Greenwood College
Year 12 Applications
Test 4 2019
Resource-Free

Name……

No calculators nor notes allowed.
15 mark total.

Formula sheet allowed.
20 minute time limit.

Question 1 **(8 marks)**

The seasonal indices for the first three quarters of a year for the turnover in a restaurant are shown in the table below.

Quarter	One	Two	Three	Four
Seasonal index	0.85	1.02	1.17	

(a) In the first and second quarters of this year, the restaurant had turnovers of $248 700 and $249 600. In which of these first two quarters will the deseasonalised value of the turnover be greatest? Explain your answer. (3 marks)

(b) Determine the seasonal index for the fourth quarter. (1 mark)

(c) What does the seasonal index for the third quarter indicate about the restaurant turnover in $. (1 mark)

(d) The equation of the trend line fitted to the deseasonlised turnover T for each quarter Q is…

$T = 285\,000 - 9500 \times Q$

(i) Explain, in context of the question, the meaning of the figure 9 500 in this equation. (1 mark)

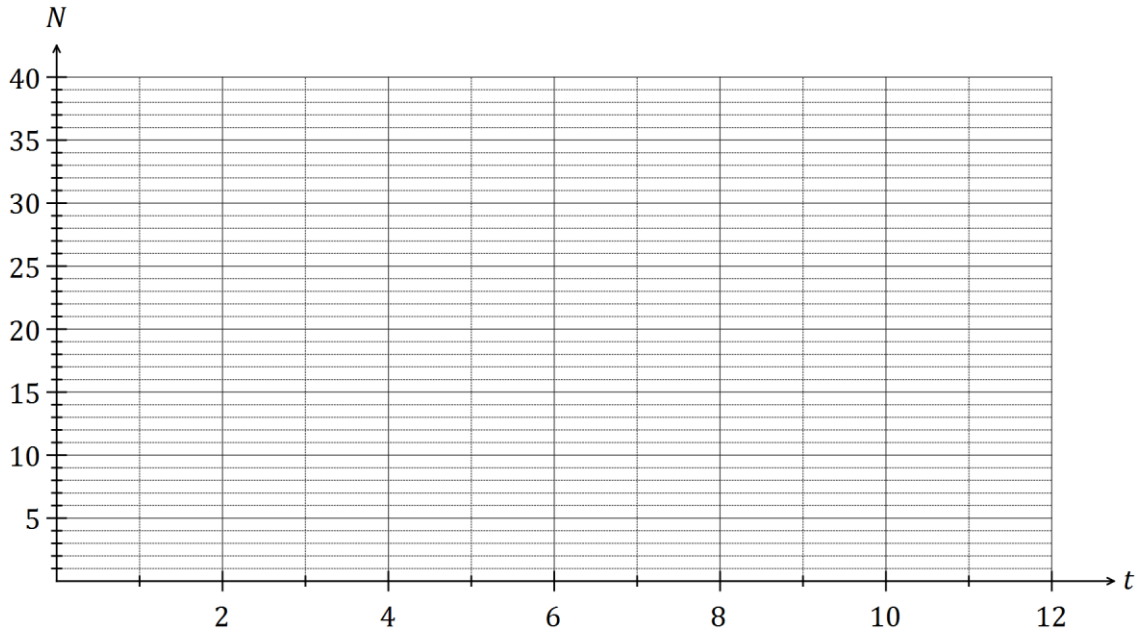
(ii) Use the equation to write down an expression to predict the actual turnover in the fourth quarter of the first year, but **do not** evaluate it. (2 marks)

Question 2 **(7 marks)**

The table below shows the number of members, N, of a swimming club who turned up for training over the first three weeks of winter. The club trained on Monday, Tuesday, Wednesday and Thursday each week.

	Week 1				Week 2				Week 3			
Day	M	T	W	T	M	T	W	T	M	T	W	T
Time, t	1	2	3	4	5	6	7	8	9	10	11	12
Number, N	35	33	19	21	32	29	4	21	30	25	19	20

(a) Construct a time series plot of this data on the axes below. (2 marks)



(b) Comment on features of the time series plot, including trend and seasonality. (3 marks)

(c) The trend line for the data is $N = 30 - 0.9t$. Comment on the usefulness of this line as a short and long term trend model. (2 marks)

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Formula sheet, one A4 page single-sided of notes and calculators allowed.

29 mark total. 35 minute time limit.

Question 3 **(6 marks)**

A service centre manager recorded the number of customers over time periods, *t*, and produced the following spreadsheet to compare different moving averages.

t	Number of customers	3-point moving average	4-point centred moving average	5-point moving average	6-point centred moving average
1	840				
2	927	901			
3	936	919	902.625	892.8	
4	894	899	893.625	890.4	**C**
5	867	863	879	888.6	895
6	828	871	880.875	886.8	890.25
7	918	891	886.5	883.8	882
8	927	908	891	**B**	874.5
9	879	886	881.625	879	877
10	852	850	866.625	876.6	883.75
11	819	859	869.25	875.4	878.75
12	906	882	876	872.4	869.75
13	921	897	879.375	868.8	863
14	864	873	870	868.2	
15	834	838			
16	**A**				

(a) What is the purpose of calculating moving averages for time series data?

(1 mark)

(b) Determine the values **A**, **B** and **C** in the table. (3 marks)

(c) From those in the table above, which is the most appropriate moving average for the manager of the service centre to consider? Justify your choice.

(2 marks)

Question 4 **(12 marks)**

A retailer in a shopping centre sells mobile phones. The data of its quarterly sales, together with some calculations, are shown in the table below.

Year	Data number (n)	Quarter	Mobile phone sales	Quarterly mean	Percentage of quarterly mean	Deseasonalised figure (D)
2013	1	March	901	905	99.56	915
	2	June	802		88.62	914
	3	September	A		97.68	900
	4	December	1033		114.14	894
2014	5	March	973	984.5	98.83	988
	6	June	863		C	984
	7	September	964		97.92	981
	8	December	1138		115.59	985
2015	9	March	1049	1065.5	98.45	1065
	10	June	932		87.47	E
	11	September	1049		98.45	1068
	12	December	1232		115.63	1066
2016	13	March	1119	B	97.01	1136
	14	June	1006		87.21	1147
	15	September	1142		99.00	1162
	16	December	1347		116.78	1166

(a) Determine the value of ***A***, ***B*** and ***C*** in the table above. (3 marks)

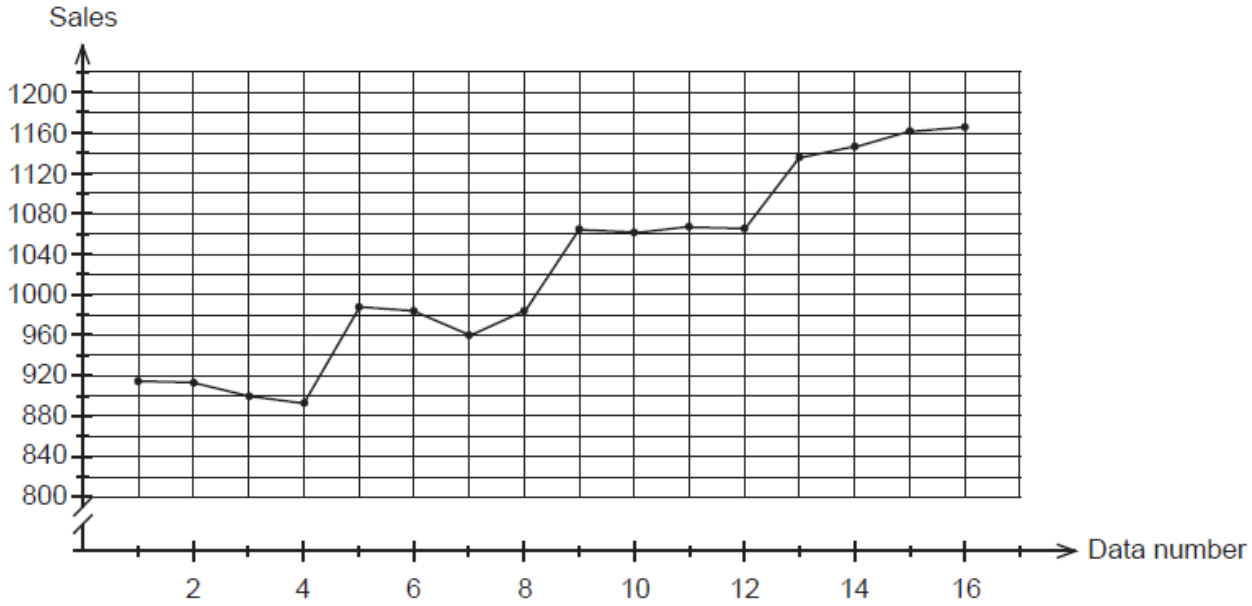
(b) Complete the Seasonal Index table below. (1 mark)

Quarter	March	June	September	December
Seasonal Index	0.9846	0.8774	0.9826	

(c) Determine the value of E in the table on the previous page. (2 marks)

The equation of the least-squares line for deseasonalised figure against data number is $D = 19.37n + 862.4$

(d) The graph below shows the deseasonalised figures. Draw on the graph, the least-squares line. (2 marks)



(e) Predict the mobile phone sales for December 2017. (2 marks)

(f) Comment on the reliability of your prediction made in part (e). (2 marks)

Question 5 **(11 marks)**

	Sales day (d)	Ice-cream sales	Weekly mean	Percentage of weekly mean
Monday	1	210		132.9%
Tuesday	2	230		145.6%
Wednesday	3	100	B	63.3%
Thursday	4	90		57.0%
Friday	5	160		101.3%
Monday	6	190		128.4%
Tuesday	7	230		155.4%
Wednesday	8	90	148	60.8%
Thursday	9	80		54.1%
Friday	10	150		101.4%
Monday	11	180		126.8%
Tuesday	12	220		154.9%
Wednesday	13	A	142	C
Thursday	14	70		49.3%
Friday	15	150		105.6%

(a) Determine the values of ***A***, ***B*** and ***C***, giving the value of ***C*** correct to one decimal place.

(b) (i) Use the average percentage method to complete the table below by calculating the seasonal index for Wednesday. (1 mark)

Day	Seasonal index
Monday	129.4% = 1.294
Tuesday	152.0% = 1.520
Wednesday	
Thursday	56.8% = 0.568
Friday	102.8% = 1.028

(ii) Use the seasonal index to determine the deseasonalised number of ice-cream sales for Tuesday of Week Three, correct to the nearest 10. (2 marks)

(c) The equation of the least-squares line used to forecast the deseasonalised number of ice-cream sales is…

Deseasonalised number of ice-creams = -1.695d + 161.16

(i) Describe the trend in the number of ice-cream sales over time. (1 mark)

(ii) Predict the actual number of ice-cream sales for Friday of Week Four. (3 marks)