MATHEMATICS APPLICATIONS

MAWA Semester 2 (Units 3 & 4) Examination 2019

Calculator-free

Marking Key

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The release date for this exam and marking scheme is

• the end of week 1 of term 4, 2019

Section One: Calculator-free

(50 Marks)

(3 marks)

Question 1 (a)

Solution						
(i) $x = 20$						
(ii) $x = \pm 12$						
Marking key/mathematical behaviours	Marks					
 identifies correct value for x 	1					
identifies rate of 12	1					
 identifies rate of -12 	1					

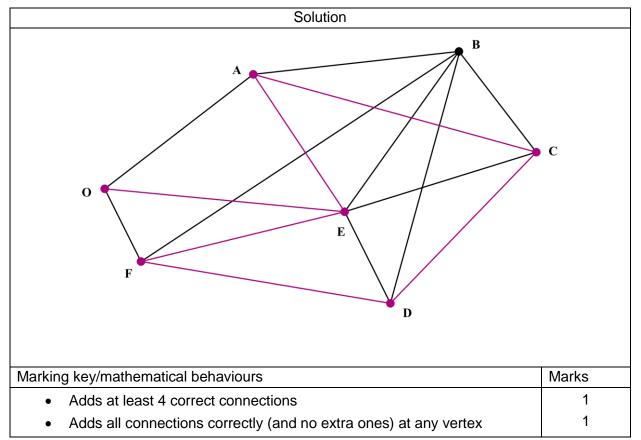
Question 1 (b)

(3 marks)

	Solution					
	$T_8 = T_5 + 3d$					
(i)	32 = 56 + 3d					
(1)	-24 = 3d					
	d = -8					
	$T_5 = T_1 + 4d$					
	$56 = T_1 - 32$					
	$T_1 = 88$					
	$T_n = a + (n-1)d$					
(ii)	$T_n = 88 + (n-1)(-8)$					
(,	$T_n = 88 - 8n + 8$					
	$T_n = 96 - 8n$					
	Therefore $b = 96$ and $c = -8$					
Marking key/mathematical behaviours						
•	substitutes correct values					
•	rearranges values to find general term equation					
•	states correct value for b and c	1				

Question 2 (a)

(2 marks)



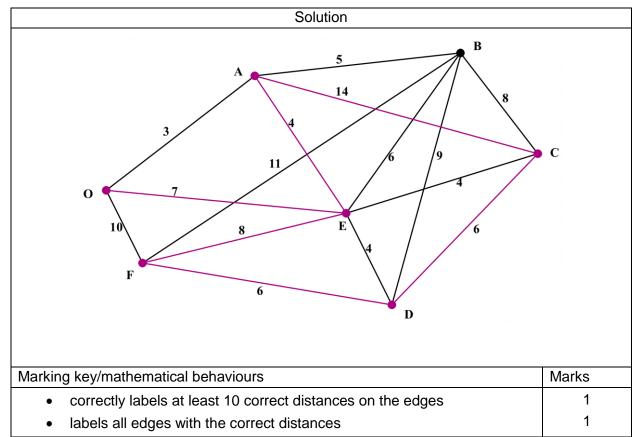
Question 2 (b)

(3 marks)

Solution					
While the graph is simple because there are no loops or multiple edges, and it because all vertices are linked (there are no isolated vertices) it cannot be des planar because the edges cross.					
Marking key/mathematical behaviours Marks					
 identifies the graph as not planar and provides a reason 	1				
 identifies the graph as simple and provides a reason 	1				
 identifies the graph as connected and provides a reason 	1				

Question 2 (c)

(2 marks)



Question 2 (d)

(2 marks)

(1 mark)

Solution					
OABCDEFO 44km or OAEBCDFO 43km (other options exist)					
Marking key/mathematical behaviours	Marks				
identifies a route to fit description	1				
determines length of route	1				

Question 2 (e)

Solution	
Hamiltonian cycle	
Marking key/mathematical behaviours	Marks
 identifies a Hamiltonian cycle 	1

CALCULATOR-FREE

MATHEMATICS APPLICATIONS SEMESTER 2 (UNITS 3 & 4) EXAMINATION MARKING KEY

Question 3 (a)

Solution						
Relationship is moderately strong and positive.						
Marking key/mathematical behaviours	Marks					
 comments on the strength of correlation 	1					
 comments on the relationship between variables 	1					

Question	3 ((b)
		·~/

	Solution						
(i)	 Approximately 51.84% of the number of accidents can be attributed to the change in the number of schools. 						
(ii)	Gradient is 2.21. As such, there is an increase of 2.21 road accidents additional school.	for every					
Marking	Marking key/mathematical behaviours Marks						
•	provides an explanation using the coefficient of determination	1					
•	provides an explanation using the gradient of the least squares regression line	1					

Question 3 (c)

Solution				
The relationship as stated in (a) is moderately strong and positive, which could be interpreted				
as "the more schools there are, the greater the number of accidents". In line with this				
thinking, merging schools would decrease the number of schools, and hence, decrease the				
number of road accidents.				
Marking key/mathematical behaviours Marks				
 identifies a plausible reason 	1			
 supports this identified reason with justification 	1			

Question 3 (d)

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Solution There are many reasons to account for road accidents (e.g. fatigue, inattention, driver experience, alcohol, speed) which have little or no causal connection to the number of schools there are in a city. Marking key/mathematical behaviours Marks identifies a plausible non-causal explanation 1 • 1 explains this identified explanation with justification •

(2 marks)

(2 marks)

(2 marks)

(2 marks)

Question 4 (a)

(2 marks)

Solution					
Sam has the correct values as he has completed the first step for maximising, which is to					
subtract all values from the highest term (10)					
Whereas Ryan has completed the first step for minimising					
Marking key/mathematical behaviours Marks					
stating Sam as correct employee	1				
• identifying the subtraction of all scores from highest value (maximising)	1				

Question 4 (b)

(5 marks)

					Ition				
Various line co	mbinat	tions. T	This is o	ne exa	of how to find a	nswer.			
Location Location							ation		
	Α	В	С	D		Α	В	С	D
Contractor 1	0	4	2	2	Contractor 1	0	3	1	2
Contractor 2	3	5	1	0	Contractor 2	3	4	0	0
Contractor 3	5	2	5	0	Contractor 3	5	1	4	0
Contractor 4	0	0	0	2	Contractor 4	1	0	0	3
Contractor 2: CTotal number of storage spaces: 10+9+8+5Contractor 3: D= 32Contractor 4: B							5		
Marking key/m	athema	atical b	ehaviou	urs				Ν	Marks
 subtracts the smallest number from each element in each row 							1		
 shows min. lines as 3 							1		
 subtracts lowest number uncovered from each uncovered number and adds to the intersection points 						nd	1		
states correct allocations							1		
 states correct maximum number of storage spaces 							1		

Question 5 (a)

Solution				
To smooth out the time series data and determine if it has cycles or trend, and if so, what				
might the trend be and what the best period or length of the cycle might be.				
Marking key/mathematical behaviours				
correctly states a valid reason for calculating moving averages	1			

Question 5 (b)

Solution	
$\frac{860+830+A}{3} = 832 \Longrightarrow 1690 + A = 2496 \Longrightarrow A = 806$	
$\frac{(920) + (930) + (880) + (850) + (820)}{5} = \frac{4400}{5} = 880$	
Marking key/mathematical behaviours	
• indicates use of the correct data and rule to determine the 3-point MA	1
calculates A correctly	1
• indicates use of the correct data and rule to determine the 5-point MA	1
calculates B correctly	1

Question 5 (c)

Solution	
5 pt M.A. as the data clearly has a cycle of 5.	
or	
The values in the 5-point moving average column are continually decreasing.	
Marking key/mathematical behaviours	Marks
 correctly states the most appropriate moving averages 	1
gives a valid justification	1

Question 5 (d)

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Solution	
There is a decreasing/downward trend.	
The high points at	
t = 3, t = 8 and $t = 13$ are decreasing as are the low points at	
t = 6, t = 11 and $t = 16$ (if A is plotted)	
Marking key/mathematical behaviours	Marks
correctly states the overall trend	1
 correctly refers to the high and low points in the cycles 	1

(1 mark)

(4 marks)

(2 marks)

(2 marks)

(5 marks)

Solution		
(i)	$A_{n+1} = 1.09A_n$, $A_0 = 5000$ where A_n represents value and n = numbrases of the second s	per of years
	passed	
	$A_n = 5000(1.09)^n$	
(ii)	or where A_n represents value and n = number of yea	rs passed
	$A_n = 5450(1.09)^{n-1}$	
Markin	g key/mathematical behaviours	Marks
•	correctly determines growth rate	1
•	uses correct format for recurrence relation	1
•	correctly states A_0	1
•	uses correct format for the n^{th} term rule	1
•	uses correct values for n^{th} term rule	1

Question 6 (b)

Question 6 (a)

Solution	
Monthly rate $ = 0.09 \div 12 $ $= 0.0075 $	
Marking key/mathematical behaviours	Marks
identifies monthly interest rate	1

Question 6 (c)

(2 marks)

Solution	
At 10 years Yearly Graph ~ \$11750 Monthly Graph ~ \$14500 Approximate increase of \$2750	
Marking key/mathematical behaviours	Marks
identifies approximate change in investmentspecifies the change as a growth	1

(1 marks)