**Stage 2 GENERAL MathematicS**

**Assessment Type 1: Skills and Applications Tasks**

**TOPIC 5: STATISTICAL MODELS (Practice Test)**

**Purpose**

To demonstrate your ability to:

* understand mathematical concepts and relationships from within Topic 3: Statistical Models
* select and apply mathematical techniques to find solutions to problems
* interpret results, draw conclusions, and consider the reasonableness of solutions in context
* communicate mathematically and present mathematical information.

This assessment allows you to show your skills in understanding and appropriate use of the mathematical concepts, process, and strategies in the following:

1. Subtopic 3.1: Bivariate Statistics
2. Subtopic 3.2: The normal distribution

**Assessment Conditions**

This is a supervised assessment.

This task is conducted in a 90 minute lesson.

**Assessment Design Criteria**

**Concepts and Techniques**

CT 1 Knowledge and understanding of concepts and relationships.

CT 2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts.

CT 4 Use of electronic technology to find solutions to mathematical problems.

**Reasoning and Communication**

RC 1 Interpretation of mathematical results.

RC 2 Drawing conclusions from mathematical results with an understanding of their reasonableness and limitations.

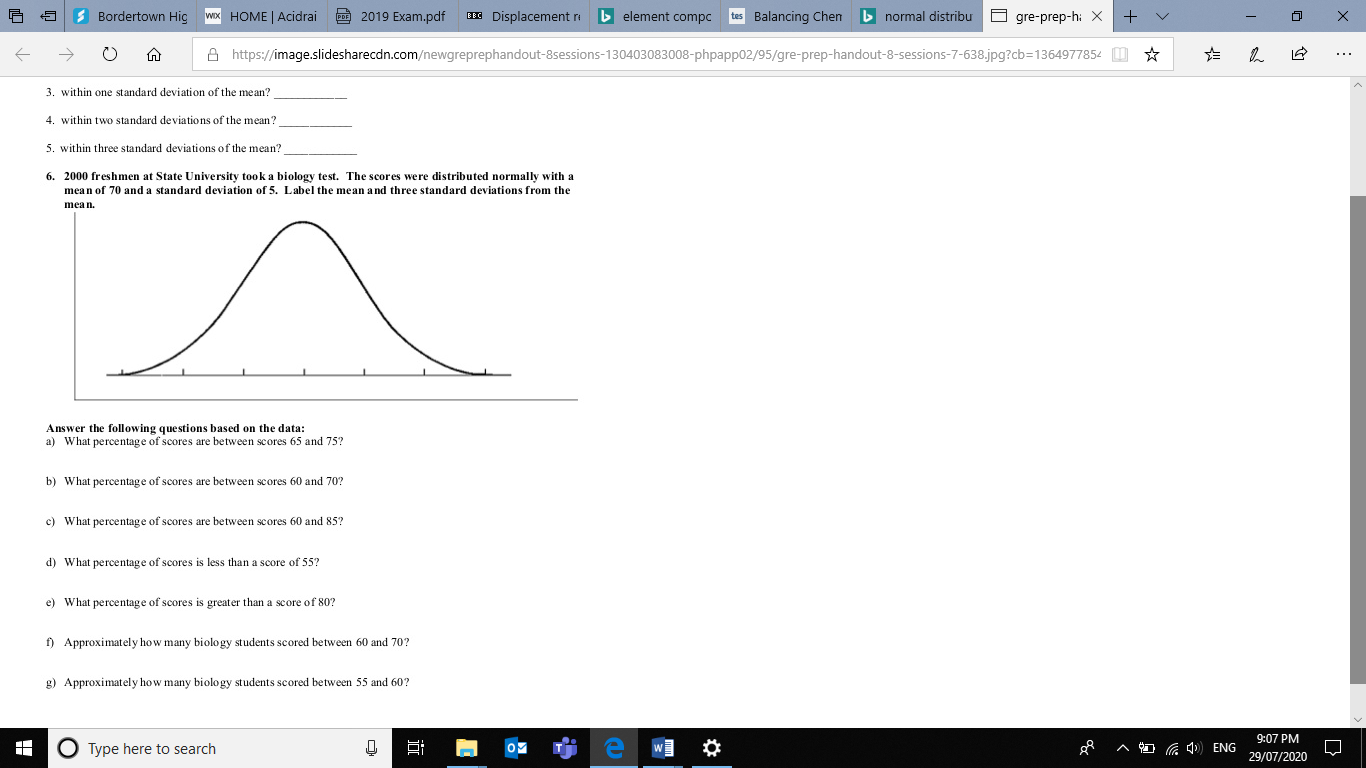
RC 3 Use of appropriate notations representations and terminology.

RC 4 Communication of mathematical ideas and reasoning to develop logical arguments.

**Year 12 General Mathematics**

**Statistics – Practice Test**

* 1. 2000 students at a state university took a biology test. The scores were distributed normally with a mean of 70 and a standard deviation of 5. Label the scale on the bell curve in full. (1mark)



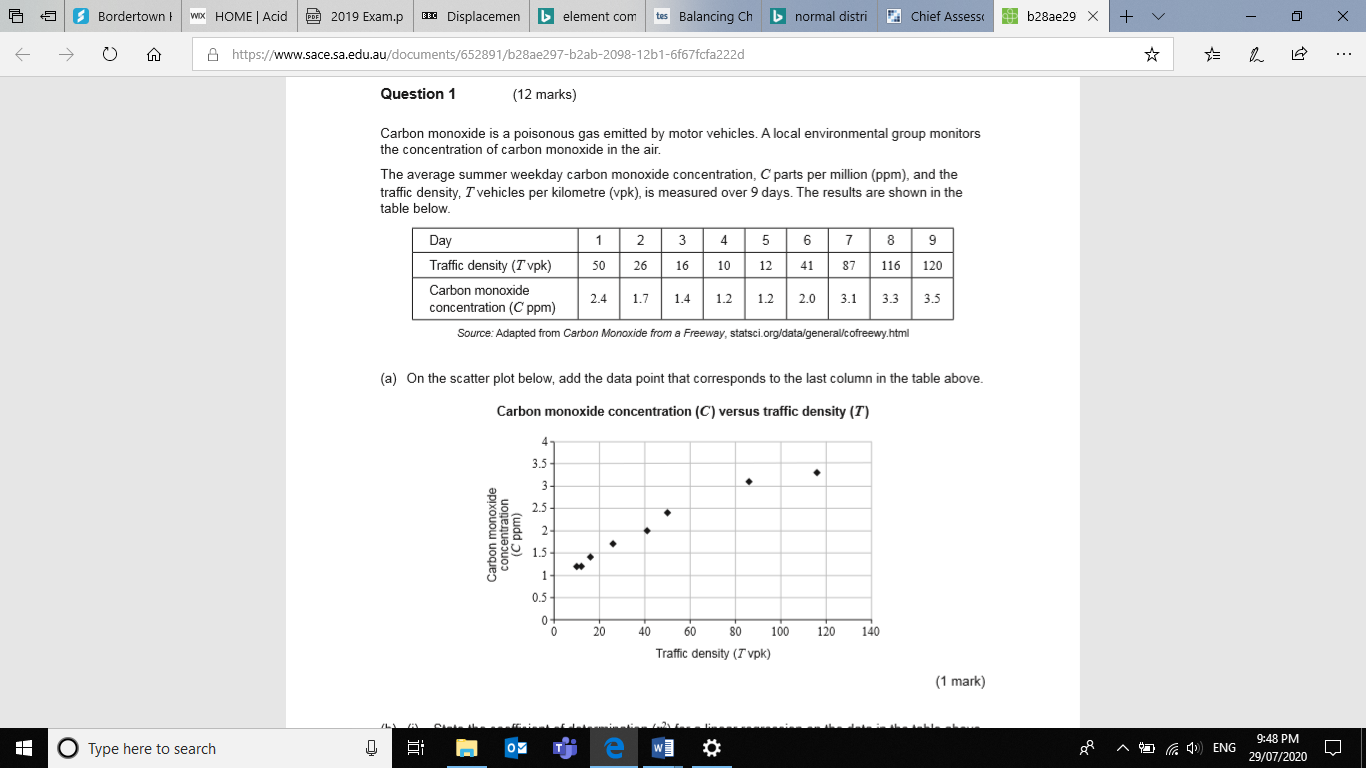
* 1. On your graph shade the region that represents the probability that a student scored greater than a 75 on the test. (1 mark)
  2. Calculate the probability that a student scored a 70 on the test. (1 mark)
  3. Calculate the probability that a student scored between 68 and 77. (1 mark)
  4. What number of students would score greater than 77? (2 marks).

* 1. Each year a lecturer at the university is awarded with a prize if more than 10% of their students receive greater than an 80. Will the biology professor receive this prize? (2 marks)

A machine packs jelly beans into packets. The packets should hold 200 jelly beans, but because of the way they fall from a spout, the number varies slightly. It was found from a sample of packets to follow a normal distribution with mean of 200 and standard deviation of 4.

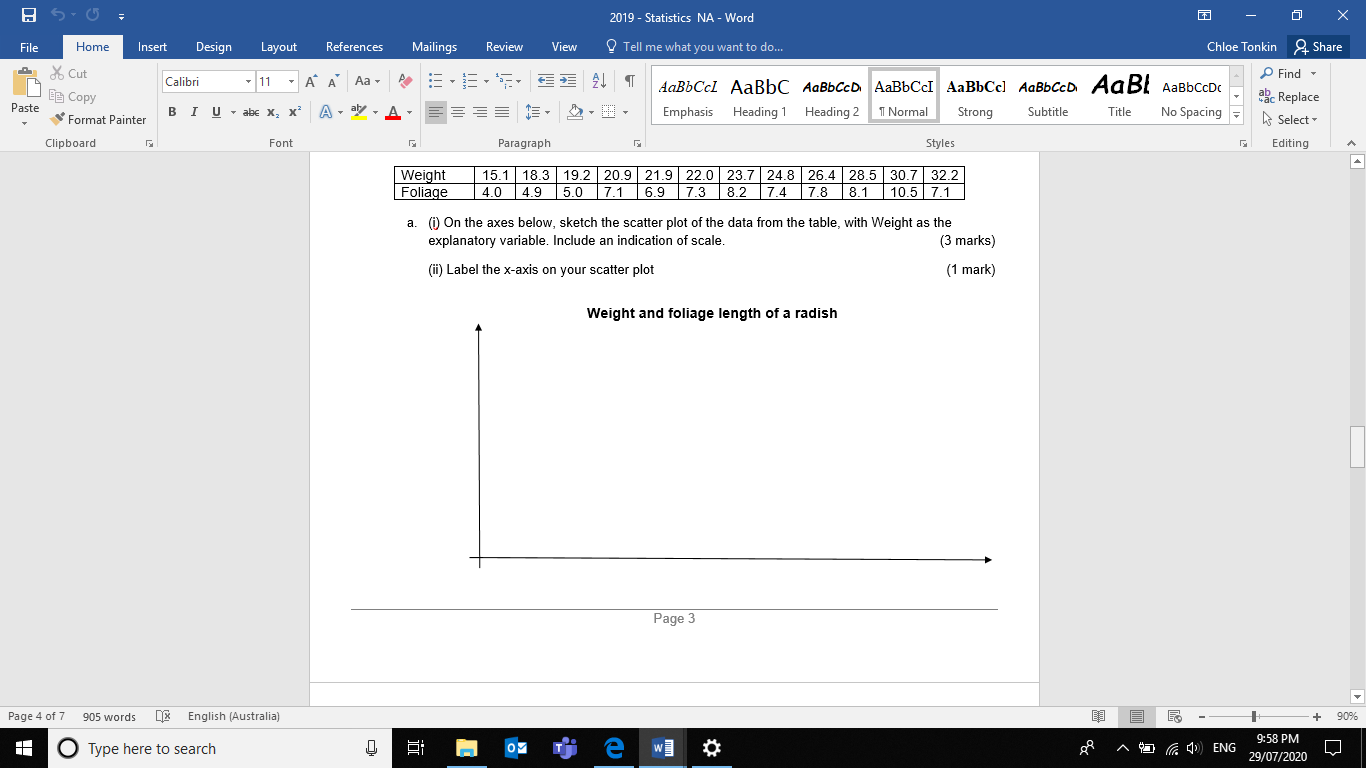
1. If a packet was chosen at random from the production line, what is the probability that it will contain:
   1. Less than 191 jelly beans (1 mark)
   2. Between 194 and 205 jelly beans (2 marks)
2. If the machine is able to package 15,000 packets in one day, how many of them would contain between 194 and 205 jelly beans? (2 marks)
3. The company rejects the top 5% of packets because they contain too many jelly beans and the packet cannot be sealed. What is the largest acceptable number of jelly beans that can be placed into a packet? (2 marks)
4. Carbon monoxide is a poisonous gas emitted by motor vehicles. A local environmental group monitors the concentration of carbon monoxide in the air.

The average summer weekday carbon monoxide concentration, C is parts per million (ppm), and the traffic density T vehicles per kilometer (vpk), is measured over 9 days. The results are shown in the table below

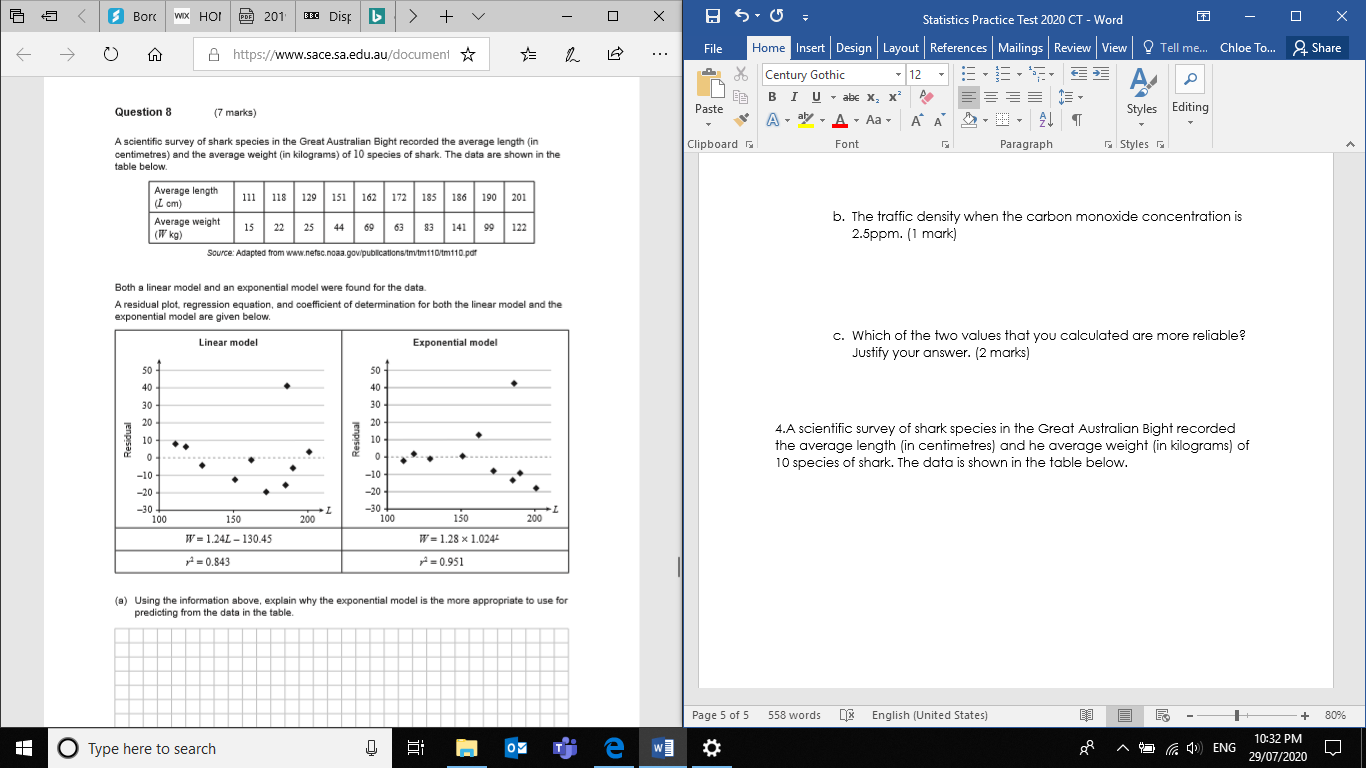


1. On the axes below, sketch the scatter plot of the data from the table, with Traffic density as the explanatory variable. Include an indication of scale (3 marks)

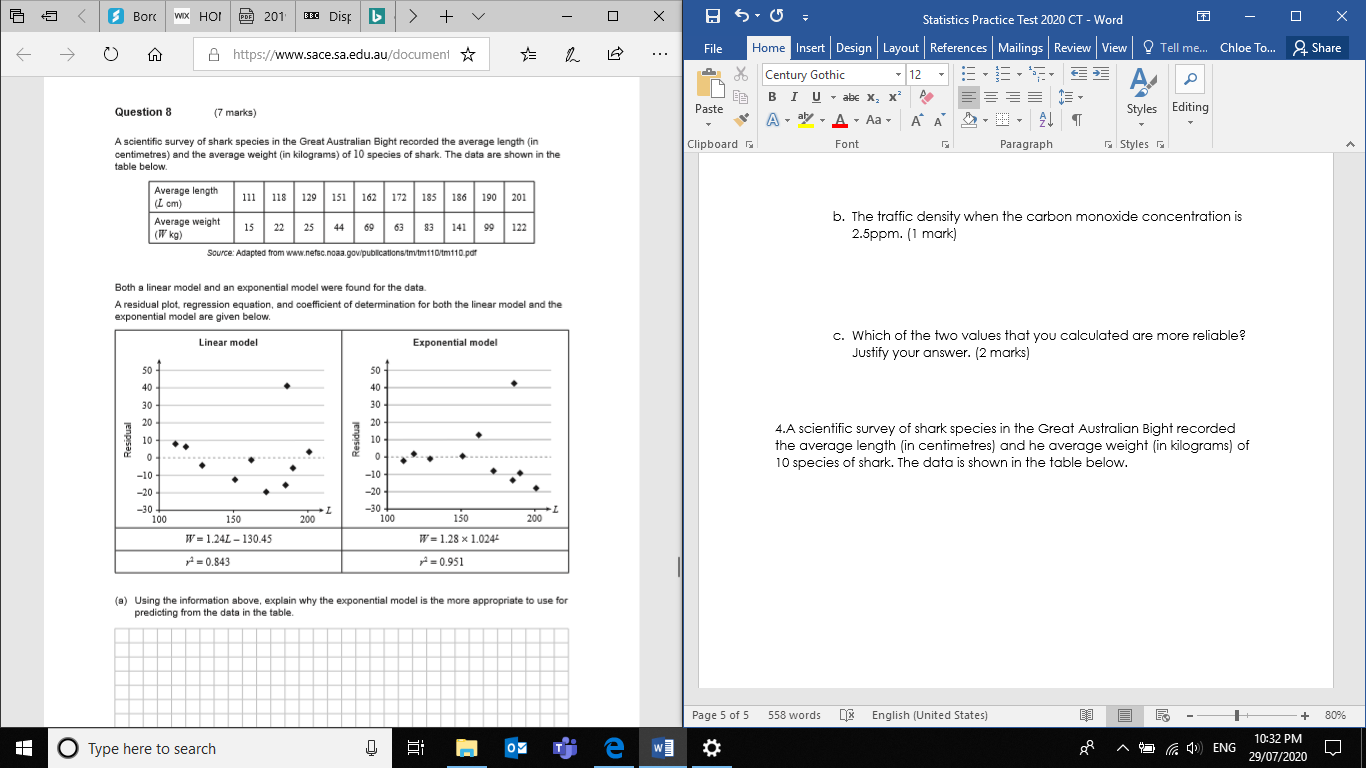
**Carbon monoxide concentration (C) versus traffic density (T)**



1. State the coefficient of determination for the linear regression on the data in the table above. (1 mark)
2. Describe the nature and strength of the linear relationship between the variables. (2 marks)
3. State the equation of the least squares regression line in terms of C and T. (2 marks)
4. State the value of ‘a’ (the slope of the least squares regression line), and interpret this value in the context of the question. (2 marks)
5. Using the equations that you stated calculate:
   1. The carbon monoxide concentration when traffic density is 250vpk. (1 mark)
   2. The traffic density when the carbon monoxide concentration is 2.5ppm. (1 mark)
   3. Which of the two values that you calculated are more reliable? Justify your answer. (2 marks)
6. A scientific survey of shark species in the Great Australian Bight recorded the average length (in centimetres) and he average weight (in kilograms) of 10 species of shark. The data is shown in the table below.



Both a linear model and an exponential model were found for the data. A residual plot, regression equation, and a coefficient of determination for both models are given below.



1. Using the information above, explain why the exponential modes is more appropriate to use for predicting from the data in the table. (2 marks)
2. Identify a possible outlier in the data (1 mark)
3. The outlier identified in part b was found to be a recording error.  
   Remove the outlier. Write the new exponential regression equation, and recalculate its coefficient of determination. (2 marks)
4. A shark has been caught in the Great Australian Bight, and scientists think it is a new species. The length of the shark is 143 centimetres.  
   Using this length and the exponential regression equation you found in part c, predict the average weight of the new species of shark. (1 mark)
5. State why making a prediction in part d may not be reasonable. (1 mark)

Performance Standards for Stage 2 General Mathematics

|  | Concepts and Techniques | Reasoning and Communication |
| --- | --- | --- |
| A | Comprehensive knowledge and understanding of concepts and relationships.  Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Successful development and application of mathematical models to find concise and accurate solutions.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Comprehensive interpretation of mathematical results in the context of the problem. Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.  Formation and testing of appropriate predictions, using sound mathematical evidence. |
| B | Some depth of knowledge and understanding of concepts and relationships.  Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Attempted development and successful application of mathematical models to find mostly accurate solutions.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly appropriate interpretation of mathematical results in the context of the problem. Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.  Formation and testing of mostly appropriate predictions, using some mathematical evidence. |
| C | Generally competent knowledge and understanding of concepts and relationships.  Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in different contexts.  Application of mathematical models to find generally accurate solutions.  Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems. | Generally appropriate interpretation of mathematical results in the context of the problem. Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.  Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.  Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.  Formation of an appropriate prediction and some attempt to test it using mathematical evidence. |
| D | Basic knowledge and some understanding of concepts and relationships.  Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in context.  Some application of mathematical models to find some accurate or partially accurate solutions.  Some appropriate use of electronic technology to find some accurate solutions to routine problems. | Some interpretation of mathematical results. Drawing some conclusions from mathematical results, with some awareness of their reasonableness.  Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.  Some communication of mathematical ideas, with attempted reasoning and/or arguments.  Attempted formation of a prediction with limited attempt to test it using mathematical evidence. |
| E | Limited knowledge or understanding of concepts and relationships.  Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.  Attempted application of mathematical models, with limited accuracy.  Attempted use of electronic technology, with limited accuracy in solving routine problems. | Limited interpretation of mathematical results. Limited understanding of the meaning of mathematical results, their reasonableness, or limitations.  Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.  Attempted communication of mathematical ideas, with limited reasoning.  Limited attempt to form or test a prediction. |