Government of South Australia

SACE Board of SA

External Examination 2012

2012 MATHEMATICAL APPLICATIONS, Semester 2

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SUPERVISOR CHECK

RE-MARKED

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Graphics calculator ☐

Brand _____

Model _____

Computer software ☐

Tuesday 30 October: 9 a.m.

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

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 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. You may write on page 7 if you need more space, making sure to label each answer clearly.

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

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

8. 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.

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

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

11. Attach one of your SACE registration number labels to the box at the top of this page.

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

TOPIC 7

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QUESTION 1

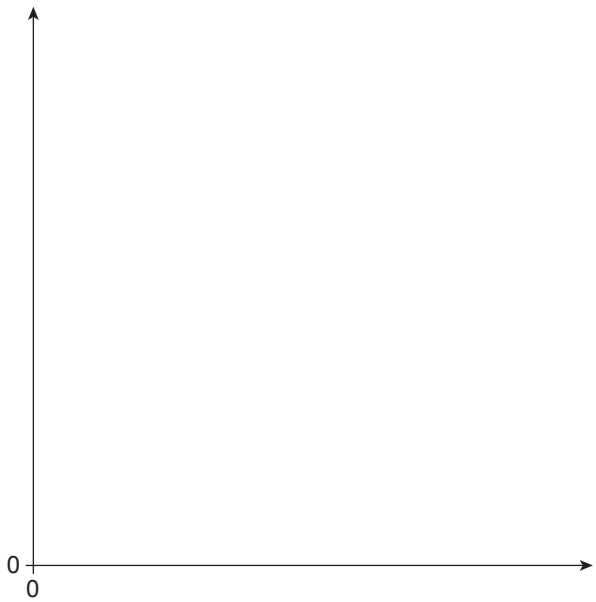
The table below shows the heart-rate of a male runner competing in a 1500 metre race. His heart-rate in beats per minute (bpm) was recorded every 30 seconds (s).

time spent running (s)	30	60	90	120	150	180	210	240
heart-rate (bpm)	130	147	157	168	172	177	181	184

(a) (i) On the axes below, sketch a scatter plot showing the correlation between heart-rate and the time spent running. (2 marks)

(ii) Label the axes. (1 mark)

Heart-rate of a Male Runner versus Time



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

(1 mark)

(ii) What does the coefficient of determination indicate about the strength of the relationship?

(1 mark)

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(c) The following linear model connects the two variables:

$$\text{Heart-rate} = 0.24 \times \text{time spent running} + 131.71$$

(i) Using the model above, predict the heart-rate of the runner after he has been running in the 1500 metre race for 5 minutes.

(2 marks)

(ii) Using the model, predict the time spent running when the runner's heart-rate is 163 beats per minute.

(2 marks)

(d) Explain which is the more reasonable of the two predictions in part (c) above.

(2 marks)

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QUESTION 2

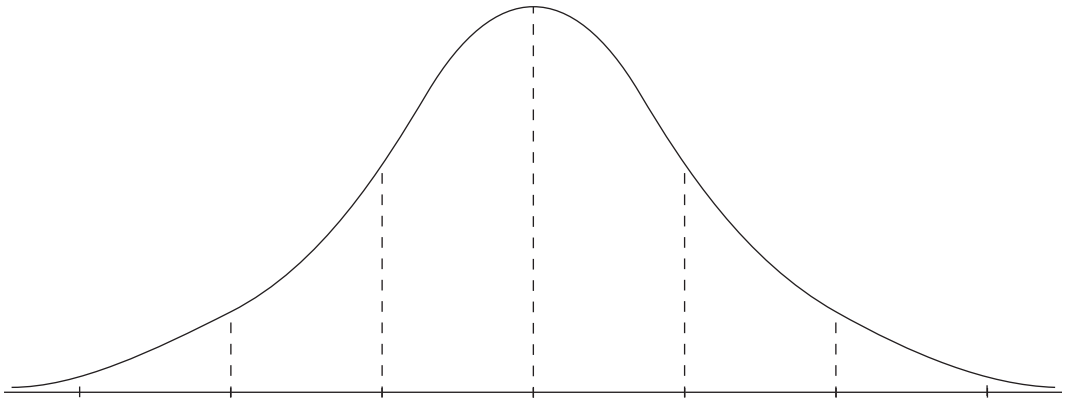
The mean number of goals kicked by one Adelaide team during the 2012 football season was 15, with a standard deviation of 4 goals.

(a) Use the following normal distribution graph to show the number of goals kicked by the Adelaide team.

Complete the scale on the graph.

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

2012 Football Season



number of goals

(1 mark)

(b) (i) On the graph above, shade the region that represents the probability that the Adelaide team kicked more than 23 goals in a single match.

(1 mark)

(ii) Calculate the probability that the Adelaide team kicked more than 23 goals in a single match.

(1 mark)

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(c) Calculate the probability that the Adelaide team kicked between 8 and 13 goals in a single match.

(2 marks)

(d) During the regular season the Adelaide team plays twenty-two matches.

Determine the number of these matches in which the team scores more than 12 goals.

(2 marks)

(e) The coach believes that the number of goals kicked by the Adelaide team in every match must be in the top 40% of its goal-scoring capacity if it is to hold one of the top four positions.

Determine how many goals the team must kick in every match to achieve this result.

(3 marks)

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(f) State *one* limitation of applying statistical analysis when predicting the outcomes of sporting events.

(1 mark)

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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 2(e) continued').

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QUESTION 3

Sally, a neighbourhood watch organiser, recorded the number of missing wheelie bins in the local council area on a sample of days in January and February 2012. The following table shows the data recorded:

number of missing wheelie bins in January	12	22	14	13	35	69	13	14	23	34	39	19	20	5	15
number of missing wheelie bins in February	10	5	22	3	18	15	21	4	9	11	22	24	34	30	17

(a) A stem plot for the number of missing wheelie bins in January is shown below.

Add the data for the number of missing wheelie bins in February to complete an ordered back-to-back stem plot.

January								February						
						5	**0**							
9	5	4	4	3	3	2	**1**							
				3	2	0	**2**							
				9	5	4	**3**							
							4							
							5							
						9	**6**							

(2 marks)

(b) Calculate the mean and standard deviation for the February data.

(2 marks)

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(c) For the January data the mean is twenty-three missing wheelie bins and the standard deviation is sixteen.

State *one* conclusion that you can draw about the number of missing wheelie bins in January compared with the number in February. Give a reason for your answer.

(2 marks)

(d) (i) Sally enquired about the number of missing wheelie bins in January. She found that the value of sixty-nine missing wheelie bins recorded for one day in January was incorrect. The number of missing wheelie bins on this day was only nine.

Recalculate the mean and the standard deviation for January.

(2 marks)

(ii) Explain why the standard deviation is now lower.

(1 mark)

(iii) If the error of sixty-nine missing wheelie bins recorded for one day in January remained in the data, the spread would be measured better by the standard deviation than by the range.

Give a reason for this.

(1 mark)

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(e) The total number of missing wheelie bins was 287 in January and 245 in February. Sally wanted to collect more information about 100 of these missing wheelie bins.

(i) Calculate how many of the missing wheelie bins in January Sally should choose for a stratified sample.

(2 marks)

(ii) State *one* advantage of choosing a sample rather than collecting information from the population.

(1 mark)

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