**MATHEMATICS APPLICATIONS**

**MAWA Semester 1 (Unit 3) Examination 2020**

**Calculator-Assumed**

# Marking Key

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**The release date for this exam and marking scheme is 12th June.**

**Section Two: Calculator-assumed (104 Marks)**

**Question 7 (4 marks)**

**Question 7 (a) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| The account grew to more than $10000 in the 9th year.  The balance in the year just before was $9995.06. | |
| Marking key/mathematical behaviours | Marks |
| * indicates method used, such as stating the sequence applied * states the correct year and balance requested. | 1  1 |

**Question 7 (b) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| At the 18th anniversary, the account balance is $24174.82.  Withdrawal of $15000, leaves $9174.82 in the account.  Seven years later the balance will be $17550.96. ($18550.96 - $1000). | |
| Marking key/mathematical behaviours | Marks |
| * indicates method used, such as stating the new sequence applied * states the correct balance on the 25th anniversary. | 1  1 |

**Question 8 (10 marks)**

**Question 8 (a) (3 marks)**

|  |  |
| --- | --- |
| Solution | |
| The sequence is a GP, so    The first four terms are either 1.6,3.2,6.4,12.8 or, 1.6, -3.2, 6.4, -12.8. | |
| Marking key/mathematical behaviours | Marks |
| * determines * determines * states both sets of the first four terms (follow through if only states , that is, the correct terms of the positive sequence is awarded 2 marks total) | 1  1  1 |

**Question 8 (b) (3 marks)**

|  |  |
| --- | --- |
| Solution | |
| the first four terms are 8, 8, 6.5, 3.5 | |
| Marking key/mathematical behaviours | Marks |
| * determines * determines terms 3 and 4 correctly * states the correct first 4 terms | 1  1  1 |

**Question 8 (c) (4 marks)**

|  |  |
| --- | --- |
| Solution | |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *n* | 1 | 2 | 3 | 4 | 5 | 6 | |  | 2800 | 3000 | 3214 | 3444 | 3690 | 3953 |   .    etc. or using CAS  . | |
| 1. James walked 2800 m on day one.   More than twice = 5600 m. Hence from the CAS screen this will be on the 12th day of the program. T12=5981 m  = | |
| Marking key/mathematical behaviours | Marks |
| * completes * completes the rest of the table correctly (and rounds correctly) * states the 12th day. | 1  1+1  1 |

**Question 9 (10 marks)**

**Question 9 (a) (4 marks)**

|  |  |
| --- | --- |
| Solution | |
| 1. The explanatory variable is Area 2. Whilst the Percentage Representation by Children across Areas is similar for the Population of WA (26%,27%) there is a marked increase in the Percentage Representation by Children using aquatic centres in Regional areas (52%) compared with Metropolitan areas (28%)   (iii) Regional centres may have less facilities/opportunities for other activities resulting in Aquatic Centres being more readily used.  Many Regional Centres are located inland whereas many Metropolitan Centres  would be coastal. Those living in coastal areas may frequent the beach instead of  Aquatic Centres resulting in higher % representation in Regional centres.  Other plausible reason and explanation. | |
| Marking key/Mathematical behaviours | Marks |
| (i)   * states Area   (ii)   * states similarity in distribution of population across Areas of the state * notes marked difference between Metropolitan and Regional areas for Patronage by Children   (iii)   * states a plausible reason with explanation | 1  1  1  1 |

**Question 9 (b)** **(6 marks)**

|  |  |
| --- | --- |
| Solution | |
| (i)    (ii)   |  |  |  |  | | --- | --- | --- | --- | |  | Type 1 | Type 2 | Type 3 | | Regional | **62%** | **30%** | 8% | | Metropolitan | 42% | 33% | **25%** |   (iii) As the size of the facility increases the % costs per patron decrease. This is the  case for both Regional and Metropolitan centres | |
| Marking key/Mathematical behaviours | Marks |
| (i)   * shows correct numerator * shows correct denominator and calculates percentage   (ii)   * correctly calculates one Regional Percentage * correctly calculates three percentages   (iii)   * identifies a relevant association * explains the association in context | 1  1  1  1  1  1 |

**Question 10 (14 marks)**

**Question 10 (a)** (i) **(3 marks)**

|  |  |
| --- | --- |
| Solution | |
| A B C D E F  A 0 1 1 0 0 1  B 1 0 1 0 0 1  C 1 1 0 1 0 0  D 0 0 1 0 1 1  E 0 0 0 1 0 1  F 1 1 0 1 1 0 | |
| Marking key/mathematical behaviours | Marks |
| * uses the correct dimensions for the matrix * completes the matrix with ‘0’s and ‘1’s and has most entries correct * completes all entries correctly | 1  1  1 |

**Question 10 (a) (ii) (2 marks)**

|  |  |  |
| --- | --- | --- |
| Solution | | |
| A B C D E F  A 3 2 1 2 1 1  B 2 3 1 2 1 1  C 1 1 3 0 1 3  D 2 2 0 3 1 1  E 1 1 1 1 2 1  F 1 1 3 1 1 4 |  | |
| Marking key/mathematical behaviours | | Marks |
| * clearly sets out the new 6x6 matrix * correctly completes the matrix | | 1  1 |

**Questions 10 (a)** **(iii) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| Cells M2(3,4) and M2(4,3) both have a value equal to zero  Cells M2(3,4) and M2(4,3)=0 that it is not possible to fly to or from cities C and D via just one other city. | |
| Marking key/mathematical behaviours | Marks |
| * identifies the two cells in M2 * explains clearly that M2(3,4) and M2(4,3)=0 implies no two leg flights | 1  1 |

**Questions 10 (a) (iv)**  **(2 marks)**

|  |  |
| --- | --- |
| Solution | |
| Cells M(3,4) and M(4,3) both have a value equal to one  M(3,4) and M(4,3) = 1  there are direct flights between cities C and D | |
| Marking key/mathematical behaviours | Marks |
| * states the values of the two cells in M * explains clearly that M(3,4) and M(4,3) = 1 implies a direct flight | 1  1 |

**Question 10 (b)(i)**  **(3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| Solution | | | |
|  |  |  | |
|  | | | |
| Marking key/mathematical behaviours | | | Marks |
| * lists M, M2 and M3 as the appropriate matrices * calculates M3 correctly * calculates M+M2+ M3 = P | | | 1  1  1 |

**Question 10 (b)(ii) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| (ii) Total = 7+7+5+5+4+8 =32 | |
| Marking key/mathematical behaviours | Marks |
| * lists the elements of the leading diagonal of matrix P * calculates the sum of these elements | 1  1 |

**Question 11 (14 marks)**

**Question 11 (a) (8 marks)**

|  |  |
| --- | --- |
| Solution | |
| (i)    (ii)      (iii)  *y* intercept is 96.7087 and this represents atmospheric pressure at sea level  (iv)  hence 92.18% of the variation in Atmospheric Pressure can be explained by the variation in Altitude. | |
| Marking key/Mathematical behaviours | Marks |
| (i)   * states correct linear equation * states *y* intercept correct to 4 decimal places * states gradient correct to 4 decimal places   (ii)   * states correct value for ***A*** * states correct value for ***B***   (iii)   * states *y* intercept * relates value to sea level   (iv)   * states correct value | 1  1  1  1  1  1  1  1 |

**Question 11 (b) (6 marks)**

|  |  |
| --- | --- |
| Solution | |
| (i) ***C*** = 14.7 - 22.64 = -7.94  ***D*** = 5.6 – (-10.28) = 15.88  (ii)  (iii)  A linear model is not appropriate as there is a pattern in the residuals. | |
| Marking key/Mathematical behaviours | Marks |
| (i)   * correctly determines ***C*** * correctly determines ***D***   (ii)  See graph above   * correctly graphs 2 points * correctly graphs 4 points   (iii)   * states a linear model is not appropriate * states valid reason | 1  1  1  1  1  1 |

**Question 12 (12 marks)**

**Question 12(a) (1 mark)**

|  |  |
| --- | --- |
| Solution | |
| Generally as the humidity increases the Maximum temperature decreases. There is a  negative relationship. | |
| Marking key/Mathematical behaviours | Marks |
| * describes the relationship or states that it is negative | 1 |

**Question12 (b) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| rainfall  temperature  9am relative humidity | |
| Marking key/Mathematical behaviours | Marks |
| * correctly labels exactly 1 graph * correctly labels 3 graphs | 1  1 |

**Question 12 (c) (9 marks)**

|  |  |
| --- | --- |
| Solution | |
| (i)  Yes. From the table and the scatter plot it is likely to be a good predictor of the maximum temperature as there is a strong correlation between the two.  (ii)    This is an unreliable prediction as it involves extrapolation  (iii)    There is a strong positive relationship between 3pm temperature and Maximum temperature.  (iv)  Since the equation is every 1 degree increase in 3pm  temperature results in a  increase in the Maximum temperature. Hence the  expected difference will be | |
| Marking key/Mathematical behaviours | Marks |
| (i)   * states yes * gives an explaination using the data   (ii)   * substitutes and states answer to 1 decimal place * states unreliable * states extrapolation   (iii)   * states correlation coefficient to at least 4 decimal places * identifies strong and positive relationship   (iv)   * uses * states correct answer to 1 decimal place | 1  1  1  1  1  1  1  1  1 |

**Question 13 (6 marks)**

**Question 13 (a)**  **(2 marks)**

|  |  |
| --- | --- |
| Solution | |
| GHEDCBJAFG OR GFAJBCDEHG | |
| Marking key/mathematical behaviours | Marks |
| * identifies a correct cycle * lists the vertices in the correct order | 1  1 |

**Question 13 (b) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| EG, AG, JG, CE, AB, JE and JC | |
| Marking key/mathematical behaviours | Marks |
| * gives a list of appropriate edges mostly correct * identifies all edges correctly | 1  1 |

**Question 13 (c) (2 marks)**

|  |  |
| --- | --- |
| CBJAFGHEDC OR CDEHGFAJBC | |
| Marking key/mathematical behaviours | Marks |
| * identifies a correct cycle * lists the vertices in the correct order | 1  1 |

**Question 14 (7 marks)**

**Question 14 (a) (1 mark)**

|  |  |
| --- | --- |
| Solution | |
|  | |
| Marking key/mathematical behaviours | Marks |
| * determines the first 3 terms | 1 |

**Question 14 (b) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
|  | |
| Marking key/mathematical behaviours | Marks |
| * states the correct recursive rule * specifies | 1  1 |

**Question 14 (c) (4 marks)**

|  |  |
| --- | --- |
| Solution | |
| Total Area = sum of the Areas of each sheet    The sequence is a GP with  We want the smallest such that the sum is just over 1.99 – so from CAS , by solving  we get  Alternatively, set up the problem in the sequence in app defining the sequence and the sum as shown below to arrive at . | |
| Marking key/mathematical behaviours | Marks |
| * indicates that the sequence is a GP and states the parameters * indicates that the sum of the sequence needs to >1.99 * states the correct * indicates then paper size as A7 (ie. term 8 of the sequence) | 1  1  1  1 |

**Question 15 (8 marks)**

**Question 15 (a)**

|  |  |
| --- | --- |
| Solution | |
| 2. Melbourne Victory | |
| Marking key/mathematical behaviours | Marks |
| * sets up the two scales appropriately * connects the bipartite elements clearly * connects all the bipartite elements correctly * states the correct club from the table | 2  1  1  1 |

**Question 15 (b) (3 marks)**

|  |  |  |
| --- | --- | --- |
| Solution | | |
|  | Alternate method:  11 teams each must play 10 other teams, at home which implies 110 matches altogether. | |
| Marking key/mathematical behaviours | | Marks |
| * uses appropriate logic * clearly states the reasoning * calculates the correct number | | 1  1  1 |

**Question 16 (8 marks)**

**Question 16 (a) (4 marks)**

|  |  |
| --- | --- |
| AGHIK = 104 minutes | |
| Marking key/mathematical behaviours | Marks |
| * Completes the algorithm by filling in values at the nodes * Calculates at least 5 nodes correctly * Calculates all 9 nodes correctly * States the correct path | 1  1  1  1 |

**Question 16 (b)(i)** **(2 marks)**

|  |  |
| --- | --- |
| Solution | |
| The modified path is shown below. | |
| Marking key/mathematical behaviours | Marks |
| * recalculates the times from F to G * calculates these 6 nodes correctly | 1  1 |

**Question 16 (b)(ii)** **(2 marks)**

|  |  |
| --- | --- |
| Solution | |
| Modified path = AFHIK Time = 127 minutes | |
| Marking key/mathematical behaviours | Marks |
| * States the new path accurately * States the new time accurately | 1  1 |

**Question 17 (11 marks)**

**Question 17 (a) (1 mark)**

|  |  |
| --- | --- |
| Depreciation amount will be 2.5% of $160000 = $4000 pa. | |
| Marking key/mathematical behaviours | Marks |
| * calculates the correct depreciation | 1 |

**Question 17 (b) (4 marks)**

|  |  |
| --- | --- |
| Solution | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Items | Original Value | Depreciation rate pa | Depreciation in 1st year | Depreciation in 2nd year | | Carpets and floor coverings | $9500 | 10% | $950 | $855 | | Hot water system | $2000 | 12% | $240 | $211.20 | | Light fittings and window treatments | $7500 | 15% | $1125 | $956.25 | | Airconditioning system | $6500 | 20% | $1300 | $1040 |   Carpets:  Light Fittings:    Air conditioners:  Alternatively, use a spreadsheet  eg. For Light fittings and window treatments below. | |
| Marking key/mathematical behaviours | Marks |
| * indicating how to calculate depreciation for first year * calculating both first year depreciations correctly * indicating how to calculate depreciation for second year * calculating both second year depreciations correctly | 1  1  1  1 |

**Question 17 (c) (2 marks)**

|  |  |
| --- | --- |
| Solution | |
| The depreciation allowed in the tenth year is $260.60.  Use a spreadsheet on CAS as shown below | |
| Marking key/mathematical behaviours | Marks |
| * shows evidence of applying the diminishing value method correctly * determines the correct answer | 1  1 |