MATHEMATICS APPLICATIONS

MAWA Semester 1 (Unit 3) Examination 2019

Calculator-free

Marking Key

The release date for this exam and marking scheme is 14th June.

Section One: Calculator-free (50 Marks)

Question 1 (a) (1 marks)

Solution	
Sum of the degrees of the vertices $=12$	
Marking key/mathematical behaviours	Marks
• calculates correct sum value	1

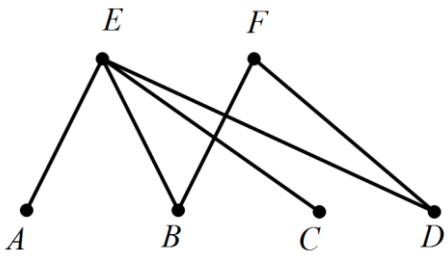
Question 1 (b) (1 marks)

Solution	
Edge EC and EA	
Marking key/mathematical behaviours	Marks
• correctly identifies BOTH edges that form a bridge	1

Question 1 (c) (2 marks)

Solution	
$C-E-B-F-D-E$ or vice versa $A-E-B-F-D-E$	
Marking key/mathematical behaviours	Marks
• identifies a walk with 5 edges • given walk contains a cycle	1 1

Question 1 (d) (3 marks)

Solution	
	
Marking key/mathematical behaviours	Marks
• correctly identifies TWO groups as $ABCD$ and EF • correctly draws at least 4 edges • correctly draws all edges	1 1 1

Question 2 (a) **(1 mark)**

Solution	
Rate how well you like Company ABC's new website using the categories VWL: very well liked, WL: well liked, S: satisfactory, UL: un-liked, VUL: very un-liked	
Marking key/mathematical behaviours	Marks
• asks respondents to rate the website and provides an appropriate scale	1

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

Solution	
$A = 7$ $B = \frac{124}{400} \times 100 = 31\%$ $C = 100\%$	
Marking key/mathematical behaviours	Marks
• one mark for each correct answer provided	1+1+1

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

Solution	
(i) Samples Y produced a proportionally consistent rating of satisfactory, both of around 30%, while the two X samples produced proportionally more varied ratings of satisfactory. (ii) Samples Y both produced combined ratings of VWL, WL and S that were higher than the combined rating of the same 3 categories for the two X samples.	
Marking key/mathematical behaviours	Marks
• identifies that the Y samples both produce roughly the same proportion of rating S, while the X samples are more varied. • identifies the 'combined ratings' as the sum of the three • states that the Y samples produce the higher ratings	1 1 1

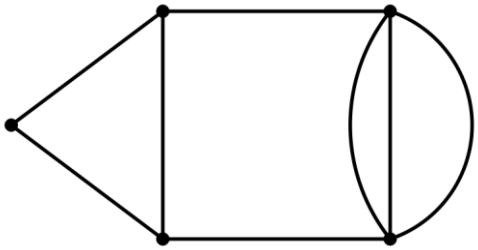
Question 2 (d) **(2 marks)**

Solution	
Yes Because both of the Y samples produce roughly the same proportion of responses for each category, where as the sample X responses are not proportionally consistent.	
Marking key/mathematical behaviours	Marks
• states, Yes • refers to proportional consistency (or equivalent idea, however expressed)	1 1

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

Solution	
(i) Graphs 1 and 3 (ii) Graph 3 (iii) Graph 2 is a digraph. Digraphs can be identified by the lack of symmetry across the leading diagonal.	
Marking key/mathematical behaviours	Marks
• identifies BOTH graphs containing loop	1
• identifies graph 3 having the isolated vertex	1
• identifies Graph 2 as a digraph	1
• refers to no symmetry AND leading diagonal	1

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

Solution	
(i)  (ii) This network is traversable as it has exactly two odd vertices.	
Marking key/mathematical behaviours	Marks
• draws network with 5 vertices	1
• correctly draws at least 3 vertices with correct order value	1
• correctly draws all vertices with correct order value	1
• states network is traversable	1
• refers to EXACTLY two odd vertices in justification	1

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

Solution	
$1=\dfrac{38-5n}{3}$ $3=38-5n$ $5n=35$ $n=7$ is an integer $\therefore$ 1 is a term of the sequence and it is the seventh term	
Marking key/mathematical behaviours	Marks
• substitutes 1 into the formula • rearranges and solves the equation for *n* • states $T_7=1$	1 1 1

Question 4 (b) **(3 marks)**

Solution	
$a+3d=11$ ----- (1) $a+15d=35$----- (2) $(2)-(1)$ results in $12d=24$ $\therefore d=2$ and $a=5$ Hence, $T_n=5+2(n-1)$ $T_n=2n+3$	
Marking key/mathematical behaviours	Marks
• uses T_4 and T_{16} to form two equations • solves the two simultaneous equations correctly for “a” and “d” values • states the nth term correctly	1 1 1

Question 5 (a) **(3 marks)**

Solution	
The relationship is a strong linear and positive one. The trend line provided appears to be a 'good fit' and the coefficient of determination of 0.6567 implies a correlation coefficient of ~ 0.8 which is quite strong.	
Marking key/mathematical behaviours	Marks
• uses at least two of the words the words, linear, strong and positive • refers to the coefficient of determination (R^2) • states and refers to the correlation coefficient of ~ 0.8	1 1 1

Question 5 (b) **(2 marks)**

Solution	
2013-14 Suburb A recorded 1819 crimes while Suburb B recorded 8616. Suburb B had a significantly higher number of crimes than would have been expected based on the more highly correlated relationship of the other years.	
Marking key/mathematical behaviours	Marks
• identifies the correct year • provides a plausible interpretation	1 1

Question 5 (c) **(2 marks)**

Solution	
The best estimate is 0.8 Since $r = \sqrt{R^2} = \sqrt{0.6567} \simeq 0.8$	
Marking key/mathematical behaviours	Marks
• selects the correct estimate • uses the coefficient of determination correctly to justify the selection	1 1

Question 5 (d) **(2 marks)**

Solution	
The number of crimes in suburb B $(y) = 1.7086 \times 3010 + 3555 \simeq 8698$ (~ 8700)	
Marking key/mathematical behaviours	Marks
• applies the provided linear prediction formula correctly • calculates the correct result, rounding appropriately • if uses the graph to give a rough estimate – allow 1 mark only (for a reasonable predicted figure)	1 1

Question 5 (e) **(2 marks)**

Solution	
Low reliability, because while it is interpolation in terms of the range of crime figures known, it is a prediction into the future and other unknown and possibly confounding factors could have played a part in influencing the crime numbers in Suburb B.	
Marking key/mathematical behaviours	Marks
• states that the prediction is questionable or has low reliability	1
• provides a plausible explanation, consistent with answer about the reliability	1

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

Solution
Substitute $V_3 = 24200$ into $V_n = a \times r^{n-1}$ resulting in $V_3 = 20000 \times r^{3-1}$ i.e. $24200 = 20000r^2$ $r^2 = \frac{24200}{20000}$ $r^2 = \frac{121}{100}$ $r = \frac{11}{10}$ $r = 1.1$

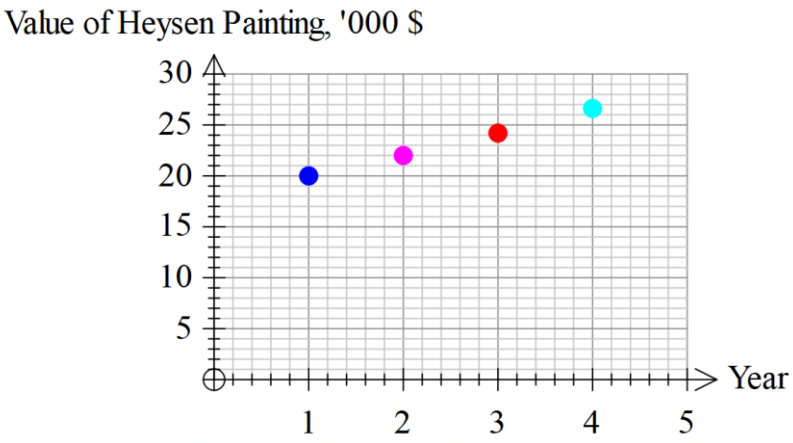
Marking key/mathematical behaviours	Marks
• substitutes $V_3 = 24200$ into $V_n = 20000 \times r^{n-1}$	1
• solves for correct "r" value of 1.1	1

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

Solution
Increasing exponentially

Marking key/mathematical behaviours	Marks
• identifies increasing	1
• identifies increasing exponentially	1

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

Solution
$V_2 = 20000 \times 1.1 = 22000$ $V_4 = 24200 \times 1.1 = 26620$ 

Marking key/mathematical behaviours	Marks
• calculates correct values for V_2 and V_4	1
• plots the data points correctly on graph	1

Question 6 (d) **(2 marks)**

Solution	
$V_{n+1} = V_n \times 1.1, \quad V_1 = 20000$	
Marking key/mathematical behaviours	Marks
• states the correct recurrence relation • states the value of V_1	1 1