Government of South Australia

SACE Board of SA

External Examination 2013

2013 MATHEMATICAL APPLICATIONS, Semester 1

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SACE REGISTRATION NUMBER

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MATHEMATICAL APPLICATIONS, Semester 1

Graphics calculator ☐

Brand _____

Model _____

Computer software ☐

Thursday 6 June: 9 a.m.

Time: 1½ hours in total (to complete two question booklets, one on each topic studied in Semester 1)

Pages: 10
Questions: 3

Topic 7: Statistics and Working with Data

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 1***:
   - Topic 2: Investment and Loans ☐
   - Topic 4: Matrices ☐
   - Topic 5: Optimisation ☐
   - 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 3 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 5 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.

TOPIC 7

QUESTION 1

Lloyd wanted to determine the numbers of peaches and nectarines produced by his 250 peach trees and 250 nectarine trees. He sampled the first ten trees of each fruit variety and counted the fruit on each tree.

(a) The following table shows the results of Lloyd's sampling:

Tree Number	Number of Peaches	Number of Nectarines
1	168	198
2	172	195
3	157	213
4	164	218
5	163	180
6	152	201
7	154	192
8	169	206
9	162	188
10	190	220

(i) Discuss *one* limitation of the method used by Lloyd to collect his sample, and its possible effect on the reliability of his results.

(2 marks)

(ii) State *one* reason why Lloyd may have chosen a sample, rather than the population, of fruit trees.

(1 mark)

(b) Calculate the mean, median, standard deviation, and interquartile range (to one decimal place) for the peaches and the nectarines, and complete the table below.

Statistical Measure	Peaches	Nectarines
mean		201.1
median	163.5	
standard deviation		13.1
interquartile range	12.0	

(2 marks)

(c) Compare the two sets of statistical data in part (a) and part (b), and tick the appropriate box to indicate which *one* of the following statements is true.

The interquartile range implies a lower variability in the number of nectarines produced than in the number of peaches produced. ☐

The standard deviation implies a higher variability in the number of nectarines produced than in the number of peaches produced. ☐

Outliers are evident in the number of nectarines produced. ☐

The number of peaches produced is always less than the number of nectarines produced. ☐

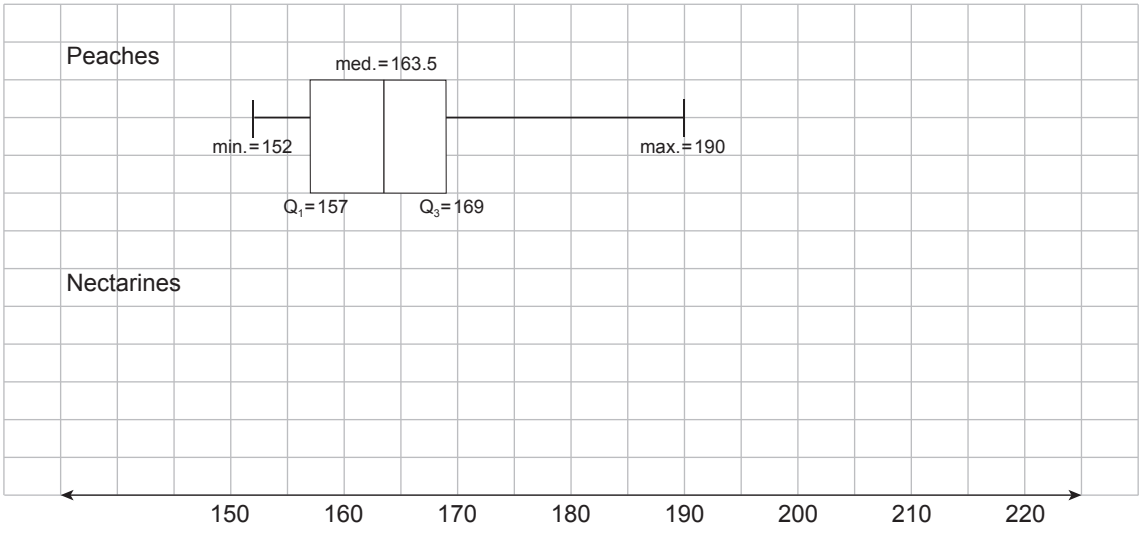
(1 mark)

Question 1 continues on page 4.

(d) (i) Draw and label a box-and-whisker diagram for the nectarine data, using the axis provided below. (2 marks)

(ii) Label the axis of the box-and-whisker diagram. (1 mark)

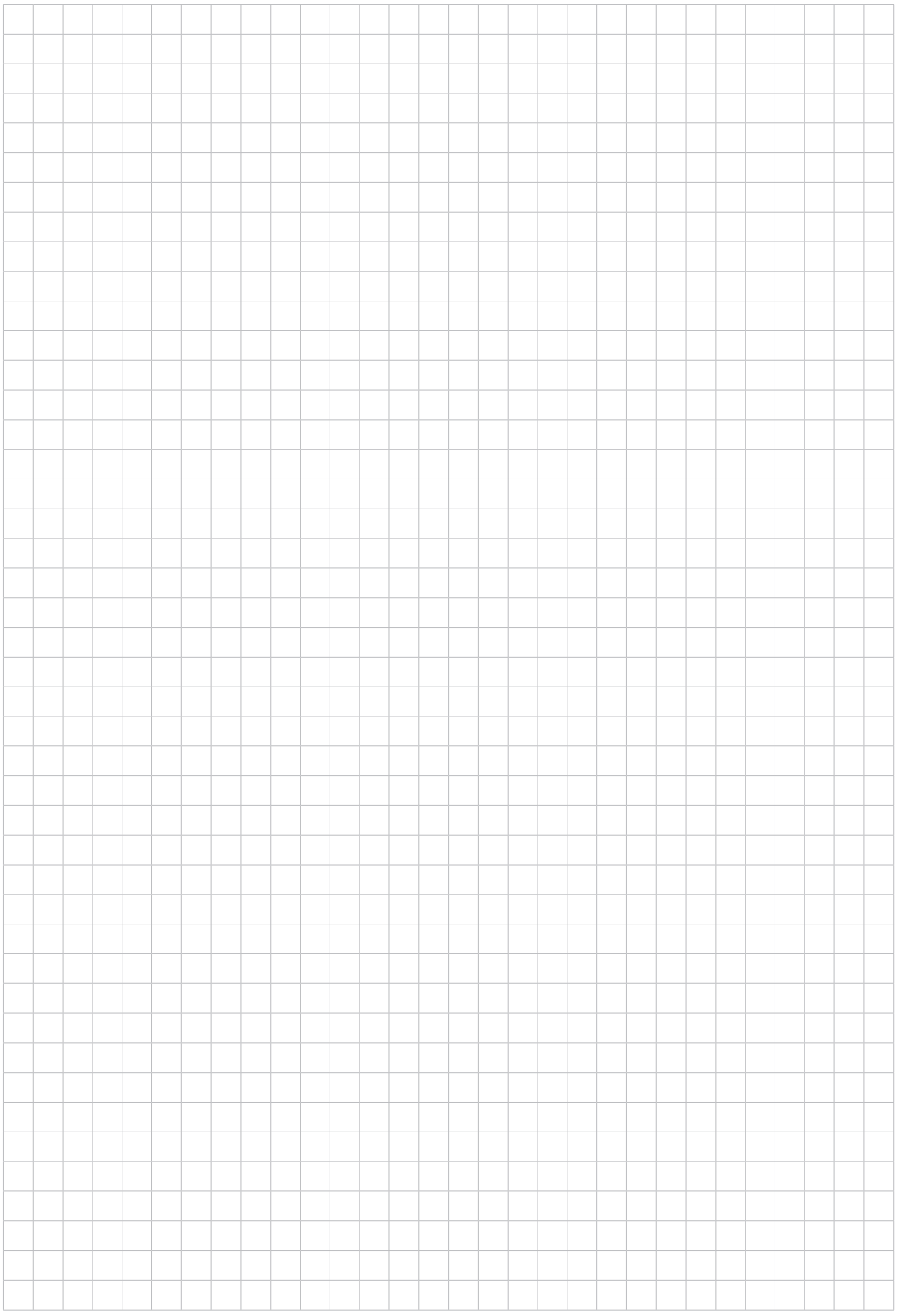
Fruit on Lloyd's Trees



(e) With reference to the statistical measures on page 3 and to the box-and-whisker diagram above, describe *two* conclusions that you can draw about the number of peaches produced in comparison with the number of nectarines produced.

(2 marks)

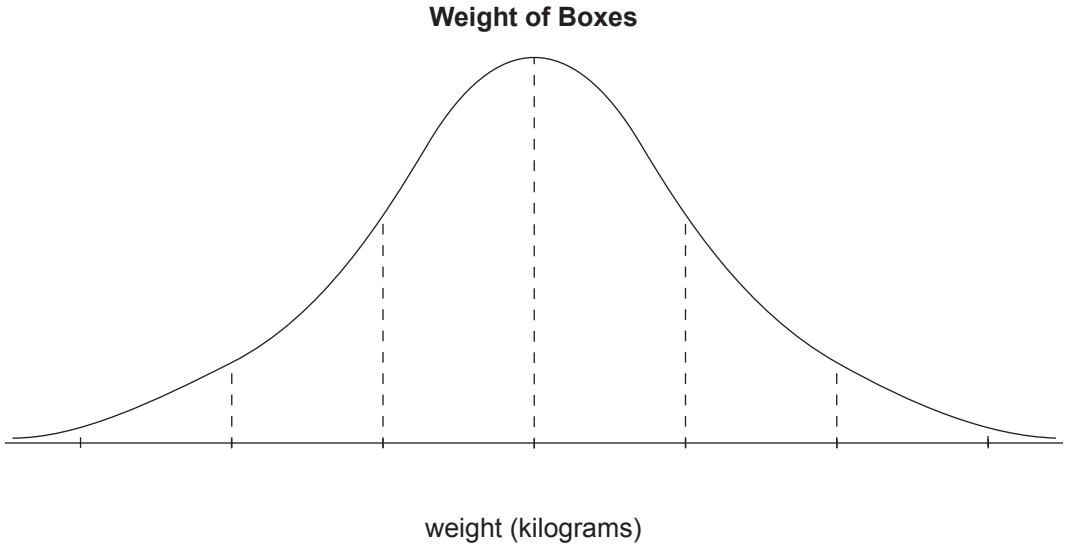
You may write on this page if you need more space to finish your answers to Topic 7. Make sure to label each answer carefully (e.g. 'Question 1(a)(i) continued').



QUESTION 2

Sam is a factory production worker in charge of quality control. His job is to weigh boxes of welding electrodes that have been packaged by a machine. It is known that the boxes have a mean weight of 1.72 kilograms and a standard deviation of 0.03 kilograms.

(a) Complete the scale on the normal distribution graph below. You are not required to show the standard proportions (percentages) on the graph.



(1 mark)

(b) Boxes of welding electrodes that do not weigh between 1.68 kilograms and 1.80 kilograms will be rejected.

(i) Determine the probability that a box will not be rejected.

(2 marks)

(ii) If Sam weighs 2500 boxes in 1 day, how many boxes would you expect to be rejected on that day?

(2 marks)

(iii) How likely would it be for Sam to randomly select a box that weighs more than 1.81 kilograms? Justify your answer.

(2 marks)

(c) The owner of the factory invests in a new machine. It will be more precise and will decrease the standard deviation to 0.02 kilograms (assume that the mean weight remains 1.72 kilograms). The boxes that do not weigh between 1.68 kilograms and 1.80 kilograms will still be rejected.

Calculate the proportion of boxes that you would now expect to be rejected.

(2 marks)

(d) A client wants to buy the heaviest 10% of boxes that will be packaged by the new machine.

What is the weight of the lightest box that the client would buy?

(2 marks)

QUESTION 3

The management committee of a netball club is reviewing the advertising budget. The club has relied on advertisements in the local newspaper to attract spectators to home matches. The committee wants to find out whether or not the newspaper advertisements are having an effect on attendance.

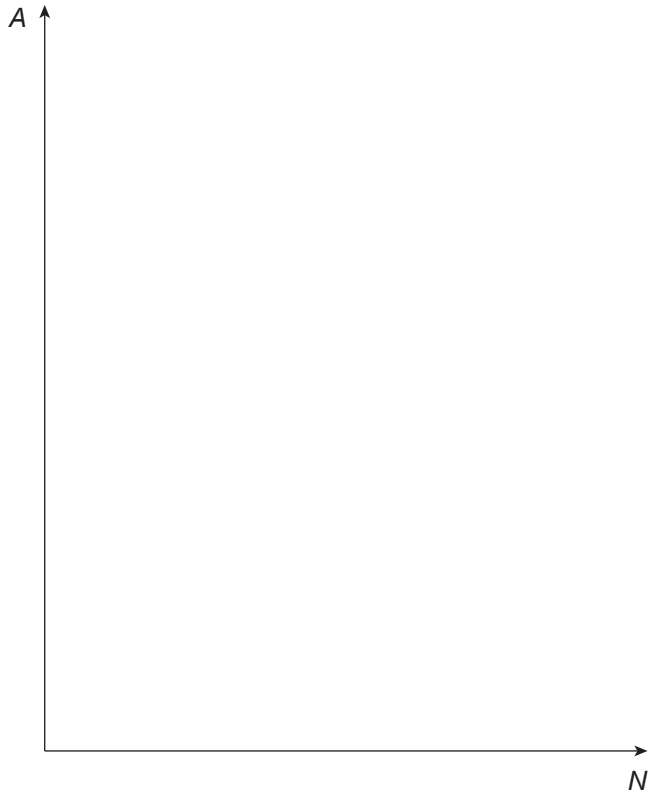
Data are randomly selected from eight matches in the past three seasons, as shown in the table below:

Match	1	2	3	4	5	6	7	8
Number of newspaper advertisements in week before match (N)	1	2	5	10	12	15	20	25
Attendance (A)	834	994	1354	2250	2796	3011	9300	5321

(a) (i) State the dependent variable in this scenario.

(1 mark)

(ii) On the axes below, sketch a scatter plot of the data in the table above and indicate scale.



(2 marks)

(b) Using a calculation, state the strength of the association between the two variables, *N* and *A*.

(2 marks)

(c) (i) On the scatter plot on page 8, circle a possible outlier in the data and suggest *one* reason for its presence.

(2 marks)

(ii) Remove the outlier and recalculate the coefficient of determination (r^2).

(1 mark)

(d) (i) Determine the equation of the least squares regression line (line of best fit) with the outlier removed.

(1 mark)

(ii) Hence, predict the attendance at a match that follows a week in which thirteen newspaper advertisements have been published.

(2 marks)

(e) Is it reasonable to use the model in part (d)(i) on page 9 to predict attendance when no newspaper advertisements have been published in the week before a match? Give a reason for your answer.

(2 marks)