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: 9
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 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 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.

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TOPIC 7

QUESTION 1

Justin, a Year 12 student, undertook some research to find out whether male students or female students at his school spent more money on casual shoes. To collect his data, he conducted a survey of ten male students and ten female students in his class and asked how much they had spent on the pair of shoes they were wearing on a casual day.

(a) State *two* ways in which Justin could have improved his survey technique in order to produce more reliable results from his research.

(2 marks)

(b) The data collected by Justin are shown below:

Amount Spent on Shoes by Male Students ($)

63	59	72	78	79	89	94	79	64	89

Amount Spent on Shoes by Female Students ($)

20	59	110	37	69	39	39	25	37	27

(i) Using the data above, complete the ordered stem-and-leaf plot for male students and female students.

Amount Spent on Shoes ($)

Male Students								Female Students							
							2	0	5	7					
							3								
							4								
						9	**5**	9							
					4	3	**6**	9							
							7								
					9	9	**8**								
						4	**9**								
							10								
							11	0							

(2 marks)

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(ii) Hence, tick the appropriate box to indicate which *one* of the following statements is correct.

- The data for the female students are approximately symmetrical, and do not appear to have any outliers. ☐
- The data for the female students are not approximately symmetrical, and do not appear to have any outliers. ☐
- The data for the male students are approximately symmetrical, and do not appear to have any outliers. ☐
- The data for the male students are more varied than the results for the female students, and do not appear to have any outliers. ☐

(1 mark)

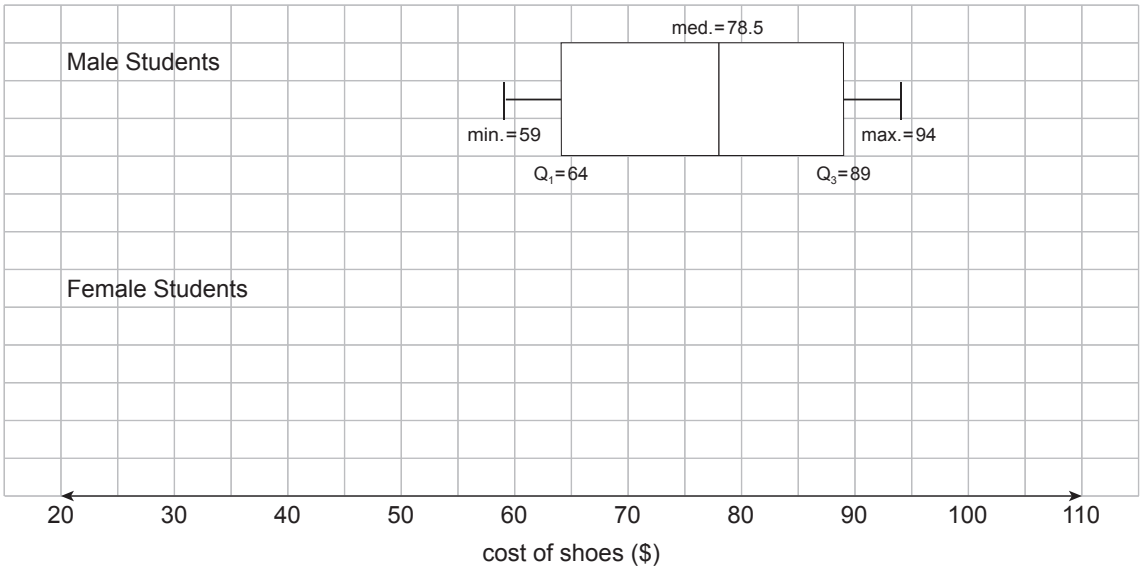
(c) (i) Complete the table below for the two sets of data on page 2.

Statistical Measure	Male Students	Female Students
mean		46.2
standard deviation		26.9
minimum	59.0	
Q_1	64.0	
median	78.5	
Q_3	89.0	
maximum	94.0	

(2 marks)

(ii) Draw and label a box-and-whisker diagram for the data for the female students, using the axis provided.

Amount Spent on Shoes ($)



(2 marks)

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(iii) Complete the following sentence:

'25% of the female students surveyed spent at least $_____ on the shoes they wore on a casual day.'

(1 mark)

(iv) Is the mean or the median a better statistical measure for the amount spent on shoes by female students? Give a reason for your answer.

(2 marks)

(d) Did male students or female students spend more money on the shoes they wore on a casual day?

With reference to parts (c)(i) to (c)(iv), make *two* points to support your answer.

(2 marks)

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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) continued').

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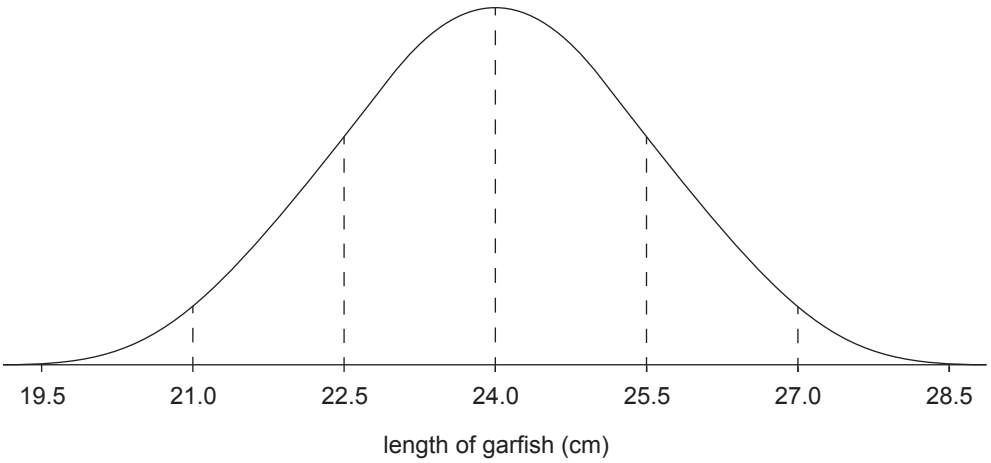
QUESTION 2

Garfish and King George whiting are two species of fish found in South Australian waters. The lengths of both species are normally distributed.

(a) The distribution of garfish lengths is shown on the normal distribution graph below:

Distribution of Garfish Lengths in South Australian Waters



Use the graph above to find the mean and standard deviation for the garfish lengths. Write your answers in the boxes below.

Mean = ☐ centimetres

Standard deviation = ☐ centimetres

(2 marks)

(b) The distribution of King George whiting lengths is known to have a mean of 29 centimetres, with a standard deviation of 2 centimetres.

The minimum legal length of a King George whiting caught in South Australian waters to the east of longitude 136° is 31 centimetres.

Calculate the probability that a King George whiting will be at least the minimum legal length.

(2 marks)

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(c) (i) A family went fishing and caught thirty King George whiting.

Calculate how many of these whiting would be expected to be at least the minimum legal length.

(1 mark)

(ii) The mean length of the King George whiting caught by the family was found to be 26.5 centimetres.

State *one* reason why this value is different from the population mean length of 29 centimetres.

(1 mark)

(d) There is a different minimum legal length for King George whiting caught in South Australian waters to the west of longitude 136°. Of the King George whiting caught off the coast of a town in this area, 69% were rejected as they did not meet the minimum legal length for the area. Assume the mean is 29 centimetres and the standard deviation is 2 centimetres.

Calculate the minimum legal length of King George whiting in this area.

(2 marks)

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QUESTION 3

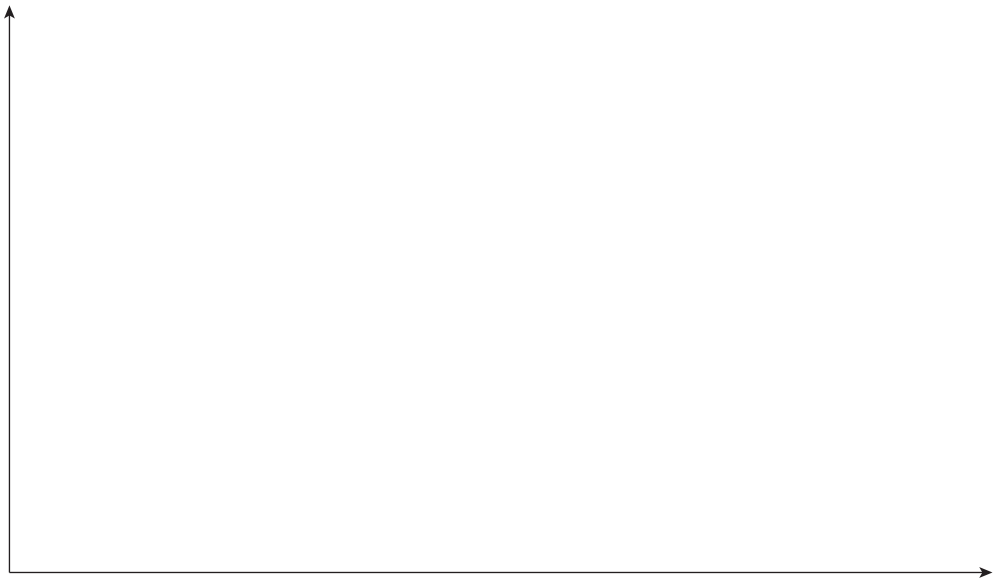
The height and weight of a boy were recorded eleven times. The results are shown in the table below:

	1	2	3	4	5	6	7	8	9	10	11
height (cm)	57.0	61.0	63.0	68.5	69.0	70.5	74.0	75.5	78.5	81.0	89.0
weight (kg)	4.4	5.6	6.2	7.2	7.9	10.6	9.2	9.7	10.6	11.2	13.7

(a) (i) On the axes below, sketch a scatter plot of the data in the table above, with height as the independent variable. Include an indication of scale. (3 marks)

(ii) Label the *x*-axis in the box provided. (1 mark)

Height and Weight of a Boy



x-axis:

(b) (i) Calculate the coefficient of determination (r^2).

(1 mark)

(ii) What does the coefficient of determination (r^2) indicate about the data?

(1 mark)

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(c) Calculate and record the equation of the least squares regression line (line of best fit).

(1 mark)

(d) Draw the least squares regression line on the scatter plot on page 8.

(1 mark)

(e) Using the equation of the least squares regression line, calculate the predicted weight of the boy when his height was 72 centimetres.

(1 mark)

(f) (i) Using the equation of the least squares regression line, calculate the predicted height of the boy when his weight is 17.2 kilograms.

(2 marks)

(ii) Comment on the reliability of your calculations in part (f)(i).

(2 marks)

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