Review of year 1 [94 marks]

1. [Maximum mark: 6]

Ms Calhoun measures the heights of students in her mathematics class. She is interested to see if the mean height of male students, μ_1, is the same as the mean height of female students, μ_2. The information is recorded in the table.

Male height (cm)	150	148	143	152	151	149	147	
Female height (cm)	148	152	154	147	146	153	152	150

At the 10 % level of significance, a t-test was used to compare the means of the two groups. The data is assumed to be normally distributed and the standard deviations are equal between the two groups.

(a.i)   State the null hypothesis. [1]

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(a.ii)   State the alternative hypothesis. [1]

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(b)   Calculate the p-value for this test. [2]

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(c)   State, giving a reason, whether Ms Calhoun should accept the null hypothesis. [2]

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2. [Maximum mark: 5]

As part of a study into healthy lifestyles, Jing visited Surrey Hills University. Jing recorded a person's position in the university and how frequently they ate a salad. Results are shown in the table.

	Salad meals per week			
	0	**1−2**	**3−4**	**>4**
Students	45	26	18	6
Professors	15	8	5	12
Staff and Administration	16	13	10	6

Jing conducted a χ^2 test for independence at a 5 % level of significance.

(a) State the null hypothesis. [1]

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(b) Calculate the p-value for this test. [2]

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(c) State, giving a reason, whether the null hypothesis should be accepted. [2]

3. [Maximum mark: 6]

At the end of a school day, the Headmaster conducted a survey asking students in how many classes they had used the internet.

The data is shown in the following table.

Number of classes in which the students used the internet	0	1	2	3	4	5	6
Number of students	20	24	30	k	10	3	1

(a) State whether the data is discrete or continuous. [1]

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The mean number of classes in which a student used the internet is 2.

(b) Find the value of k. [4]

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(c) It was not possible to ask every person in the school, so the Headmaster arranged the student names in alphabetical order and then asked every 10th person on the list.

Identify the sampling technique used in the survey. [1]

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4. [Maximum mark: 6]

Mr Burke teaches a mathematics class with 15 students. In this class there are 6 female students and 9 male students.

Each day Mr Burke randomly chooses one student to answer a homework question.

(a) Find the probability that on any given day Mr Burke chooses a female student to answer a question. [1]

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In the first month, Mr Burke will teach his class 20 times.

(b) Find the probability he will choose a female student 8 times. [2]

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(c) Find the probability he will choose a male student at most 9 times. [3]

5.

Jae Hee plays a game involving a biased six-sided die.

The faces of the die are labelled $-3, -1, 0, 1, 2$ and 5.

The score for the game, X, is the number which lands face up after the die is rolled.

The following table shows the probability distribution for X.

Score x	-3	-1	0	1	2	5
$P(X=x)$	$\dfrac{1}{18}$	p	$\dfrac{3}{18}$	$\dfrac{1}{18}$	$\dfrac{2}{18}$	$\dfrac{7}{18}$

(a)   Find the exact value of p.   [1]

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Jae Hee plays the game once.

(b)   Calculate the expected score.   [2]

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(c)   Jae Hee plays the game twice and adds the two scores together.

Find the probability Jae Hee has a **total** score of -3.   [3]

6. [Maximum mark: 7]

A food scientist measures the weights of 760 potatoes taken from a single field and the distribution of the weights is shown by the cumulative frequency curve below.
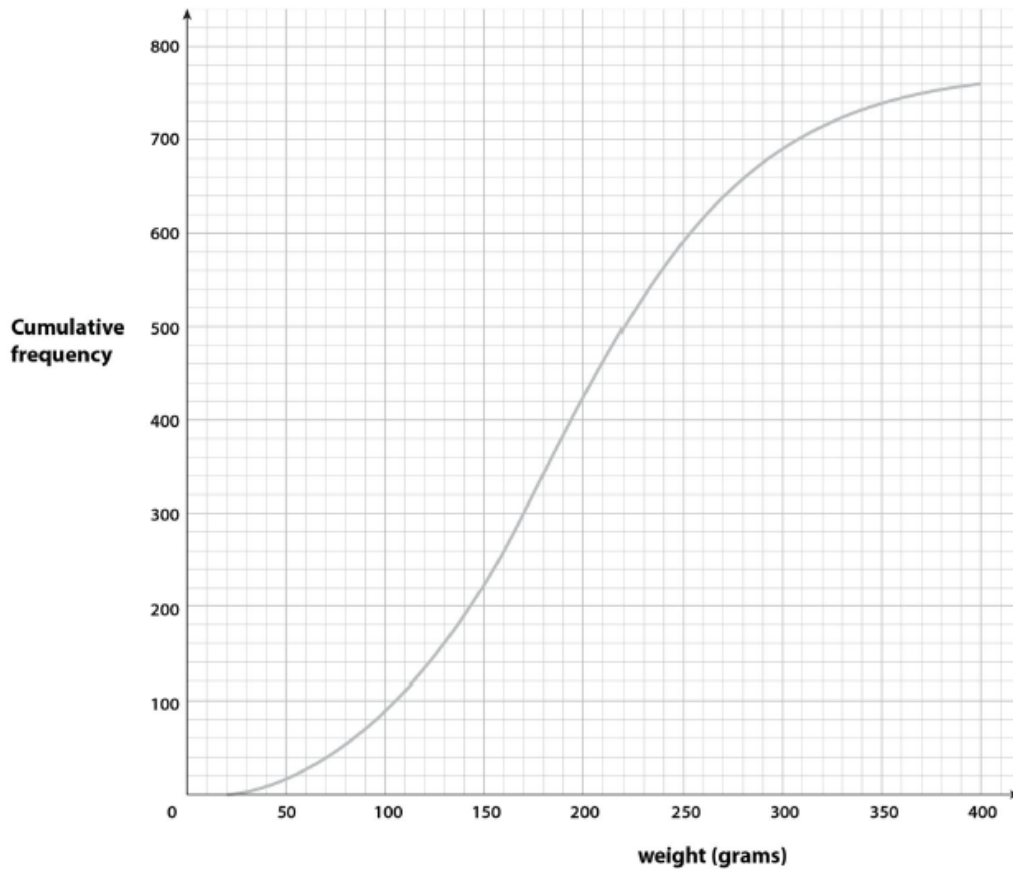
(a) Find the number of potatoes in the sample with a weight of more than 200 grams. [2]

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(b.i)   Find the median weight.   [1]

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(b.ii) Find the lower quartile.   [1]

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(b.iii) Find the upper quartile.   [1]

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(c)   The weight of the smallest potato in the sample is 20 grams and the
        weight of the largest is 400 grams.

        Use the scale shown below to draw a box and whisker diagram
        showing the distribution of the weights of the potatoes. You may
        assume there are no outliers.

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 0      50     100    150    200    250    300    350    400
                        Weights (g)
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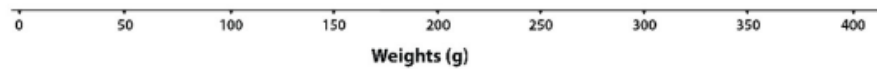
7.   [Maximum mark: 6]

Kacheena stands at point K, the top of a 218 m vertical cliff. The base of the cliff is located at point B. A ship is located at point S, 1200 m from Kacheena.

This information is shown in the following diagram.

diagram not to scale
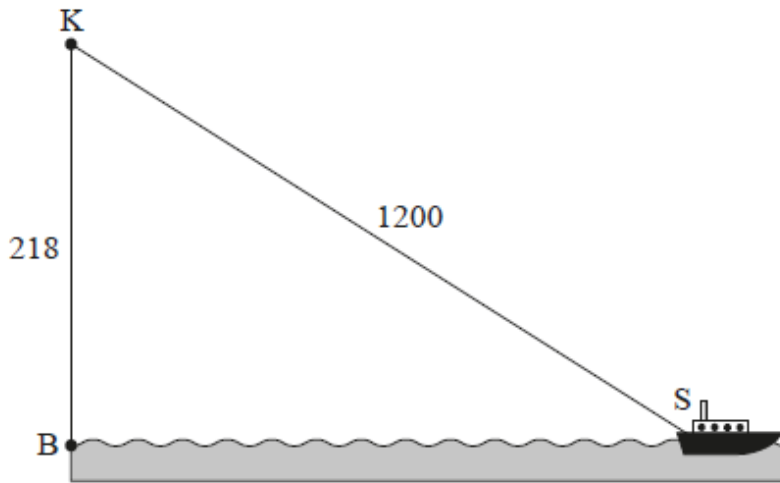
(a)   Find the angle of elevation from the ship to Kacheena.   [2]

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(b)   Find the horizontal distance from the base of the cliff to the ship.   [2]

(c)   Write down your answer to part (b) in the form $a \times 10^k$ where
$1 \le a < 10$ and $k \in \mathbb{Z}$.   [2]

8. [Maximum mark: 17]

The following diagram shows a park bounded by a fence in the shape of a quadrilateral $ABCD$. A straight path crosses through the park from B to D.

$AB = 85$ m, $AD = 85$ m, $BC = 40$ m, $C\widehat{B}D = 41°$, $B\widehat{C}D = 120°$

diagram not to scale
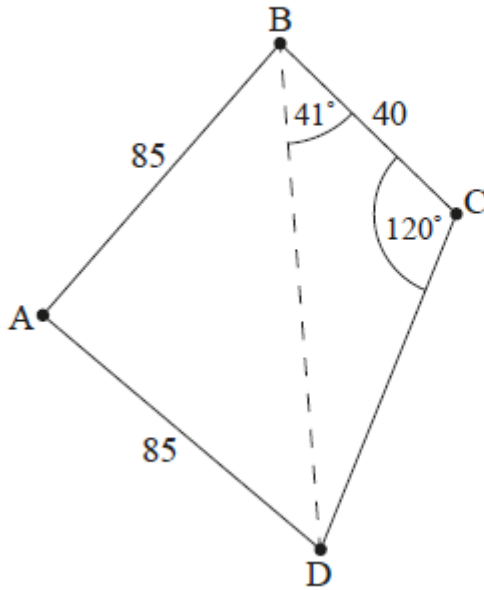
(a.i)   Write down the value of angle BDC.   [1]

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(a.ii) Hence use triangle BDC to find the length of path BD.   [3]

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(b)   Calculate the size of angle $B\widehat{A}D$, correct to five significant figures.   [3]

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The size of angle $B\widehat{A}D$ rounds to $77°$, correct to the nearest degree. Use $B\widehat{A}D = 77°$ for the rest of this question.

(c)   Find the area bounded by the path BD, and fences AB and AD.   [3]

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A landscaping firm proposes a new design for the park. Fences BC and CD are to be replaced by a fence in the shape of a circular arc BED with center A. This is illustrated in the following diagram.

diagram not to scale
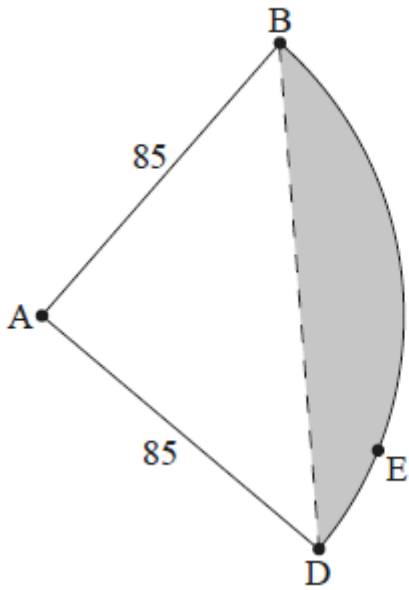
(d)   Write down the distance from A to E.   [1]

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(e)   Find the perimeter of the proposed park, $ABED$.   [3]

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(f) Find the area of the shaded region in the proposed park. [3]

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9.   [Maximum mark: 17]

In this question, give all answers to two decimal places.

Bryan decides to purchase a new car with a price of €14 000, but cannot afford
the full amount. The car dealership offers two options to finance a loan.

Finance option A:

A 6 year loan at a nominal annual interest rate of 14 % **compounded
quarterly**. No deposit required and repayments are made each quarter.

(a.i)   Find the repayment made each quarter.   [3]

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(a.ii)   Find the total amount paid for the car.   [2]

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(a.iii)   Find the interest paid on the loan.   [2]

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Finance option B:

A 6 year loan at a nominal annual interest rate of r % **compounded monthly**.
Terms of the loan require a 10 % deposit and monthly repayments of €250.

(b.i)   Find the amount to be borrowed for this option.   [2]

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(b.ii)   Find the annual interest rate, r.   [3]

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(c)   State which option Bryan should choose. Justify your answer.   [2]

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(d)   Bryan's car depreciates at an annual rate of 25 % per year.

Find the value of Bryan's car six years after it is purchased.   [3]

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10. [Maximum mark: 5]

Give your answers to this question correct to two decimal places.

Gen invests $2400 in a savings account that pays interest at a rate of 4% per year, compounded annually. She leaves the money in her account for 10 years, and she does not invest or withdraw any money during this time.

(a) Calculate the value of her savings after 10 years. [2]

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(b) The rate of inflation during this 10 year period is 1.5% per year.

Calculate the real value of her savings after 10 years. [3]

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11. [Maximum mark: 6]

Yejin plans to retire at age 60. She wants to create an annuity fund, which will pay her a monthly allowance of $4000 during her retirement. She wants to save enough money so that the payments last for 30 years. A financial advisor has told her that she can expect to earn 5% interest on her funds, compounded annually.

(a) Calculate the amount Yejin needs to have saved into her annuity fund, in order to meet her retirement goal. [3]

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(b) Yejin has just turned 28 years old. She currently has no retirement savings. She wants to save part of her salary each month into her annuity fund.

Calculate the amount Yejin needs to save each month, to meet her retirement goal. [3]

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12. [Maximum mark: 7]

In the first month of a reforestation program, the town of Neerim plants 85 trees. Each subsequent month the number of trees planted will increase by an additional 30 trees.

The number of trees to be planted in each of the first three months are shown in the following table.

Month	Trees planted
1	85
2	115
3	145

(a)   Find the number of trees to be planted in the 15th month.   [3]

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(b)   Find the total number of trees to be planted in the first 15 months.   [2]

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(c)   Find the mean number of trees planted per month during the first 15
       months.   [2]

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