



Government  
of South Australia

**SACE**  
Board of SA

External Examination 2012

# 2012 MATHEMATICAL APPLICATIONS, Semester 1

**FOR OFFICE  
USE ONLY**

SUPERVISOR  
CHECK

RE-MARKED

**ATTACH SACE REGISTRATION NUMBER LABEL  
TO THIS BOX**

Graphics calculator   
Brand \_\_\_\_\_  
Model \_\_\_\_\_  
Computer software

**Thursday 7 June: 9 a.m.**

Time: 1½ hours

Pages: 10  
Questions: 3

## Topic 7: Statistics and Working with Data

Examination material: two question booklets  
two SACE registration number labels

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

### Instructions to Students

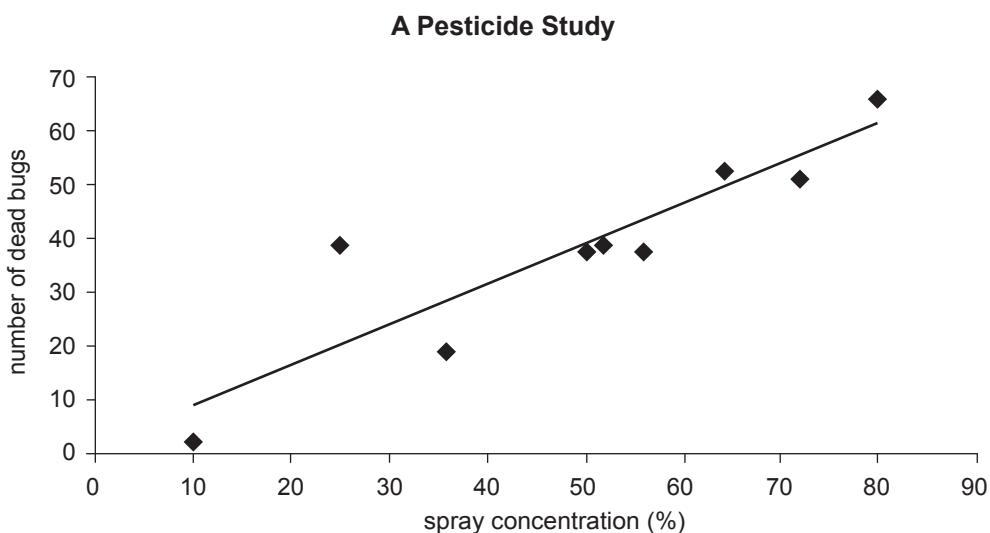
1. You will have 10 minutes to read the question booklets. You must not write in your question booklets or use a calculator during this reading time but you may make notes on the scribbling paper provided.
2. Each of the following five topics is printed in a separate question booklet. ***Tick the boxes 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 one of your SACE registration number labels to the box at the top of this page.
13. At the end of the examination, place one question booklet inside the back cover of the other question booklet.

## QUESTION 1

Plants were sprayed with various concentrations of a new pesticide. After 2 weeks the number of dead bugs on each plant was counted. The results are shown in the table below:

Plant	1	2	3	4	5	6	7	8	9
spray concentration (%)	10	25	36	50	52	56	64	72	80
number of dead bugs after 2 weeks	2	39	19	38	39	38	53	51	66

A scatter plot of the data in the table above is shown below:



- (a) Calculate the coefficient of determination ( $r^2$ ).

(1 mark)

- (b) (i) Circle a possible outlier in the data above.

(1 mark)

- (ii) If the outlier is due to an error, suggest one possible reason for this error.

(1 mark)

- (c) (i) Remove the outlier and recalculate the coefficient of determination ( $r^2$ ).

(1 mark)

- (ii) Interpret the strength of the association between the two variables with the outlier removed.

(1 mark)

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

(1 mark)

- (e) (i) Using the least squares regression line (line of best fit) that you determined in part (d), predict the number of dead bugs after 2 weeks if the spray concentration was 49%.

(2 marks)

- (ii) Using the term ‘interpolation’ or ‘extrapolation’, discuss the accuracy of the prediction you made in part (e)(i).

(2 marks)

- (iii) Assuming the sample size is appropriate, state *one other* factor that could cause the prediction you made in part (e)(i) to be unreliable.

(1 mark)

*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 3(a) continued').*

A large grid of squares, approximately 20 columns by 30 rows, designed for handwriting practice or providing additional space for answers.

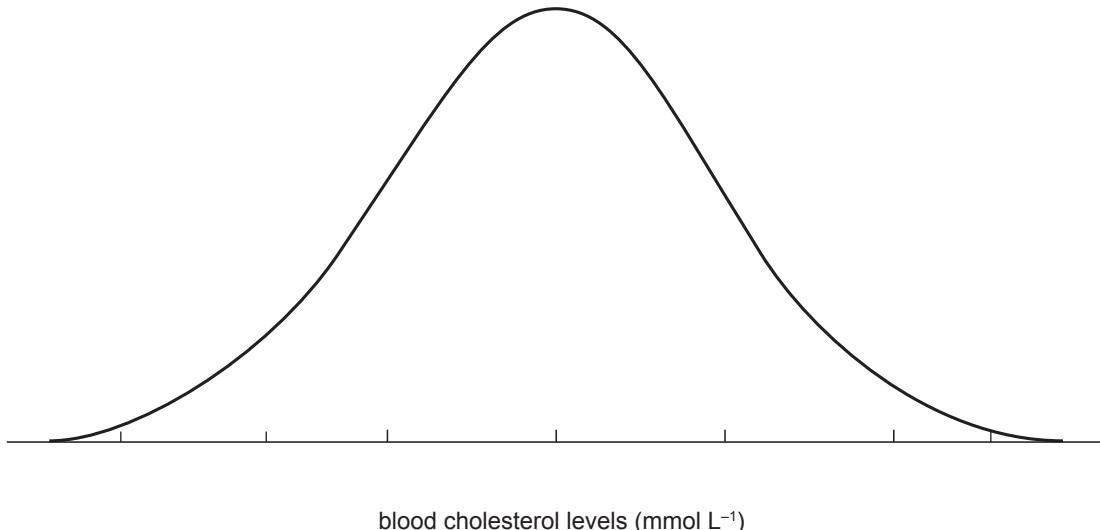
## QUESTION 2

- (a) The blood cholesterol levels of a group of adult males are normally distributed, with a mean of 5.2 millimoles per litre ( $\text{mmol L}^{-1}$ ) and a standard deviation of 1.2 millimoles per litre.

- (i) The following normal distribution graph shows the blood cholesterol levels of the group of adult males.

Complete the scale on the graph. You are not required to show the standard proportions (percentages) on the diagram.

## Blood Cholesterol Levels of a Group of Adult Males



- (ii) Calculate the percentage of the group of adult males who have a blood cholesterol level of more than 4 millimoles per litre.

(1 mark)

- (iii) According to the National Heart Foundation, the desirable blood cholesterol levels for adult males are less than 5.5 millimoles per litre.

What percentage of the group of adult males have blood cholesterol levels that are less than 5.5 millimoles per litre?

(2 marks)

- (iv) Suppose that there are 700 adult males in the group.

How many of these adult males would you expect to have blood cholesterol levels that are less than 5.5 millimoles per litre?

(1 mark)

- (b) (i) The blood cholesterol levels of a group of adult females have a mean of 5.2 millimoles per litre and a standard deviation of 0.8 millimoles per litre.

Using the axis on the diagram in part (a), sketch a curve of this information to show the blood cholesterol levels of the group of adult females.

(2 marks)

- (ii) State one assumption that you have made when sketching the curve for the blood cholesterol levels of these adult females on the same axis as the curve for the blood cholesterol levels of the adult males.

(1 mark)

- (iii) Is the percentage of blood cholesterol levels between 4 and 6 millimoles per litre greater for the adult males or for the adult females?

Justify your answer.

(2 marks)

### QUESTION 3

A health agency wants to launch an advertising campaign to encourage people to eat more healthily. The agency considers the average daily intake of calories to be 1650 calories for women and 1850 calories for men. The health agency conducts an online survey to gather information. The first fifteen women and fifteen men to respond are asked to calculate their average daily intake of calories (to the nearest 10).

The following table shows the data for the fifteen women and the fifteen men:

Women	Men
1470	1840
1480	1860
1550	1950
1560	1970
1560	1980
1630	2060
1630	2070
1640	2090
1670	2090
1780	2120
1790	2130
1800	2130
2030	2160
2120	2240
2310	2560

- (a) Discuss two concerns about the reliability of the results, given that the survey was accessible only through the health agency's website.

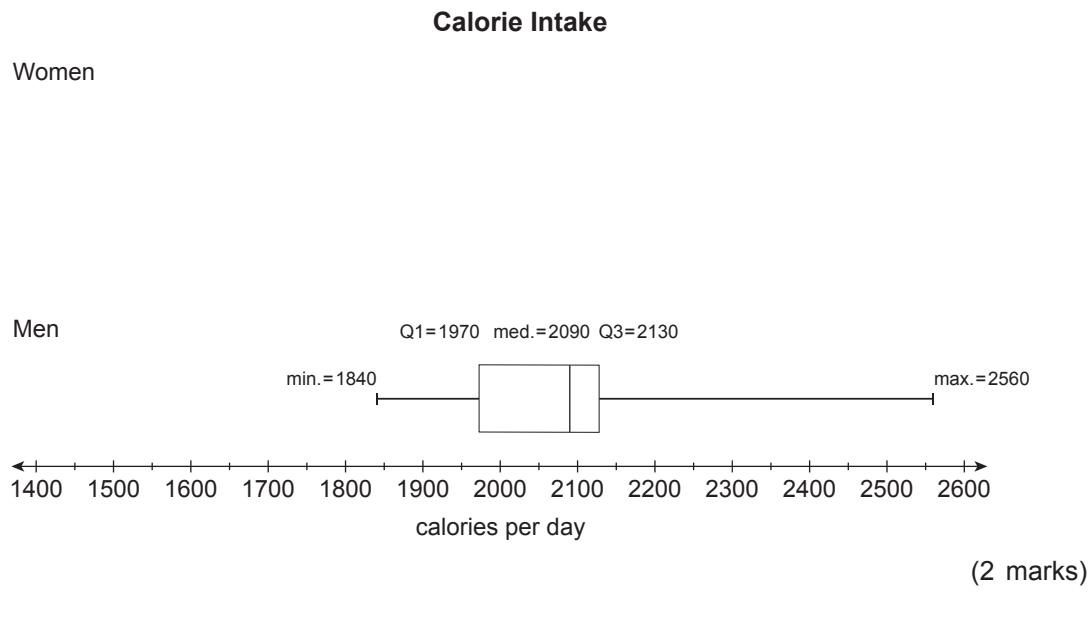
(2 marks)

- (b) Complete the table below.

Statistical measure	Women	Men
mean	1734.7	
median		2090.0
standard deviation	245.1	
interquartile range		160.0

(3 marks)

- (c) Draw and label a box-and-whisker diagram for the women's data, using the axis provided.



- (d) Fill in the blanks in the following sentences with 'men' or 'women':

'The standard deviation suggests that \_\_\_\_\_ demonstrate a higher level of variability in the number of calories they consume on an average day.'

'On average, \_\_\_\_\_ consume fewer calories each day.'

(2 marks)

*Question 3 continues on page 10.*

- (e) There was an error in the recording of the data. The men's value of 2560 calories should have been 1860.

Replace 2560 with 1860 and recalculate the mean, median, standard deviation, and interquartile range for the men's data.

Statistical measure	Men
mean	
median	
standard deviation	
interquartile range	

(2 marks)

- (f) Tick the pair of statistical measures that are most affected by the presence of outliers.

mean and standard deviation	
median and interquartile range	
mean and median	

(1 mark)

- (g) The agency's promotional material includes the following claim:

'The average daily intake of calories is exceeded by a far greater amount by women than by men.'

Using the information given in this question, and the calculations you have made, explain whether or not you think this claim is accurate. (Assume that the outlier has been removed from the men's data.)



(2 marks)