Name:

Teacher:

Mark:

Repton School

IB Standard Level
Mathematical Studies
Year 12 – Paper 2

June 2013

Time allowed: 1 Hour   Marks: 58

A clean copy of the *Mathematical Studies SL formula booklet* is required for this paper.

- A graphic display calculator is required for this paper.

- Answer all questions.

- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.

- Write in blue or black pen and draw diagrams in pencil.

- Do not use correction fluid or tape.

Please start each question on a new page. You are advised to show all working, where possible. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer.

1. *[Maximum mark: 13]*

The lengths (l) in centimetres of 100 copper pipes at a local building supplier were measured. The results are listed in the table below.

Length l (cm)	Frequency
17.5	12
32.5	26
47.5	32
62.5	21
77.5	9

(a) Write down the mode.

[1 mark]

(b) Using your graphic display calculator, write down the value of

    (i)   the mean;

    (ii)   the standard deviation;

    (iii) the median.

[4 marks]

(c) Find the interquartile range.

[2 marks]

(d) Draw a box and whisker diagram for this data, on graph paper, using a scale of 1 cm to represent 5 cm.

[4 marks]

Sam estimated the value of the mean of the measured lengths to be 43 cm.

(e) Find the percentage error of Sam's estimated mean.

[2 marks]

2. *[Maximum mark: 23]*

Part A

One day the number of customers at three cafés, "Alan's Diner" (A), "Sarah's Snackbar" (S) and "Pete's Eats" (P) was recorded and are given below.

17 were customers of Pete's Eats only
27 were customers of Sarah's Snackbar only
15 were customers of Alan's Diner only
10 were customers of Pete's Eats **and** Sarah's Snackbar **but not** Alan's Diner
8 were customers of Pete's Eats **and** Alan's Diner **but not** Sarah's Snackbar

(a)   Draw a Venn Diagram, using sets labelled A, S and P, that shows this information.   *[3 marks]*

There were 48 customers of Pete's Eats that day.

(b)   Calculate the number of people who were customers of all three cafés.   *[2 marks]*

There were 50 customers of Sarah's Snackbar that day.

(c)   Calculate the total number of people who were customers of Alan's Diner.   *[3 marks]*

(d)   Write down the number of customers of Alan's Diner that were also customers of Pete's Eats.   *[1 mark]*

(e)   Find $n[(S \cup P) \cap A']$.   *[2 marks]*

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(Question 2 continued)

Part B

Some of the customers in each café were given survey forms to complete to find out if they were satisfied with the standard of service they received.

	Pete's Eats	Alan's Diner	Sarah's Snackbar	Total
Dissatisfied	16	8	16	40
Satisfied	26	20	34	80
Total	42	28	50	120

One of the survey forms was chosen at random, find the probability that

(a)   the form showed "Dissatisfied";   *[2 marks]*

(b)   the form showed "Satisfied" and was completed at Sarah's Snackbar; *[2 marks]*

(c)   the form showed "Dissatisfied", given that it was completed at Alan's Diner. *[2 marks]*

A χ^2 test at the 5 % significance level was carried out to determine whether there was any difference in the level of customer satisfaction in each of the cafés.

(d)   Write down the null hypothesis, H_0, for the χ^2 test.   *[1 mark]*

(e)   Write down the number of degrees of freedom for the test.   *[1 mark]*

(f)   Using your graphic display calculator, find χ^2_{calc}.   *[2 marks]*

(g)   State, giving a reason, the conclusion to the test.   *[2 marks]*

3.   *[Maximum mark: 14]*

The Brahma chicken produces eggs with weights in grams that are normally distributed about a mean of 55 g with a standard deviation of 7 g. The eggs are classified as small, medium, large or extra large according to their weight, as shown in the table below.

Size	Weight (g)
Small	Weight < 53
Medium	$53 \leq$ Weight < 63
Large	$63 \leq$ Weight < 73
Extra Large	Weight ≥ 73

(a)   Sketch a diagram of the distribution of the weight of Brahma chicken eggs. On your diagram, show clearly the boundaries for the classification of the eggs.   *[3 marks]*

An egg is chosen at random.

(b)   Find the probability that the egg is

   (i)   medium;

   (ii)   extra large.   *[4 marks]*

There is a probability of 0.3 that a randomly chosen egg weighs more than w grams.

(c)   Find w.   *[2 marks]*

The probability that a Brahma chicken produces a large size egg is 0.121. Frank's Brahma chickens produce 2000 eggs each month.

(d)   Calculate an estimate of the number of large size eggs produced by Frank's chickens each month.   *[2 marks]*

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The selling price, in US dollars (USD), of each size is shown in the table below.

Size	Selling price (USD)
Small	0.30
Medium	0.50
Large	0.65
Extra Large	0.80

The probability that a Brahma chicken produces a small size egg is 0.388.

(c) Estimate the monthly income, in USD, earned by selling the 2000 eggs. Give your answer correct to two decimal places. *[3 marks]*

4. *[maximum mark: 14]*

Consider the arithmetic sequence $1, 4, 7, 10, 13, \ldots$

(a) Find the value of the eleventh term. *[2 marks]*

(b) The sum of the first n terms of this sequence is $\frac{n}{2}(3n-1)$.

    (i) Find the sum of the first 100 terms in this arithmetic sequence.

    (ii) The sum of the first n terms is 477.

        (a) Show that $3n^2 - n - 954 = 0$.

        (b) Using your graphic display calculator or otherwise, find the number of terms, n. *[6 marks]*

End of Test.