**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 * provides the correct result for * states correct result for * correctly states | 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)**

** one mark ( no need to simplify)**

**Question 11 (b)**

** one mark for denominator, one mark for numerator**

**Question 11 c**

** one mark for denominator, one mark for numerator**

**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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