**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)**

|  |  |
| --- | --- |
| Solution  No,  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 | 1  1 |

**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* | 1  1  1 |

**Question 2(a)**

|  |  |
| --- | --- |
| Solution  A 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)**

|  |  |
| --- | --- |
| Solution  There 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)**

|  |  |
| --- | --- |
| Solution  Use 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)**

|  |  |
| --- | --- |
| Solution  Using 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 | 1  1 |

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

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * correct use of the chain rule * differentiates correctly | 1  1 |

**Question 3(b)**

|  |  |
| --- | --- |
| Solution  Differentiating both sides:  so  But  and so  i.e. | |
| Marking key/mathematical behaviours | Marks |
| * uses product rule correctly * obtains correct expression for * replaces  with | 1  1  1 |

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

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

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

|  |  |
| --- | --- |
| Solution  Find the mean of the sample proportions, (from the graph)  0.4  May 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 | 1  1 |

**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 | 1  1 |

**Question 5**

|  |  |
| --- | --- |
| Solution  Note that: | |
| Marking key/mathematical behaviours | Marks |
| * Recognises * Determines (or uses) derivative of denominator * Uses constants to achieve numerator of -8*x* * Finds integral accurately | 1  1  1  1 |

**Question 6(a)**

|  |  |
| --- | --- |
| Solution  Since  we have  (#)  i.e.  and hence |  |
| Marking key/mathematical behaviours | Marks |
| * Obtains equation (#) or equivalent * Obtains correct answer | 1  1 |

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

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

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

|  |  |
| --- | --- |
| Solution  If  then  have opposite signs (#) and are unequal.  So  if | |
| Marking key/mathematical behaviours | Marks |
| * deduces that  have opposite signs if * complete proof correctly | 1  1 |

**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 | 1  1 |

**Question 7(c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * correctly states the equation to be solved * solves for *a* | 1  1 |

**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 | 1  1  1 |

**Question 8(b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * Substitutes into the correct formula * Integrates correctly and arrives at the required answer | 1  1 |

**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. | 1  1  1  1 |

**Question 9(a)**

|  |  |
| --- | --- |
| Solution  Since 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 | 1  1  1  1 |