Government of South Australia

SACE Board of SA

External Examination 2013

2013 MATHEMATICAL APPLICATIONS, Semester 2

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SUPERVISOR CHECK

RE-MARKED

SACE REGISTRATION NUMBER

SEQ | FIGURES | CHECK LETTER | BIN

MATHEMATICAL APPLICATIONS, Semester 2

Graphics calculator

Brand _____

Model _____

Computer software

Thursday 7 November: 9 a.m.

Time: 1½ hours in total (to complete two question booklets, one on each topic studied in Semester 2)

Pages: 11
Questions: 4

Topic 1: Applied Geometry

Examination material: two question booklets
one SACE registration number label

Approved dictionaries, notes, calculators, and computer software may be used.

Instructions to Students

1. You will have 10 minutes to read the question booklets. You must not write in your question booklets or use a calculator during this reading time but you may make notes on the scribbling paper provided.

2. Each of the following five topics is printed in a separate question booklet. ***Tick the boxes by the two topics you have studied in Semester 2:***

   Topic 1: Applied Geometry ☐
   Topic 2: Investment and Loans ☐
   Topic 3: Mathematics and Small Business ☐
   Topic 6: Share Investments ☐
   Topic 7: Statistics and Working with Data. ☐

3. The total mark for each topic is 35.

4. Answer ***all*** parts of Questions 1 to 4 in the spaces provided in this question booklet. There is no need to fill all the space provided.

5. Show all working in this booklet. (You are strongly advised ***not*** to use scribbling paper. Work that you consider incorrect should be crossed out with a single line.)

6. Write on page 8 if you need more space. Make sure to label each answer carefully.

7. Use only black or blue pens for all work other than graphs and diagrams, for which you may use a sharp dark pencil.

8. Appropriate steps of logic and correct answers are required.

9. Marks may be deducted if you do not clearly show all steps in the solution of problems, if your answers have an inappropriate number of decimal places, or if you use incorrect units.

10. Diagrams, where given, are not necessarily drawn to scale.

11. Complete the box on the top right-hand side of this page with information about the electronic technology you are using in this examination.

12. Attach your SACE registration number label to the box at the top of this page on one of your question booklets. Copy the information from your SACE registration number label into the box on the front cover of your other question booklet.

13. At the end of the examination, place one question booklet inside the back cover of the other question booklet.

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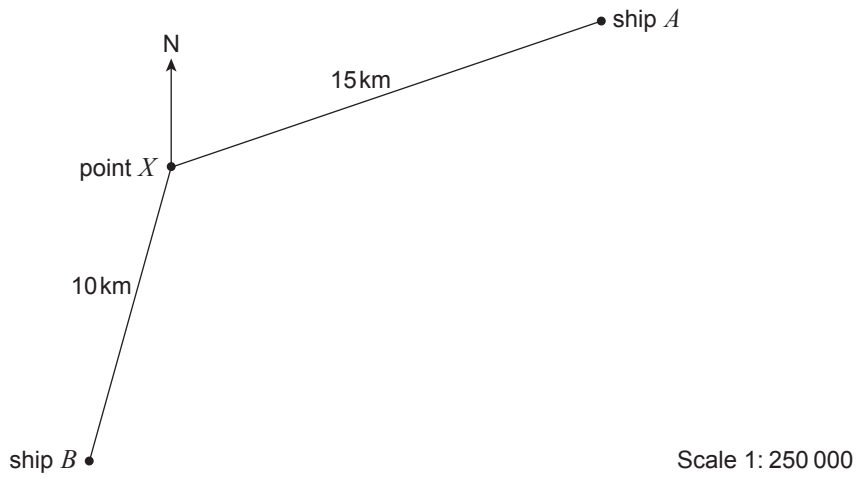
QUESTION 1

Two ships are sailing in different directions in Bass Strait, between Tasmania and Victoria. Ship A leaves point X and sails on a bearing of 71°T for 15 kilometres. Ship B leaves point X and sails on a bearing of 195°T for 10 kilometres.

The movement of the ships is shown on the scaled diagram below:



(a) Assume that the distance from ship A to Launceston in Tasmania is 65 kilometres.

What would the measured distance be on a map with a scale of 1: 250 000?

(2 marks)

(b) Show, with a calculation, that the size of angle AXB is 124°, and write this measurement on the diagram above.

(1 mark)

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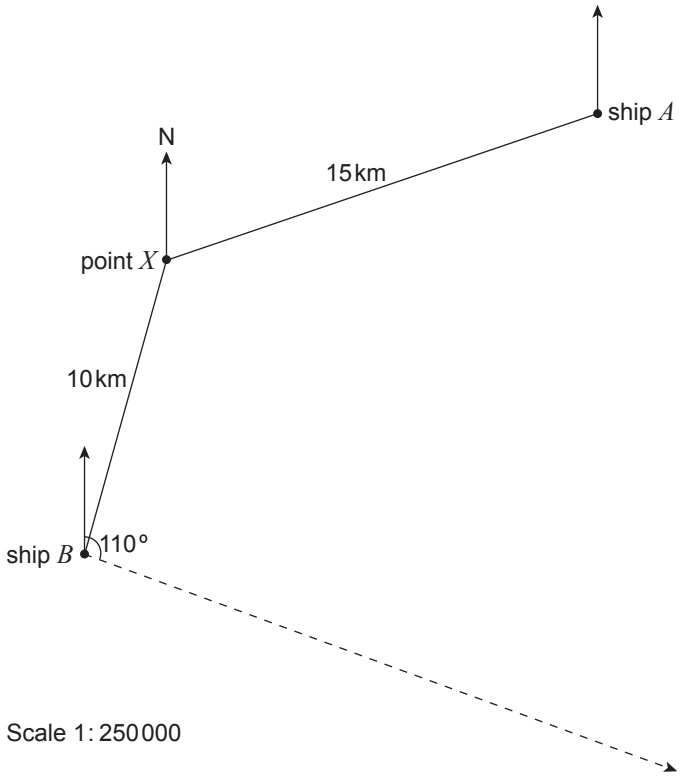
(c) Calculate the distance between the two ships (AB), using an appropriate mathematical formula.

(3 marks)

(d) (i) Ship A receives a distress call from ship C on a bearing of 192° T. Ship B receives the same distress call on a bearing of 110° T. Some of this information is shown on the scaled diagram below.

Add the rest of the information to the diagram and show the position of the ship in distress (label this ship C).



(2 marks)

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(ii) By measuring on the scaled diagram on page 3, determine the distance that ship B must travel to reach ship C. Show any calculations required.

(2 marks)

(iii) Assume that ship B is travelling at a speed of 17 kilometres per hour.

How long (in minutes) would it take ship B to reach ship C?

(2 marks)

(iv) State *one* factor that would affect the reasonableness of expecting ship B to arrive in the time you have calculated in part (d)(iii) above.

(1 mark)

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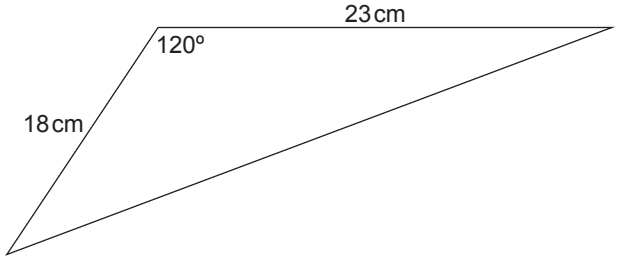
QUESTION 2

A corner brace for the frame of a chair is cut from steel plate. An apprentice is instructed to measure the plate. His measurements are shown on the diagram below:



(a) Show that the area of the corner brace plate is 179.3 square centimetres.

(2 marks)

(b) The apprentice's length measurements have an error tolerance of ±2 millimetres.

Show that the maximum possible area of the corner brace plate is 182.8 square centimetres. (Assume that the angle has been measured correctly.)

(1 mark)

(c) Hence calculate the percentage error that the apprentice could have made in finding the area of the corner brace plate.

(2 marks)

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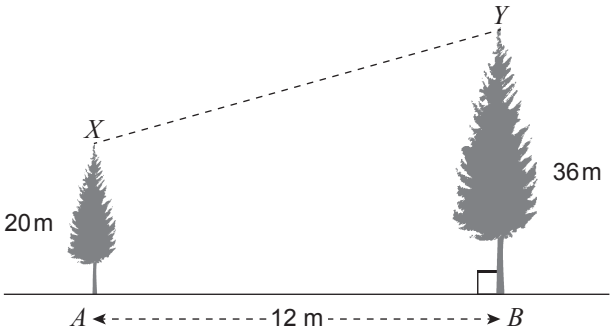
QUESTION 3

Pine tree A (20 metres tall) and pine tree B (36 metres tall) are 12 metres apart in the botanic gardens, as shown in the diagram below (*not* drawn to scale):



(a) Calculate the distance between the tops of the two trees (XY).

(2 marks)

(b) If all the measurements are accurate, state *one* mathematical assumption that you have made in calculating the distance in part (a).

(1 mark)

(c) Using a calculation, show that the angle of elevation from the base of the 20 metre pine tree A to the top of the 36 metre pine tree B ($\angle YAB$) is approximately 72°.

(2 marks)

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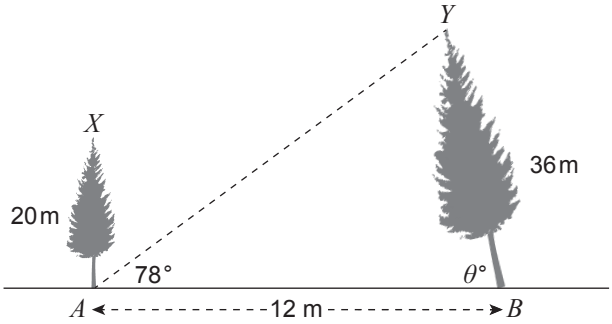
(d) After a storm pine tree B now leans towards pine tree A at an angle, as shown in the diagram below. The angle of elevation ($\angle YAB$) is measured and found to be 78°.



Use the sine rule to find the angle of lean of pine tree B ($\theta°$).

(3 marks)

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You may write on this page if you need more space to finish your answers to Topic 1. Make sure to label each answer carefully (e.g. 'Question 1(c) continued').

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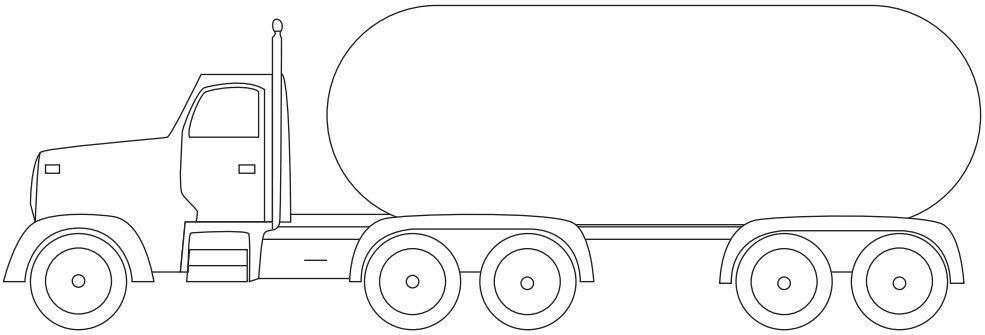
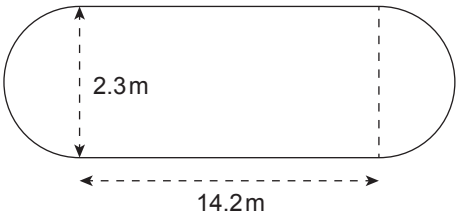
QUESTION 4



A fuel tanker is carrying fuel in a cylindrical tank with hemispherical ends.

The dimensions of the tank are shown in the two-dimensional diagram below:



The following information may be useful in answering this question:

- $V_{sphere} = \frac{4}{3}\pi r^3$
- $1\,\text{m}^3 = 1000\,\text{L}.$

(a) Calculate the volume of fuel needed to fill the tanker in cubic metres (m^3).

(3 marks)

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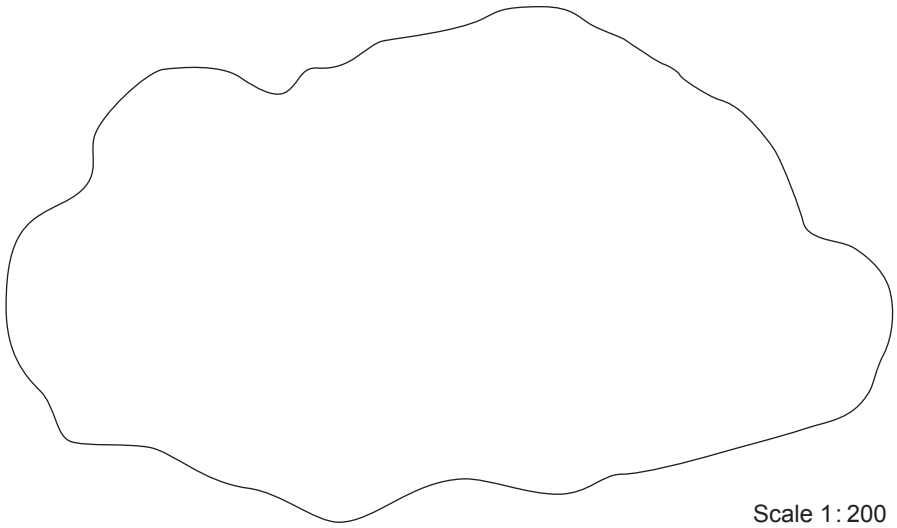
(b) The amount of fuel needed to fill the underground storage tank of a service station was overestimated. The tanker pumped more fuel than was needed and there was a spill.

The size and shape of the area of spilt fuel are shown in the scaled diagram below:



(i) A useful way of estimating the area of this fuel spill is to approximate it by using a simpler shape.

Draw an appropriate ***simple mathematical shape*** on the diagram above. Show any relevant measurements scaled up to their true size.

(3 marks)

(ii) Using your diagram and measurements, calculate the estimated area of the spill.

(1 mark)

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(iii) • Pulverised peat is an eco-friendly product that can be spread over spills to absorb the fuel.

• It is accepted that there are 500 millilitres of fuel for every square metre of a spill.

• A 1.5 kilogram bag of a pulverised peat product can absorb 7 litres of fuel.

What is the approximate weight of the pulverised peat product that would be needed to clean up the spill at the service station in this question?

(2 marks)

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