**MATHEMATICS METHODS**

**MAWA Semester 2 (Units 3 and 4) Examination 2017**

**Calculator-free**

# Marking Key

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The release date for this exam and marking scheme is

* **the end of week 1 of term 4, 2017**

**Section One: Calculator-free (52 Marks)**

**Question 1(a)**

|  |  |
| --- | --- |
| Solution  |  |
| Marking key/mathematical behaviours | Marks |
| * correctly solves for *.*
 | 1 |

**Question 1(b)**

|  |  |
| --- | --- |
| SolutionNo,This is not a discrete probability distribution as *P*(5) has a negative value and probabilities need to positive. |  |
| Marking key/mathematical behaviours | Marks |
| * recognises the properties of discrete probability distributions
* relates above property back to the question to justify answer
 | 11 |

**Question 1(c)**

|  |  |
| --- | --- |
| Solution  Expand and solve for *p*    Sub value of *p* and solve for *n*. |  |
| Marking key/mathematical behaviours | Marks |
| * determines variance
* solves for parameter, *p*
* solves for parameter, *n*
 | 111 |

**Question 2(a)**

|  |  |
| --- | --- |
| SolutionA census involves **every member** of the **population** being tested/questioned/investigated |  |
| Marking key/mathematical behaviours | Marks |
| * indicates the need to include every member of the population
 | 1 |

**Question 2(b)**

|  |
| --- |
| SolutionThere would be no stoves left to sell as all of them would have broken down. |
| Marking key/mathematical behaviours | Marks |
| * indicates that there would be no items left for sale (no marks for cheaper or quicker)
 | 1 |

**Question 2(c)**

|  |
| --- |
| SolutionUse the unique serial numbers to select a random sample or similar |
| Marking key/mathematical behaviours | Marks |
| * indicates use of a suitable random selection method (based on serial numbers or other method)
 | 1 |

**Question 2(d)**

|  |
| --- |
| SolutionUsing the list of the serial numbers, select every 400th stove  |
| Marking key/mathematical behaviours | Marks |
| * indicates use of a suitable selection method
 | 1 |

**Question 3(a) (i)**

|  |  |
| --- | --- |
| Solution     |  |
| Marking key/mathematical behaviours | Marks |
| * correct use of the quotient rule
* differentiates correctly
 | 11 |

**Question 3(a) (ii)**

|  |
| --- |
| Solution   |
| Marking key/mathematical behaviours | Marks |
| * correct use of the chain rule
* differentiates correctly
 | 11 |

**Question 3(b)**

|  |
| --- |
| SolutionDifferentiating both sides:  so  But  and so  i.e.   |
| Marking key/mathematical behaviours | Marks |
| * uses product rule correctly
* obtains correct expression for
* replaces  with
 | 111 |

**Question 4(a)(i)**

|  |
| --- |
| SolutionApproximately 200 samples are involved |
| Marking key/mathematical behaviours | Marks |
| * States the number of samples (allow 190 to 210)
 | 1 |

**Question 4(a)(ii)**

|  |
| --- |
| SolutionFind the mean of the sample proportions, (from the graph)  0.4May use sample proportion as an estimate of the population proportion  |
| Marking key/mathematical behaviours | Marks |
| * identifies sample proportion as 0.4 (by reference to the graph or calculation)
* uses the sample proportion as an estimate for the population proportion
 | 11 |

**Question 4(b)**

|  |  |
| --- | --- |
|  Solution* Survey is restricted to listeners of one particular station and therefore not representative of the population
* Survey is using a self-selection model and this indicates bias
* Timing may exclude some groups of people
* Access to a telephone is presumed
* People could respond more than once
* Nature of the question means football fans may be more likely to respond
 |  |
| Marking key/mathematical behaviours | Marks |
| * Lists one possibility
* Lists a second possibility
 | 11 |

**Question 5**

|  |
| --- |
| SolutionNote that:   |
| Marking key/mathematical behaviours | Marks |
| * Recognises
* Determines (or uses) derivative of denominator
* Uses constants to achieve numerator of -8*x*
* Finds integral accurately
 | 1111 |

**Question 6(a)**

|  |  |
| --- | --- |
|  SolutionSince  we have  (#)i.e.  and hence   |  |
| Marking key/mathematical behaviours | Marks |
| * Obtains equation (#) or equivalent
* Obtains correct answer
 | 11 |

**Question 6(b)(i)**

|  |
| --- |
| SolutionIf  then  i.e. negative |
| Marking key/mathematical behaviours | Marks |
| * obtains correct answer
 | 1 |

**Question 6(b)(ii)**

|  |
| --- |
| SolutionIf  then  have opposite signs (#) and are unequal.So  if   |
| Marking key/mathematical behaviours | Marks |
| * deduces that  have opposite signs if
* complete proof correctly
 | 11 |

**Question 7(a)**

|  |
| --- |
| Solution   |
| Marking key/mathematical behaviours | Marks |
| * sets up integral in either form
 | 1 |

**Question 7(b)**

|  |
| --- |
| Solution   |
| Marking key/mathematical behaviours | Marks |
| * integrates correctly
* correctly evaluates the integral
 | 11 |

**Question 7(c)**

|  |
| --- |
| Solution    |
| Marking key/mathematical behaviours | Marks |
| * correctly states the equation to be solved
* solves for *a*
 | 11 |

**Question 8(a)**

|  |
| --- |
| Solution |
| Marking key/mathematical behaviours | Marks |
| * uses the correct integral
* equates the pdf to one and solves for *c*
* Clearly states why  has been rejected
 | 111 |

**Question 8(b)**

|  |
| --- |
| Solution  |
| Marking key/mathematical behaviours | Marks |
| * Substitutes into the correct formula
* Integrates correctly and arrives at the required answer
 | 11 |

**Question 8(c)**

|  |
| --- |
| Solution(i) From the graph, read the relative frequencies for the parking times (0,30] mins and (30, 60] mins 🡺 Pr (at most 60 minutes) = 0.38 + 0.42 = 0.8.(ii) relative frequency of vehicles parked between 1 and 1.5hrs = 0.14. 200 x 0.14 = 28 vehicles.(iii) Answers will vary. One possible answer: The data shows that 80% of the vehicles are parked for at most 60 minutes. Businesses that would tailor to this time length could be a nearby café or a mini mall with a few necessities stores (ie. Grocery store, bakery, pharmacy, clothing shop). (iv) Answers will vary. One possible answer: On which day of the week was the data collected? |
| Marking key/mathematical behaviours | Marks |
| * sums the two relative frequencies required
* multiplies the relative frequency by the total number of parked cars
* links to a type of business requiring less than 1 hour of parking
* links question to day of the week or other plausible variable.
 | 1111 |

**Question 9(a)**

|  |
| --- |
| SolutionSince the graph has a vertical asymptote at  ,  Since the point  lies on the graph,  , i.e.  Since the point  lies on the graph,  , i.e.  and hence   |
| Marking key/mathematical behaviours | Marks |
| * evaluates   and  correctly
 | 1, 1, 1 |

**Question 9(b)**

|  |
| --- |
| Solution |
| Marking key/mathematical behaviours | Marks |
| * asymptote at
* intercept at
* intercept at
* graph of standard logarithm function reflected in both axes
 | 1111 |