MATHEMATICS APPLICATIONS

MAWA Semester 1 (Unit 3) Examination 2020

Calculator-free

Marking Key

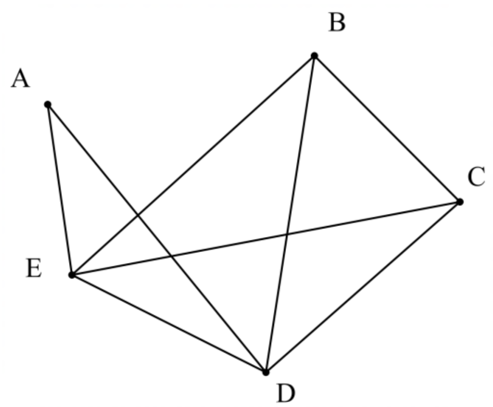
The release date for this exam and marking scheme is

- **12th June, the end of week 7 of term 2, 2020**

Section One: Calculator-free (50 Marks)

Question 1 (5 marks)

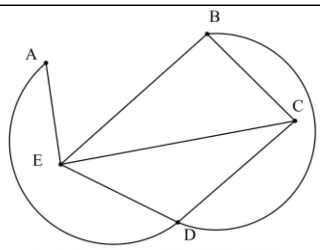
Question1 (a) (3 marks)

Solution	
	
Marking key/mathematical behaviours	Marks
• draws a connected graph • graph contains the correct number of vertices • graph contains the correct number of edges	1 1 1

Question 1 (b) (2 marks)

Solution	
Graph has exactly 2 odd vertices $\Rightarrow$ Semi-Eulerian $\Rightarrow$ Traversable	
Marking key/mathematical behaviours	Marks
• identifies the correct rule for a Semi-Eulerian trail • states that a Semi-Eulerian trail is traversable	1 1

Question 1 (b) Alternative solution

Alternate solution	
$v+f \ = \ e+2 \Rightarrow$ $5+5 \quad = 8+2$	

Marking key/mathematical behaviours	Marks
• uses a planar graph to count the faces, edges and vertices • shows Euler's rule concerning traversibility holds for this graph	1 1

Question 2 **(14 marks)**

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

Solution	
$T_{n+1} = T_n + 3, \quad T_1 = 5$	
Marking key/mathematical behaviours	Marks
• states term $n+1$ recursively, correctly • states term 1.	1 1

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

Solution

Ring number	Guests that arrive	Total guests
1	5	5
2	3	8
3	3	11
4	3	14
5	3	17
…	….	…
10	3	32

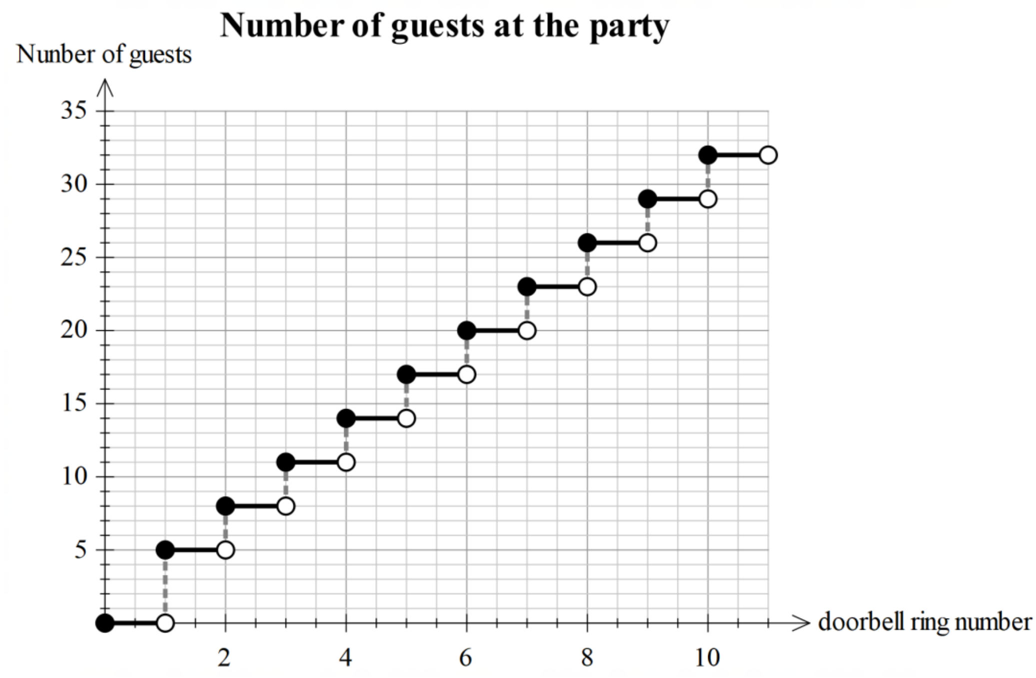
Marking key/mathematical behaviours	Marks
• completes the table correctly for ring numbers 1-5 • completes correctly for ring number 10	1 1

Question 2 (c) **(1 mark)**

Solution	
$T_n = 5 + 3(n-1) = 3n + 2$	
Marking key/mathematical behaviours	Marks
• states the n^{th} term correctly	1

Question 2 (d) **(3 marks)**

Solution



Marking key/mathematical behaviours	Marks
• labels the vertical axis correctly	1
• draws the correct step graph	2
• draws a 'dot' graph that follows the correct rule (allow 1 mark only) or	
• draws a line graph with the correct gradient (allow 1 mark only)	

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

Solution
It is a step graph, as the number of guests is always a whole number that 'jumps' at each ring of the doorbell. The 'jumps' are always the same (ie. the common difference of the sequence). In between the doorbell rings, the graph is flat, as the number of guests remains constant. After the first doorbell ring, the left-hand end of each 'step' follows the rule $N = 2 + 3n \ (n = 1, 2, 3, ...10)$

Marking key/mathematical behaviours	Marks
• identifies the graph (any appropriate description acceptable)	1
• indicates that the gradient of the 'dots' is connected to the constant difference of the sequence	1

Question 2 (f) **(2 marks)**

Solution	
Arithmetic sequence It is a step graph, as the number of guests is always a whole number that 'jumps' at each ring of the doorbell. The size of the 'jumps' reflect the common difference of the sequence. In between the doorbell rings, the graph is flat, as the number of guests remains constant. After the first doorbell ring, the left-hand end of each 'step' change with a gradient of 3 (equal to the common difference of the sequence) and follow the rule $N = 2 + 3n \ (n = 1, 2, 3, \ldots 10)$	
Marking key/mathematical behaviours	Marks
• states that the sequence is 'arithmetic' • links the size of the jumps and the gradient of the 'dots' to the constant difference of the sequence	1 1

Question 2 (g) **(2 marks)**

Solution	
Since there were at least 120 guests at the party, then $T_n = 2 + 3n \geq 120$ $\therefore 3n \geq 118$ $\Rightarrow n \geq 39.\dot{3}$ $\Rightarrow$ the door bell must have rung at least 40 times.	
Marking key/mathematical behaviours	Marks
• identifies a correct equation of inequation to solve • solves it correctly and draws the appropriate conclusion	1 1

Question 3 **(10 marks)**

Question 3 (a) **(1 mark)**

Solution

	School A	School B
Not satisfied	50	200
Fairly satisfied	**50**	250
Very satisfied	250	550

Mathematical behaviours	Marks
• correctly completes the table	1

Question 3 (b) **(2 marks)**

Solution	
The survey only reaches those who do access their school email. Every child's parent was sent the email so parents are able to respond multiple times if they have more than 1 child in the school. Some people may not respond to the email. Other valid reasons.	
Mathematical behaviours	**Marks**
• explains one issue • explains two issues	1 1

Question 3 (c) **(2 marks)**

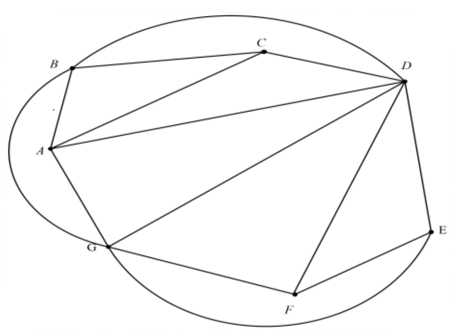
Solution	
$\frac{200}{250} = 80\%$	
Mathematical behaviours	**Marks**
• states correct fraction • states correct percentage	1 1

Question 3 (d) **(5 marks)**

Solution	
(i) Yes. For the high school the percentage of Very Satisfied parents is $\frac{550}{1000} = 55\%$. This means the primary school's Very Satisfied parents (71%) is a larger percentage (ii) The principal's claim is not true. Whilst there does seem to be a relationship between the type of school and the percentage of Very Satisfied parents, we cannot conclude that the school type causes the level of satisfaction.	
Mathematical behaviours	**Marks**
(i) • states yes • calculates the percentage correctly • compares the percentage of the primary school with the high school (ii) • states the claim is not true • correctly justifies the decision	 1 1 1 1 1

Question 3 **(5 marks)**

Question 4 (a) **(3 marks)**

solution	
	
Marking key/mathematical behaviours	Marks
• redraws the 3 edges on the exterior of the 7-sided figure	3

Question 4 (b) **(2 marks)**

Solution	
$v+f=e+2 \Rightarrow 7+9=14+2$	
Marking key/mathematical behaviours	Marks
• states Euler's formula	1
• shows the formula is true for this graph	1

Question 5 **(8 marks)**

Question 5 (a) **(1 mark)**

Solution

Vertex	A	B	C	D	E	F	G
Degree	4	4	3	6	3	3	5

Marking key/mathematical behaviours	Marks
• completes all the table correctly	1

Question 5 (b) **(3 marks)**

Solution	
0 ODD vertices $\Leftrightarrow$ Eulerian trail 2 ODD vertices $\Leftrightarrow$ Semi-Eulerian trail 3 ODD vertices $\Rightarrow$ the network is neither Eulerian nor Semi-Eulerian	
Marking key/mathematical behaviours	Marks
• states the network has 3 odd vertices • states the condition for a Eulerian trail • states the condition for a Semi- Eulerian trail	1 1 1

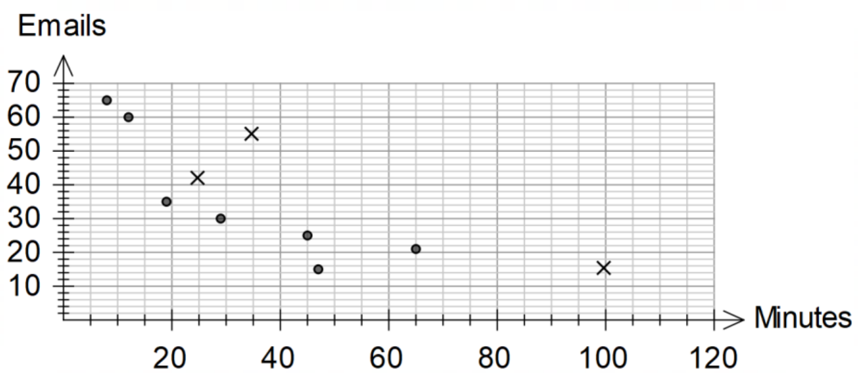
Question 5 (c) **(4 marks)**

Solution	
From the table we consider the odd vertices and to make them even we remove an appropriate edge. Also, by removing an edge that starts and finishes at an odd vertex we can change the number of odd vertices in the graph from 4 to 2 which gives a Semi-Eulerian network. The edges are EF, EG, or FG	
Marking key/mathematical behaviours	Marks
• states the network is Semi-Eulerian • correctly lists the 3 edges	1 3

Question 6 **(8 marks)**

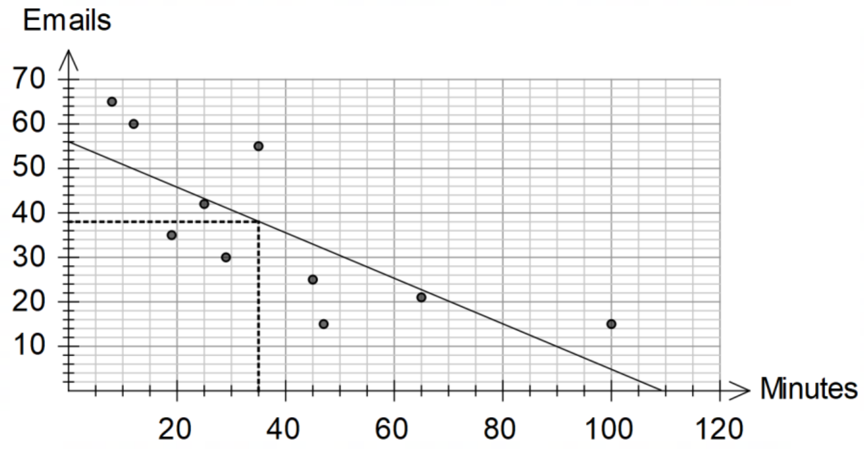
Question 6 (a) **(2 marks)**

Solution



Mathematical behaviours	Marks
• correctly graphs one point • correctly graphs 3 points	1 1

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

Solution	
	
Mathematical behaviours	**Marks**
• correctly graphs y intercept • graphs x axis intercept between 100 and 120	1 1

Question 6 (c) **(3 marks)**

Solution	
(i) See dotted line in graph above. Approximately 38 emails. (ii) This result is reliable as there is a strong correlation and the prediction involves interpolation	
Mathematical behaviours	**Marks**
(i) • correctly states value from graph (ii) • states reliable noting the strong correlation • notes interpolation	 1 1 1

Question 6 (d) **(1 mark)**

Solution	
The line would become steeper.	
Mathematical behaviours	**Marks**
• states the effect on the slope correctly	1