**MATHEMATICS METHODS**

**MAWA Semester 1 (Unit1) Examination 2015**

**Calculator-Assumed**

# Marking Key

**Section Two: Calculator-assumed (90 Marks)**

**Question 8(a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * calculates gradient * uses a point to calculate c and states equation | 1  1 |

**Question 8(b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * calculates gradient * uses the given point to calculate c and states equation | 1  1 |

**Question 8(c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * calculates gradient * determines perpendicular gradient * uses the given point to calculate c and states equation | 1  1  1 |

**Question 8(d)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * determines gradient of original line * determines gradient of reflected line and states equation | 1  1 |

**Question 9(a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * reads correctly from the graph * uses the graph to read each of the individual probabilities * provides the correct result for * states correct result for * correctly states | 1  1  1  1  1 |

**Question 9(b)**

|  |  |
| --- | --- |
| Solution  The events are mutually exclusive, since =0 | |
| Marking key/mathematical behaviours | Marks |
| * states events are M.E. * provides a valid reason | 1  1 |

**Question 9(c)**

|  |  |
| --- | --- |
| Solution  Since we know (given) that the selected person takes at least 5 attempts (=0), this reduces the probability sample space to 0.59  Hence the probability that a selected person takes 5 attempts = | |
| Marking key/mathematical behaviours | Marks |
| * uses the idea of a reduced sample space * states the correct response | 1  1 |

**Question 10(a)**

|  |  |
| --- | --- |
| Solution    Using the sine rule: | |
| Marking key/mathematical behaviours | Marks |
| * calculates angle ACB * uses the sine rule to calculate the length of BC | 1  1 |

**Question 10(b)**

|  |  |
| --- | --- |
| Solution    Using the area rule: | |
| Marking key/mathematical behaviours | Marks |
| * calculates angle ABC * uses the area formula to calculate the required area | 1  1 |

**Question 10(c)**

|  |  |
| --- | --- |
| Solution    Let the mid-point of BC be D. BD = 32.57 cm  Using the cosine rule: | |
| Marking key/mathematical behaviours | Marks |
| * calculates the length of BD * uses the cosine rule to calculate the length of AD | 1  1 |

**Question 11 (a)**

|  |  |
| --- | --- |
| Solution  i.e.  =4457400 | |
| Marking key/mathematical behaviours | Marks |
| * Uses appropriate notation to express the number of combinations * State the correct answer | 1  1 |

**Question 11 (b)**

|  |  |
| --- | --- |
| Solution   1. If we know that the two best players are not selected, then all the possible teams are selected from 23 members. i.e.   So the number of possible teams is  i.e.  =135078  (ii)  Probability = | |
| Marking key/mathematical behaviours | Marks |
| * indicates that members for selection is reduced to 23 * calculates the restricted number of possible team combinations * determines the correct probability | 1  1  1 |

**Question 12(a)**

|  |  |
| --- | --- |
| Solution  By substitution of  into  we get . That is, the weight is at the rest (or 0 position). | |
| Marking key/mathematical behaviours | Marks |
| * Determines that the weight is at the rest position | 1 |

**Question 12(b)**

|  |  |
| --- | --- |
| Solution  The period of the weights oscillation is 2 seconds. Hence it goes through the rest position twice every 2 seconds. That is once every second. Because it starts at the rest position and finishes at the rest position, we need to add one. Hence the answer is 6 times.  Alternatively, we note that  for every whole number value of  .  i.e. when . So 6 times. | |
| Marking key/mathematical behaviours | Marks |
| * Provides a reasonable explanation as to how arrived at the number of times the weight is at the rest position * Determines the correct number of times (i.e. 6 times) | 1  1 |

**Question 12(c)**

|  |  |
| --- | --- |
| Solution  Negative values of  represent the distance that the weight is below the rest position.  The negative represents ‘below the rest position’ the magnitude of the number represents the distance. | |
| Marking key/mathematical behaviours | Marks |
| * Indicates that the negative represents the distance ‘below’ | 1 |

**Question 12(d)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * graph is sinusoidal with correct amplitude and number of cycles * graph passes through the  axis at each of the whole number of seconds in the domain * graph has smooth TP’s and is acceptably accurate | 1  1  1 |

**Question 12(e)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * Indicates (by use of colour or otherwise), the points of the curve where the magnitude of  is greater than 2 * Excludes when . | 1  1 |

**Question 12(f)**

|  |  |
| --- | --- |
| Solution  From the graph, the values of  for which  is approximately  for the first second of motion. This is approx. 75% of the time. This is repeated during every second of the motion. Hence the fraction requested is approximately .  For a more accurate answer, use a CAS calculator as follows:    This indicates that the weight is further than 2 cm from the rest position for approximately 73.8% of the time. | |
| Marking key/mathematical behaviours | Marks |
| * Attempts to estimate the correct fraction of any of the cycles from the graph * Provides an reasonably accurate estimate (70-80%) * Use a calculator to refine the result to 73.8% | 1  1  1 |

**Question 13(a)**

|  |  |
| --- | --- |
| Solution      Hence domain of  = ={0,1,2, …,10}   1. Range of ={0,1,2,3,4} | |
| Marking key/mathematical behaviours | Marks |
| (i)   * states the correct domain of   (ii)   * provides a full listing of the elements of * states the correct range of | 1  1  1 |

**Question 13(b)**

|  |  |
| --- | --- |
| Solution      Hence domain of ={0,1,2,3,4}   1. Range of  = ={0,1,2, …,10} | |
| Marking key/mathematical behaviours | Marks |
| (i)   * provides a listing of the elements of * states the correct domain of   (ii)   * states the correct range of | 1  1  1 |

**Question 13(c)**

|  |  |
| --- | --- |
| Solution  is a function, is not as it does not satisfy the vertical line test when graphed (or it has multiple  vales for some  values i.e. ((2,3) and (2,4) etc. | |
| Marking key/mathematical behaviours | Marks |
| * indicates that is a function and that  is not * states a valid reason | 1  1 |

**Question 14(a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * uses the correct centre * uses the correct radius | 1  1 |

**Question 14(b)**

|  |  |
| --- | --- |
| Solution    Solving simultaneously we get that  Hence the equation is | |
| Marking key/mathematical behaviours | Marks |
| * uses known points off graph * determines axis of symmetry * substitutes two points into a general, appropriate equation of a parabola * solves for * states the equation in the required form | 1  1  1  1  1 |

**Question 14(c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * determines the discriminant ( of the parabola function equated to 0) * interprets | 1  1 |

**Question 15 (a)**

|  |  |
| --- | --- |
| Solution  substitute  into upper curve and get    therefore coordinates are (9, 9) | |
| Marking key/mathematical behaviours | Marks |
| * substitutes x = 9 into upper curve * states coordinates | 1  1 |

**Question 15 (b)**

|  |  |
| --- | --- |
| Solution  using the coordinate (9, 9) | |
| Marking key/mathematical behaviours | Marks |
| * substitutes x = 9 into lower curve to obtain value of a * states equation of lower curve | 1  1 |

**Question 15 (c)**

|  |  |
| --- | --- |
| Solution  new upper curve:  new lower curve: | |
| Marking key/mathematical behaviours | Marks |
| * states equation of new upper curve * states equation of new lower curve | 1  1 |

**Question 16 (a)**

|  |  |
| --- | --- |
| Solution  (i)    From graph P(x) = 0 only has one real solution | |
| Marking key/mathematical behaviours | Mark |
| * identifies one solution | 1 |

|  |  |
| --- | --- |
| (ii)    From graph P(x) = k has exactly two solutions when k = 6 or 2 | |
| Marking key/mathematical behaviours | Mark |
| * identifies local max and min points * identifies P(x) = k has exactly two solutions when k = 6 or 2 | 1  1 |

**Question 16(b)**

|  |  |
| --- | --- |
| Solution  dividing by 2  Hence | |
| Marking key/mathematical behaviours | Marks |
| * divides by 2 * expands brackets * collects like terms * equates coefficients to solve for a, b, c and d * factorises expression | 1  1  1  1  1 |

**Question 17(a)**

|  |  |
| --- | --- |
| Solution    Firstly we determine the proportional areas for each colour (gives the probability sample space). Hence the Probability that the coin lands on Blue is | |
| Marking key/mathematical behaviours | Marks |
| * represents sample space * determines the correct probability | 1  1 |

**Question 17(b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * identifies that needs to add the proportional areas * adds the appropriate proportional areas correctly | 1  1 |

**Question 17(c)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * identifies that two events need to occur simultaneously * multiplies the appropriate probabilities to get the correct result | 1  1 |

**Question 17(d)**

|  |  |
| --- | --- |
| Solution  The events are independent i.e. probability of a tail is not affected by the colour it lands on  Hence, answer is | |
| Marking key/mathematical behaviours | Marks |
| * identifies that events are independent * states the correct result | 1  1 |

**Question 17(e)**

|  |  |
| --- | --- |
| Solution  Here, it is best to draw a tree diagram to represent what happens    What we want is the probability of:  Blue and Blue or Red and Red or Green and Green or Orange and Orange or Pink and Pink  = | |
| Marking key/mathematical behaviours | Marks |
| * applies the multiplication principle for simultaneously occurring independent events * adds the mutually exclusive events * identifies all the possibilities (by listing or other sample space representation) * calculates correctly to give the correct result | 1  1  1  1 |

**Question 18(a)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * Substituting  into given identity * Indicating  and simplifying | 1  1 |

**Question 18(b)**

|  |  |
| --- | --- |
| Solution        Hence the length of the rope  cm  Alternatively, using the geometry app on a CAS    Length of rope = 38.11417+2(28.28427) = 94.68 cm (which is within 1 mm of the above answer, due to rounding) | |
| Marking key/mathematical behaviours | Marks |
| * Indicates length of AB and shows appropriate central angle on the diagram * Calculates length of tangents * Calculates size of central angle * Calculates appropriate arc length * Determines correct length of rope (including units)   Or, calculates the length of belt using CAS   * Indicates length of the tangents (implies knowledge of length of AB) * Indicates length of major arc () * Provides the correct length of the rope (including units) | 1  1  1  1  1  or  2  2  1 |

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