**MATHEMATICS METHODS**

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

**Calculator-free**

# Marking Key

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The release date for this exam and marking scheme is

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

**Section One: Calculator-free (50 Marks)**

**Question 1 (a) (2 marks)**

|  |
| --- |
| Solution |
|   . |
| Mathematical behaviours | Marks |
| * applies product rule
* differentiates  term
 | 11 |

**Question 1 (b) (2 marks)**

|  |
| --- |
| Solution |
|   |
| Mathematical behaviours | Marks |
| * applies the chain rule
* differentiates *sin x* term
 | 11 |

**Question 1 (c) (3 marks)**

|  |
| --- |
| Solution |
|     |
| Mathematical behaviours | Marks |
| * applies chain rule to obtain
* applies quotient rule
* correct answer
 | 111 |

|  |
| --- |
| Solution |
|   |
| Mathematical behaviours | Marks |
| * states a correct expression using integrals to determine the area
* anti-differentiates integral correctly
* subs in limits of integration correctly
* determines correct result
 | 1111 |

**Question 2 (4 marks)**

**Question 3 (3 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * anti-differentiates square root term
* uses anti-derivative and  to determine
* states
 | 111 |

**Question 4 (a) (1 mark)**

|  |
| --- |
| Solution |
|  $X$ has a discrete uniform distribution |
| Mathematical behaviours | Marks |
| * states that the distribution is uniform
 | 1 |

**Question 4 (b) (1 mark)**

|  |
| --- |
| Solution |
| There are $550-250+1=301$ whole numbers in the interval $250\leq X\leq 550.$So $P\left(250\leq X\leq 550\right)=0.301$ |
| Mathematical behaviours | Marks |
| * correct answer
 | 1 |

**Question 4 (c) (2 marks)**

|  |
| --- |
| Solution |
| There are $\frac{1000}{7}=142\frac{6}{7},$ and so there are $142$ whole numbers in the interval $1\leq X\leq 1000$ that are divisible by $7.$So $P(X is divisible by 7) = 0.142$.  |
| Mathematical behaviours | Marks |
| * obtains 142 whole numbers divisible by 7
* divides by 1000
 | 11 |

**Question 4 (d) (4 marks)**

|  |
| --- |
| Solution |
| In the interval $1\leq X\leq 1000 $there are: $100$ whole numbers that are divisible by $10, $ $40$ whole numbers that are divisible by $25, $ and $20$ whole numbers that are divisible by both $10 and 25, $(i.e. divisible by $50)$So there are $100+40-20=120$ whole numbers that are divisible by $10 or 25$ .and so $P(X is divisible by 10 or 25) = 0.12$.  |
| Mathematical behaviours | Marks |
| * correct numbers for divisibility by 10 and by 25
* uses $\#(A∪B)=\#\left(A\right)+\#\left(B\right)-\#(A∩B)$
* divides by 1000
 | 1+111 |

**Question 4 (e) (2 marks)**

|  |
| --- |
| Solution |
| The following numbers have exactly two 3’s in their decimal expansion:$33, 133, 233,433, …,933$, $303,313,323,343, …,393$, and $330,331,332,334, …339$So $P(X has exactly two 3's in its decimal expansion)=\frac{27}{1000}=0.027$.  |
| Mathematical behaviours | Marks |
| * obtains 27 whole numbers with the desired property
* divides by 1000
 | 11 |

**Question 5 (3 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * correctly identifies stationary points
* correctly identifies point of inflection
* accurate sketch of the curve including *x* axis intercepts
 | 111 |

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * splits the fraction into two parts and anti-differentiates
* states anti-derivative including +*c*
 | 11 |

**Question 6 (a) (2 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * anti-differentiates sin or cos part of expression correctly
* states correct solution
 | 11 |

**Question 6 (b) (2 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * expands brackets correctly
* anti-differentiates each part correctly
 | 11 |

**Question 6 (c) (2 marks)**

|  |
| --- |
| Solution |
|    |
| Mathematical behaviours | Marks |
| * correctly differentiates $\sec(x)$
* applies chain rule
* correct answer
 | 111 |

**Question 7 (a) (3 marks)**

**Question 7 (b) (4 marks)**

|  |
| --- |
| Solution |
| , when  |
| Mathematical behaviours | Marks |
| * correct substitution and subtraction of fractions
* both exact values correct
* correct simplified answer
 | 1+111 |

**Question 8 (a) (i) (1 mark)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * determines expression
 | 1 |

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

|  |
| --- |
| Solution |
|   |
| Mathematical behaviours | Marks |
| * uses linearity to deduce
* uses relationship
* sums expressions and simplifies
 | 111 |

**Question 8 (b) (2 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * applies the Fundamental Theorem
* evaluates result
 | 11 |

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * states *m* = 0 or *m* = 3
* states all correct values for *m*
 | 11 |

**Question 8 (c) (i) (2 marks)**

**Question 8 (c) (ii) (2 marks)**

|  |
| --- |
| Solution |
|  |
| Mathematical behaviours | Marks |
| * uses linearity to split
* evaluates sum of integrals
 | 11 |