**MATHEMATICS APPLICATIONS**

**MAWA Semester 1 (Unit 3) Examination 2018**

**Calculator-Assumed**

# Marking Key

© MAWA, 2018

**Licence Agreement**

This examination is Copyright but may be freely used within the school that purchases this licence.

* The items that are contained in this examination are to be used solely in the school for which they are purchased.
* They are not to be shared in any manner with a school which has not purchased their own licence.
* The items and the solutions/marking keys are to be kept confidentially and not copied or made available to anyone who is not a teacher at the school. Teachers may give feedback to students in the form of showing them how the work is marked but students are not to retain a copy of the paper or marking guide until the agreed release date stipulated in the purchasing agreement/licence.

The release date for this exam and marking scheme is

* **the end of week 8 of term 2, 2018**

**Section Two: Calculator-assumed (100 Marks)**

**Question 7 (a)**

|  |  |
| --- | --- |
| Solution  As population increases so does the number of people migrating overseas | |
| Marking key/mathematical behaviours | Marks |
| * describes the association | 1 |

**Question 7 (b)**

|  |  |
| --- | --- |
| Solution  It is possible but unlikely as an increase in population does not cause migration. Association does not guarantee causality. | |
| Marking key/mathematical behaviours | Marks |
| * concludes correctly * explains role of causality | 1  1 |

**Question 7 (c)**

|  |  |
| --- | --- |
| Solution  Confounding – both of these variables are influenced by / associated with another variable which has a similar effect on both of these variables.  These two variables may be responding to the current population with each state. | |
| Marking key/mathematical behaviours | Marks |
| * explains confounding * identifies another variable | 1  1 |

**Question 8 (a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * determines recurrence growth * identifies first term | 1  1 |

**Question 8 (b)**

|  |  |
| --- | --- |
| Solution  20 = 10 + 25 x 0.4 So at the end of the 26th week | |
| Marking key/mathematical behaviours | Marks |
| * determines equation to solve / lists terms of the sequence * determines term number | 1  1 |

**Question 8 (c)**

|  |  |
| --- | --- |
| Solution  Klind. Growth is at 0.8 km per week but in Fland it is 0.4 km per week | |
| Marking key/mathematical behaviours | Marks |
| * identifies sequence with fastest rate * explains conclusion | 1  1 |

**Question 8 (d)**

|  |  |
| --- | --- |
| Solution  4 + 0.8*n* = 9.6 + 0.4 *n* 🡪 *n* = 14  OR  10 10.4 10.8 11.2 11.6 12.0 12.4 12.8 13.2 13.6 14.0 14.4 14.8 15.2  4.8 5.6 6.4 7.2 8.0 8.8 9.6 10.4 11.2 12.0 12.8 13.6 14.4 15.2 | |
| Marking key/mathematical behaviours | Marks |
| * determines term number * justifies conclusion | 1  1 |

**Question 9 (a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * marks all routes * correct markings on 2-way routes * correct markings on one-way routes | 1  1  1 |

**Question 9 (b)**

|  |  |
| --- | --- |
| Solution  NF is a bridge – without it the netball centre is not connected | |
| Marking key/mathematical behaviours | Marks |
| * identifies bridge * explains selection | 1  1 |

**Question 9 (c)**

|  |  |
| --- | --- |
| Solution  Yes – because it can be drawn without paths crossing | |
| Marking key/mathematical behaviours | Marks |
| * correctly concludes * explains conclusions | 1  1 |

**Question 10 (a)**

|  |  |
| --- | --- |
| Solution  Positive, strong, linear | |
| Marking key/mathematical behaviours | Marks |
| * describes relationship as strong * describes relationship as approaching linear * describes relationship as positive | 1  1  1 |

**Question 10 (b)**

|  |  |
| --- | --- |
| Solution  response | |
| Marking key/mathematical behaviours | Marks |
| * identifies response variable | 1 |

**Question 10 (c)(i)(ii)**

|  |  |
| --- | --- |
| Solution  WBGT = 0.62 x AT + 6.15  *r*=0.9258 | |
| Marking key/mathematical behaviours | Marks |
| * identifies gradient and intercept * expresses relationship as linear with correct variables * identifies correlation coefficient | 1  1  1 |

**Question 10 (d)**

|  |  |
| --- | --- |
| Solution  0.62 x 25 + 6.15 = 21.7 | |
| Marking key/mathematical behaviours | Marks |
| * uses relationship to predict temperature | 1 |

**Question 10 (e)**

|  |  |
| --- | --- |
| Solution  Fairly reliable  - correlation coefficient is close to 1  - uses interpolation | |
| Marking key/mathematical behaviours | Marks |
| * concludes correctly * gives first reason for conclusion * gives second reason for conclusion | 1  1  1 |

**Question 10 (f)**

|  |  |
| --- | --- |
| Solution  (i) smaller  (ii) smaller | |
| Marking key/mathematical behaviours | Marks |
| * selects best option for change in correlation coefficient * selects best option for change in gradient | 1  1 |

**Question 11 (a)**

|  |  |
| --- | --- |
| Solution    Decreasing exponential | |
| Marking key/mathematical behaviours | Marks |
| * identifies decreasing * identifies type of decreasing | 1  1 |

**Question 11 (b)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 1980 | 1990 | 2000 | 2010 | 2020 | | Population | 1000 | 800 | 640 | 512 | 410 | | |
| Marking key/mathematical behaviours | Marks |
| * enters 3 correct values * enters a further 2 correct values | 1  1 |

**Question 11 (c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * correctly plots three values * correctly plots further two values | 1  1 |

**Question 11 (d)**

|  |  |
| --- | --- |
| Solution  *n* = 18 so 2160 | |
| Marking key/mathematical behaviours | Marks |
| * determines which term * states value of term | 1  1 |

**Question 11 (e)**

|  |  |
| --- | --- |
| Solution  (i) rhinos  (ii) rhinos  (iii) both | |
| Marking key/mathematical behaviours | Marks |
| * identifies faster rate * identifies difference in terms * identifies geometric sequences | 1  1  1 |

**Question 12 (a)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution  (i) They can all be drawn in the plane without any edges crossing  (ii)   |  |  |  |  | | --- | --- | --- | --- | | Number of vertices  (*v*) | Number of edges  (*e*) | Number of faces  (*f*) | *v* + *f* - *e* | | 5 | 4 | 1 | 2 | | 5 | 5 | 2 | 2 | | 5 | 5 | 2 | 2 | | 5 | 6 | 3 | 2 | | 5 | 7 | 4 | 2 | | 5 | 8 | 5 | 2 | | |
| Marking key/mathematical behaviours | Marks |
| * describes planarity * completes first column with given data * completes last column * determines number of edges in each graph * determines number of internal faces * includes external faces | 1  1  1  1  1  1 |

**Question 12 (b)**

|  |  |
| --- | --- |
| Solution  (i) multiple edges from W to G OR M to G  (ii) G  (iii) | |
| Marking key/mathematical behaviours | Marks |
| * identifies multiple edges between two nodes * identifies vertex with highest degree * redrawn with same number of vertices * redrawn with same number of edges * redrawn so no edges cross | 1  1  1  1  1 |

**Question 13 (a)**

|  |  |
| --- | --- |
| Solution  420 | |
| Marking key/mathematical behaviours | Marks |
| * determines total in column / row | 1 |

**Question 13 (b)**

|  |  |
| --- | --- |
| Solution  Dog ownership  gender | |
| Marking key/mathematical behaviours | Marks |
| * identifies one categorical variable * identifies second categorical variable | 1  1 |

**Question 13 (c)**

|  |  |
| --- | --- |
| Solution  35% 15% 50% | |
| Marking key/mathematical behaviours | Marks |
| * determines correct percentages * rounds to the nearest integer | 1  1 |

**Question 13 (d)**

|  |  |
| --- | --- |
| Solution  Males favoured Option 3 whereas females favoured Option 1  The least favoured options for males (or females) was Option 2 at 15% or 20% and this was lower than for other options selected by males | |
| Marking key/mathematical behaviours | Marks |
| * describes one association * provides data from the table to support description | 1  1 |

**Question 13 (e)**

|  |  |
| --- | --- |
| Solution  Comparisons can only be made when the values are comparable eg percentages  Cannot compare the numbers when the totals are different | |
| Marking key/mathematical behaviours | Marks |
| * describes ability to compare values | 1 |

**Question 14 (a)**

|  |  |
| --- | --- |
| Solution  arithmetic | |
| Marking key/mathematical behaviours | Marks |
| * identifies pattern in arithmetic sequence | 1 |

**Question 14 (b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * identifies starting value and increasing amount * determines an expression to show arithmetic sequence | 1  1 |

**Question 14 (c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * substitutes into rule * determines 10th term | 1  1 |

**Question 14 (d)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * determines recurrence relation | 1 |

**Question 14 (e)**

|  |  |
| --- | --- |
| Solution  Using table function on CAS, sequence = 98.8 when *n* = 63 and 100.2 when *n* = 64 So *n* = 64 | |
| Marking key/mathematical behaviours | Marks |
| * provides evidence of attempt to solve equation * presents *n* as an integer | 1  1 |

**Question 14 (f)**

|  |  |
| --- | --- |
| Solution  B is increasing faster than A. At *n* = 16, A is 33 and B is 32.548. This is as close as they get | |
| Marking key/mathematical behaviours | Marks |
| * identifies term number 16 * justifies by providing values or list of values | 1  1 |

**Question 15 (a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * marks given route | 1 |

**Question 15 (b)**

|  |  |
| --- | --- |
| Solution  No. Vertex C is not linked to G | |
| Marking key/mathematical behaviours | Marks |
| * determines correct conclusion * justifies conclusion | 1  1 |

**Question 15 (c)**

|  |  |
| --- | --- |
| Solution  Starts and ends at the same vertex  No repeated edges  No repeated vertices | |
| Marking key/mathematical behaviours | Marks |
| * identifies first reason * identifies second reason * identifies third reason | 1  1  1 |

**Question 15 (d)**

|  |  |
| --- | --- |
| Solution  Hamiltonian | |
| Marking key/mathematical behaviours | Marks |
| * identifies cycle is Hamiltonian | 1 |

**Question 15 (e)**

|  |  |
| --- | --- |
| Solution  10 (edges) | |
| Marking key/mathematical behaviours | Marks |
| * identifies length of cycle | 1 |

**Question 15 (f)**

|  |  |
| --- | --- |
| Solution  CPMNTWBGKSC | |
| Marking key/mathematical behaviours | Marks |
| * names another route * shows route on diagram | 1  1 |

**Question 16 (a)**

|  |  |
| --- | --- |
| Solution  No edges are repeated  Starts and finishes at different vertices | |
| Marking key/mathematical behaviours | Marks |
| * identifies feature of trail * identifies feature of being open | 1  1 |

**Question 16 (b)**

|  |  |
| --- | --- |
| Solution  QHYQGPRHBRZBGZ | |
| Marking key/mathematical behaviours | Marks |
| * starts and finishes at an odd vertex * all edges covered once only * all destinations visited | 1  1  1 |

**Question 16 (c)**

|  |  |
| --- | --- |
| Solution  Semi- eulerian  It has a open trail – every edge is included and the trail finishes at a vertex other than the starting vertex | |
| Marking key/mathematical behaviours | Marks |
| * concludes graph is semi-eulerian * identifies open * identifies trail | 1  1  1 |

**Question 16 (d)**

|  |  |
| --- | --- |
| Solution  Vertex must have an even degree | |
| Marking key/mathematical behaviours | Marks |
| * identifies conditions for an additional vertex | 1 |

**Question 17 (a)**

|  |  |
| --- | --- |
| Solution  99.27 | |
| Marking key/mathematical behaviours | Marks |
| * interprets the coefficient of determination | 1 |

**Question 17 (b)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Residuals | -11 | -10 | -5 | 8 | 12 | 21 | -1 | -14 | | |
| Marking key/mathematical behaviours | Marks |
| * uses cost – predicted cost * determines residuals | 1  1 |

**Question 17 (c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * scales horizontal axis * scales vertical axis * plots 4 correct values * plots another 4 correct values | 1  1  1  1 |

**Question 17 (d)**

|  |  |
| --- | --- |
| Solution  Residuals are randomly scattered around the x-axis | |
| Marking key/mathematical behaviours | Marks |
| * identifies condition for linear relationship | 1 |