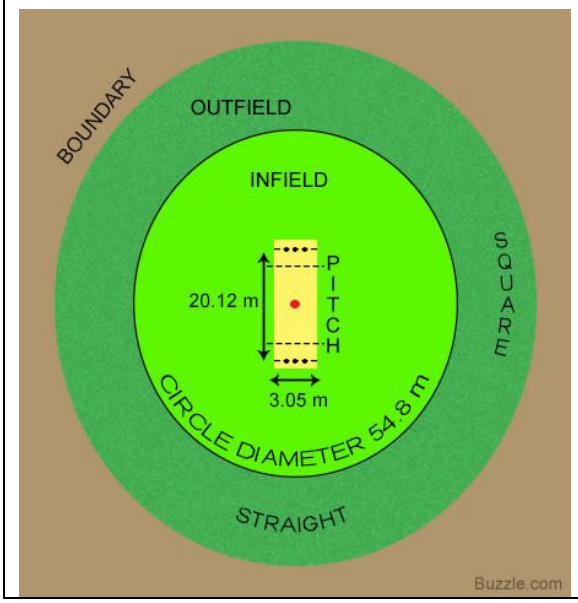

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The boundary on a large professional cricket field is approximately 100 yards from the wicket. On a smaller ground it is about 70 yards from the wicket.

Years 9 and 10

Drawing scale diagrams should be encouraged. It is an important life skill whether in the workplace or at home, and it provides methods of solving complex design and surveying problems, without the need for trigonometry.

1. **For sports enthusiasts:** The distance between the batsman and bowler when the ball leaves the bowler's hand is 58 feet or approximately 1770 centimetres. A fast bowler can bowl at 140 kilometres per hour. The speed of the ball is between 50 kilometres per hour and 140 kilometres per hour. After the ball has left the bowler's hands, how long does the batsman have to decide on his shot?
2. **Solve the Cable Car problem.** Students should be confident about **scale drawing** but practice is always useful. They should be able to solve the problem**,** choosing their own scale, copying the diagram on page 1 and drawing it accurately to scale. They should do this independently and then compare and check their answers in a group discussion.

Years 11, 12 and 13

These students should be able to tackle the Cable Car problem using trigonometry.
To make the problem more challenging, give the students the written question and ask them to draw their own diagrams.

Ask students to explain their work.

Use the Diagnostic Quiz to find out how confident the students are about methods of using trigonometry to solve right angled triangles, and to review these methods.

SOLUTION

CABLE CAR: $h = 1200 \sin 40^o = 771$ metres to the nearest metre.

The height of the upper cable car station is 1073 metres.
There is 12 metres to climb from the upper cable car station to the highest point of the mountain.

CRICKET BOWLING SPEEDS AND TIMES
Working in metres per second.

For the slow bowler, the time from hand to bat $= \frac{\text{Distance}}{\text{Speed}} = \frac{17.70 \times 60 \times 60}{50000} = 1.27$ seconds

For the fast bowler, the time from hand to bat $= \frac{\text{Distance}}{\text{Speed}} = \frac{17.70 \times 60 \times 60}{140000} = 0.46$ seconds

So roughly speaking the batsman has between half a second and one and a quarter seconds to hit the ball.

Why do this activity?

The vertical height climbed by the cable car can be found by an accurate scale drawing or by using trigonometry. This is a very simple practical application of the use of trigonometric functions and learners can see that this can be used in a real life situation. A deep understanding of scale is an important life skill with many applications.

Learning objectives

In doing this activity students will have an opportunity to:

- deepen understanding of scale in drawing accurate diagrams to represent real objects and situations;
- review facts and definitions of the trigonometric ratios in right-angled triangles;
- develop the skills to apply this knowledge to solve problems in 2 dimensions.

Generic competences

In doing this activity students will have an opportunity to interpret and **solve problems** in a real world situation.

Key questions

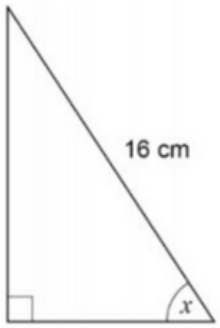
- What units are you using?
- What scale factor are you using?
- Have you measured that length in your drawing? What is the length?
- How will you use the height in your drawing, and your chosen scale factor, to find the actual height?
- You should be able to make drawings and measure lengths to the nearest millimetre. What actual length corresponds to 1 millimetre in your drawing?
- Which trig ratio would you use there?

Diagnostic Assessment This should take about 5–10 minutes.

1. Show the question to the students and say: "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".
2. Notice how the students respond. Ask why they gave their answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.

Not drawn accurately

Use trigonometry to work out the size of angle x.



A) sin^-1 (13/16) = 54.3
B) cos^-1 (16/13) = 45
C) tan^-1 (13/16) = 39
D) cos (13/16) = 0.9

3. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.** It is important for learners to explain the reason for their answer as putting thoughts into words can help people to think more clearly and to develop communication skills.

The correct answer is **A**:
Learners who gave other answers do not know the definitions of the trigonometric ratios.

https://diagnosticquestions.com

Follow up

Problems involving right angled triangles:
At Sea: https://aiminghigh.aimssec.ac.za/years-10-11-at-sea/
Cliff rescue: https://aiminghigh.aimssec.ac.za/years-10-11-cliff-rescue/

Preparation for generalising the definition of the trigonometric functions from angles between 0º and 90º to 0º to 360º https://aiminghigh.aimssec.ac.za/years-10-12-trig-lengths/

Definition of trigonometric functions for all angles:
https://aiminghigh.aimssec.ac.za/year-10-general-angle-trigonometry-investigation/