
MATHEMATICS ITEMS

Guide to the Content and Layout of This Section

The *Mathematics Items* section contains, in a ready-to-use form, the 11 mathematics assessment items that appeared in Section 5.1, *Mathematics Concepts and Mathematics Items*. Each item is presented on a separate page to facilitate photocopying.

The two sections are designed to be used in tandem. The *Mathematics Items* section is designed to facilitate the construction of sets of items tailored to the purpose of the user—most likely a classroom teacher. Users can select items for their own purpose based on their reading of *Mathematics Concepts and Mathematics Item* section, photocopy these and administer them to students. Student responses can be scored using the scoring instructions presented in the *Mathematics Concepts and Mathematics Items* section, and may be compared to the international benchmarks presented there.

To assist in the recording and scoring of items, Scoring Worksheets can be generated by photocopying the master copy included in this section.

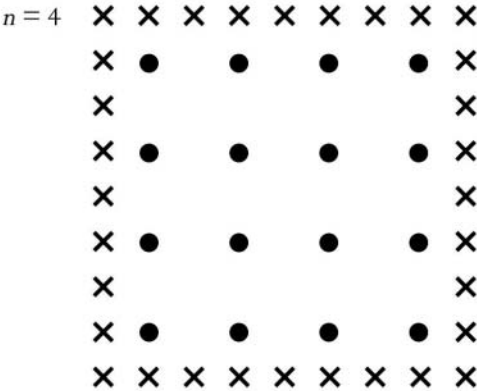
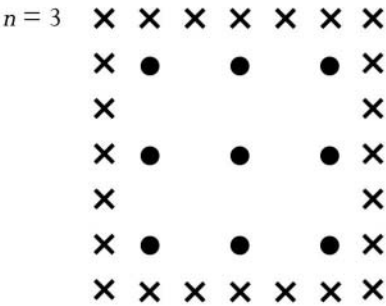
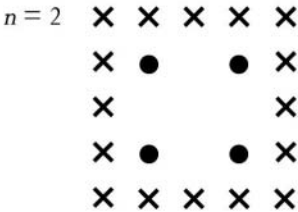
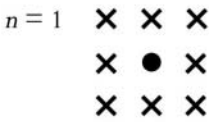
MATHEMATICS UNIT 1

Apples

A farmer plants apple trees in a square pattern. In order to protect the trees against the wind he plants conifers all around the orchard.

Here you see a diagram of this situation where you can see the pattern of apple trees and conifers for any number (n) of rows of apple trees:

✕ = conifer
● = apple tree



Question 1: APPLES

Complete the table:

n	Number of apple trees	Number of conifers
1	1	8
2	4	
3		
4		
5		

Question 2: APPLES

There are two formulae you can use to calculate the number of apple trees and the number of conifers for the pattern described above:

$$\text{Number of apple trees} = n^2$$

$$\text{Number of conifers} = 8n$$

where n is the number of rows of apple trees.

There is a value of n for which the number of apple trees equals the number of conifers. Find the value of n and show your method of calculating this.

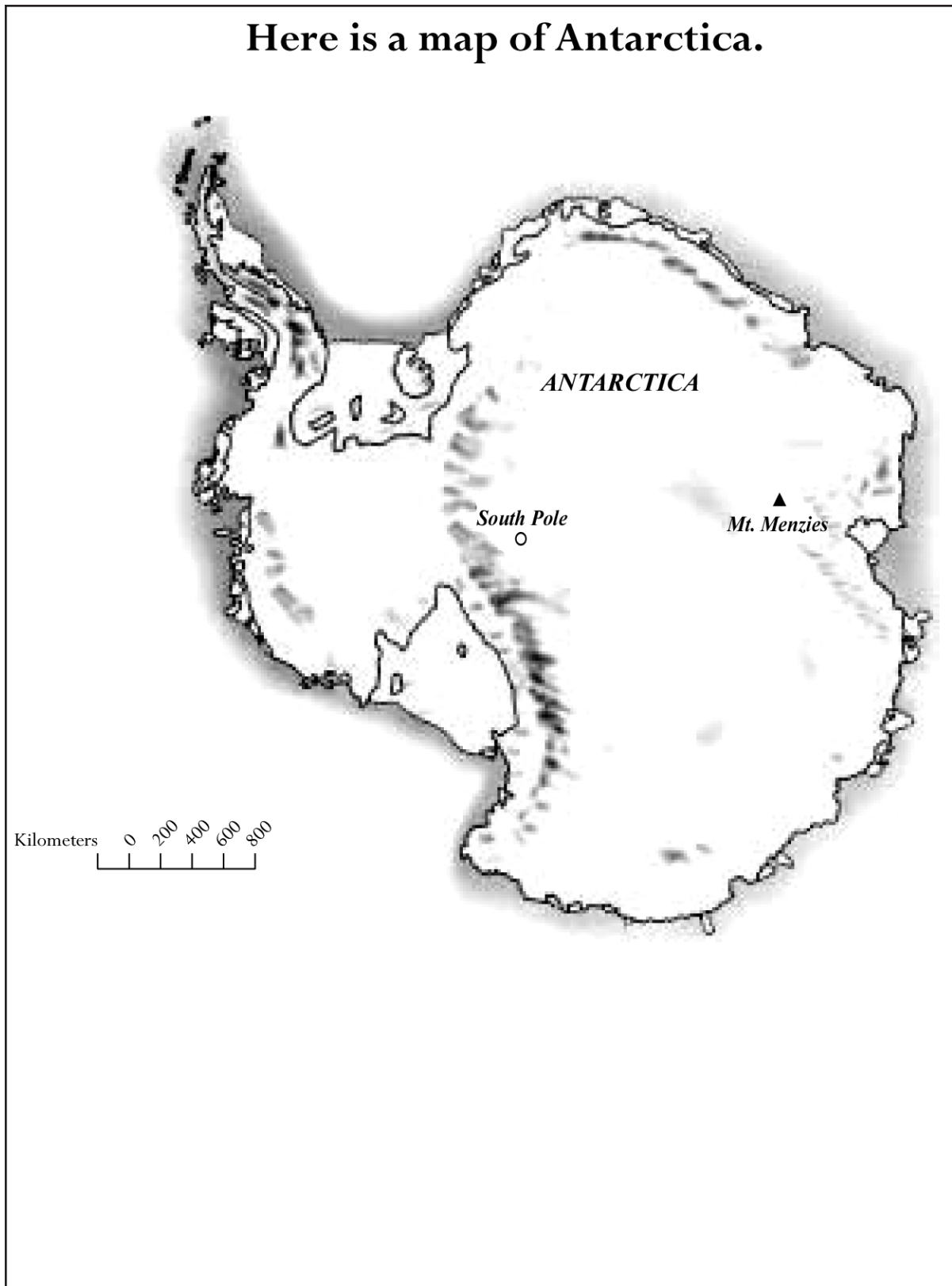
Question 3: APPLES

Suppose the farmer wants to make a much larger orchard with many rows of trees. As the farmer makes the orchard bigger, which will increase more quickly: the number of apple trees or the number of conifers?

Explain how you found your answer.

Continent area

Here is a map of Antarctica.



Question 1: CONTINENT AREA

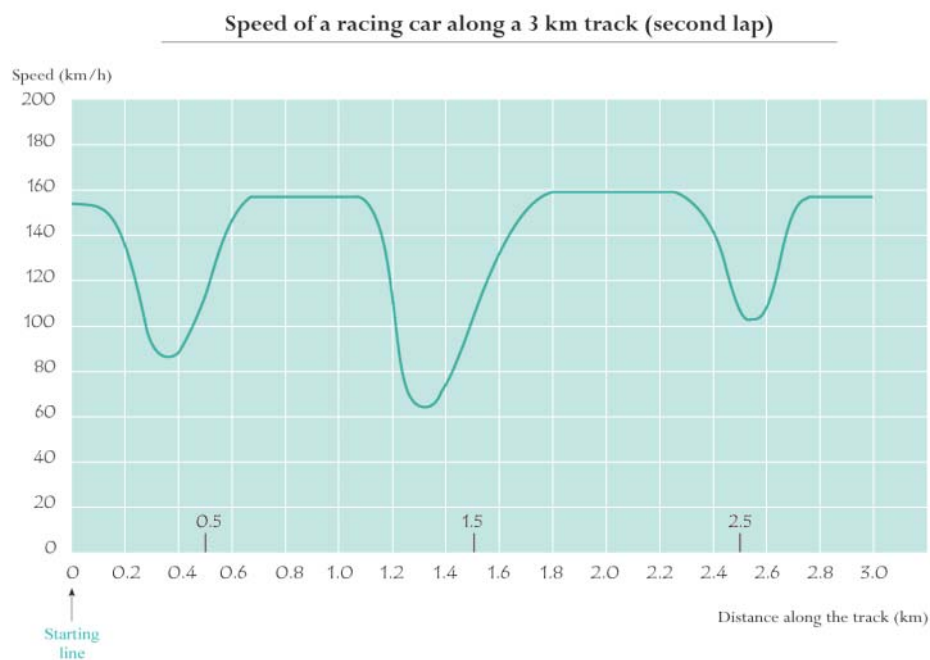
Estimate the area of Antarctica using the map scale.

Show your working out and explain how you made your estimate.
(You can draw over the map if it helps you with your estimation)

MATHEMATICS UNIT 3

Speed of a racing car

This graph shows how the speed of a racing car varies along a flat 3 kilometer track during its second lap.



Source: In memory of Claude Janvier, who died in June 1998. Modified task after his ideas in Janvier, C. (1978): The interpretation of complex graphs – studies and teaching experiments. Accompanying brochure to the Dissertation. University of Nottingham, Shell Centre for Mathematical Education, Item C-2.

The pictures of the tracks are taken from Fischer, R & Malle, G. (1985): *Mensch und Mathematik*. Bibliographisches Institut: Mannheim-Wien-Zurich, 234-238.



Question 1: SPEED OF A RACING CAR

What is the approximate distance from the starting line to the beginning of the longest straight section of the track?

- A 0.5 km.
- B 1.5 km.
- C 2.3 km.
- D 2.6 km.

Question 2: SPEED OF A RACING CAR

Where was the lowest speed recorded during the second lap?

- A At the starting line.
- B At about 0.8 km.
- C At about 1.3 km.
- D Halfway around the track.



Question 3: SPEED OF A RACING CAR

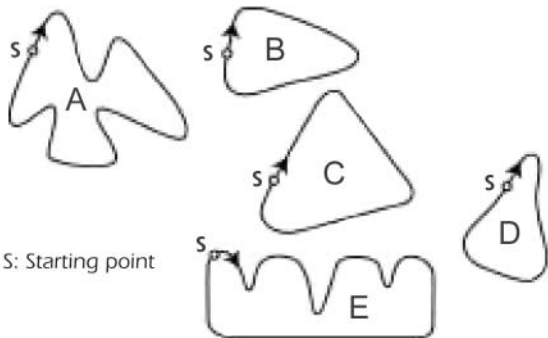
What can you say about the speed of the car between the 2.6 km and 2.8 km marks?

- A The speed of the car remains constant.
- B The speed of the car is increasing.
- C The speed of the car is decreasing.
- D The speed of the car cannot be determined from the graph.

Question 4: SPEED OF A RACING CAR

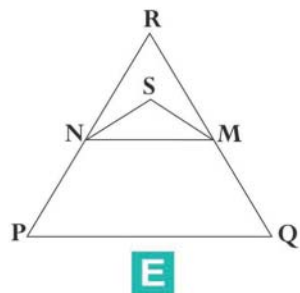
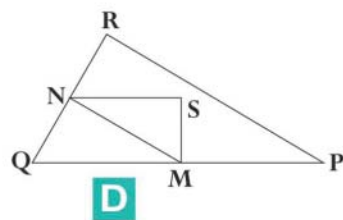
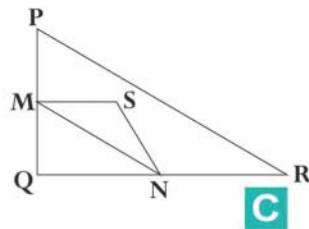
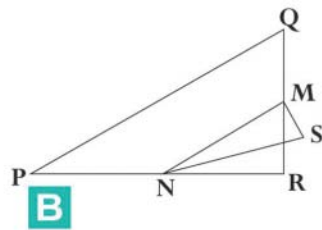
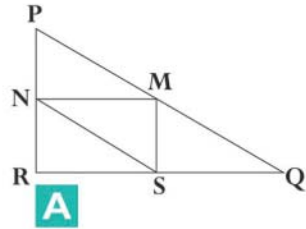
Here are pictures of five tracks:

Along which one of these tracks was the car driven to produce the speed graph shown earlier?



MATHEMATICS UNIT 4

Triangles



Question 1: TRIANGLES

Circle the one figure on the previous page that fits the following description.

Triangle PQR is a right triangle with right angle at R. The line RQ is less than the line PR. M is the midpoint of the line PQ and N is the midpoint of the line QR. S is a point inside the triangle. The line MN is greater than the line MS.

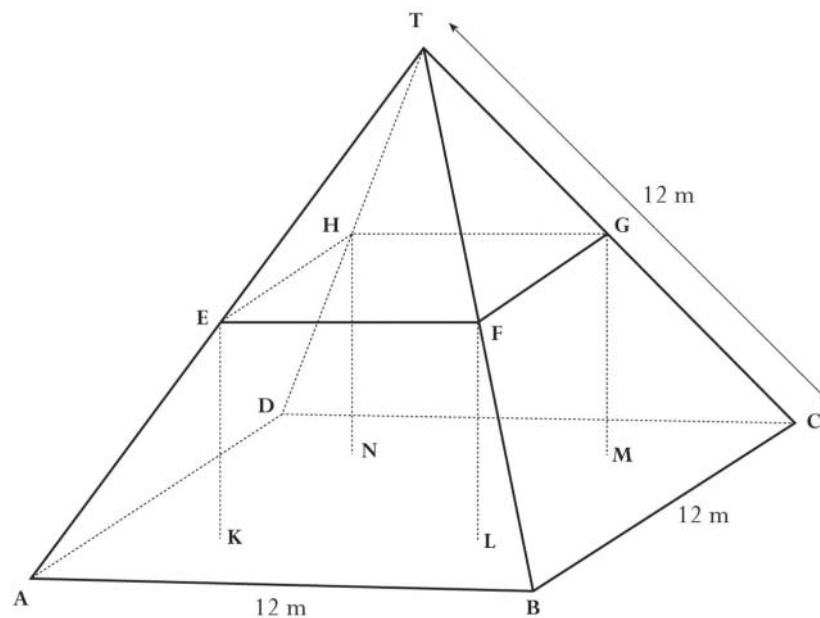
MATHEMATICS UNIT 5

Farms

Here you see a photograph of a farmhouse with a roof in the shape of a pyramid.



Below is a student's mathematical model of the farmhouse **roof** with measurements added.



The attic floor, ABCD in the model, is a square. The beams that support the roof are the edges of a block (rectangular prism) EFGHKL MN. E is the middle of AT, F is the middle of BT, G is the middle of CT and H is the middle of DT. All the edges of the pyramid in the model have the length 12 m.

Question 1: FARMS

Calculate the area of the attic floor ABCD.

The area of the attic floor ABCD = _____ m²

Question 2: FARMS

Calculate the length of EF, one of the horizontal edges of the block.

The length of EF = _____ m