TRINITY COLLEGE

Year 12 Mathematics Applications
Test 4 2021

Calculator Assumed

Time Series Data

STUDENT'S NAME _____

DATE: Friday 25th June **TIME:** 40 minutes **MARKS**: 37

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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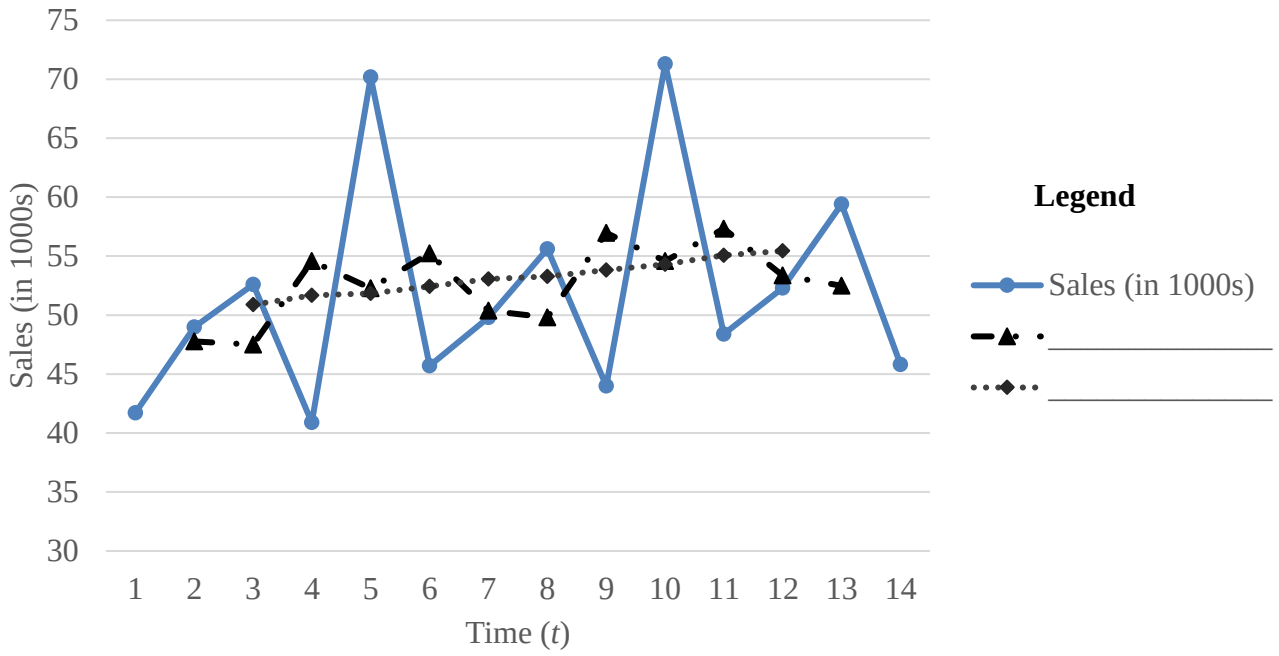
1. (5 marks)



The graph above shows the sales at a local restaurant over a 14 day period. A 3 point moving average and a 5 point moving average have been fit to the model.

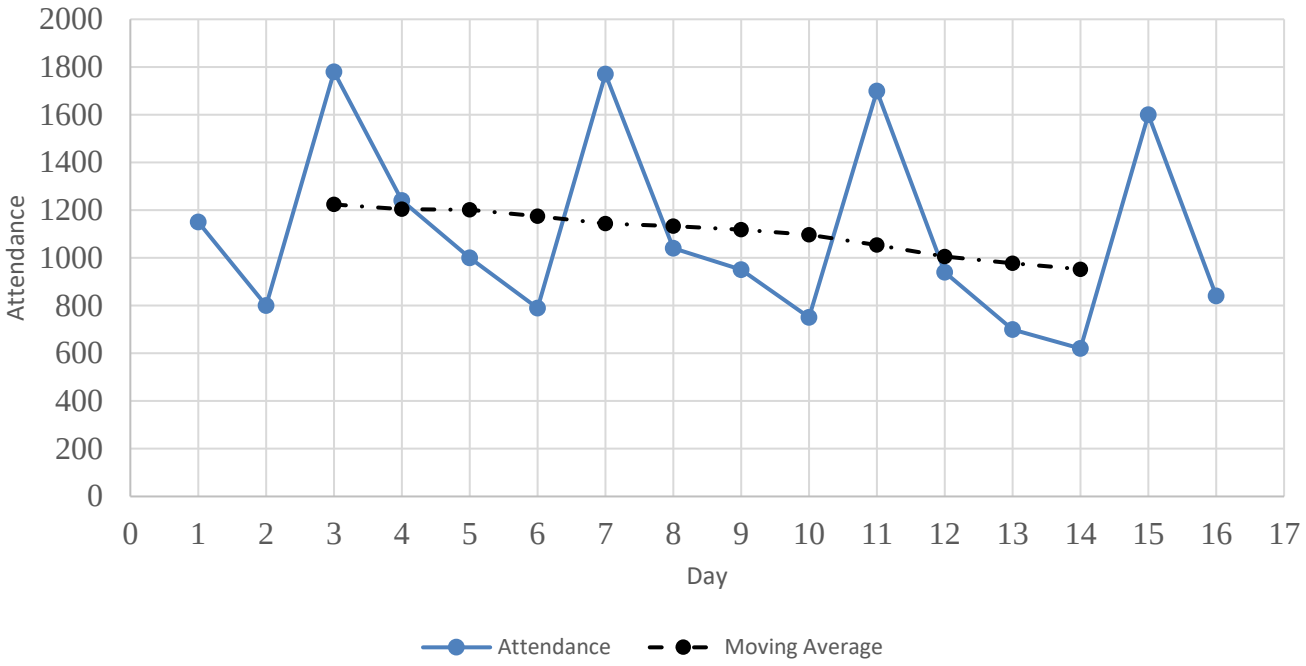
(a) On the legend in the graph clearly label the 3 point moving average and the 5 point moving average. [1]

(b) Which moving average is most appropriate for the given data? Explain your answer. [2]

(c) Explain the purpose of fitting a moving average to time series data. [2]

2. (5 marks)

Cirque De Moon performed a certain number of times a week for the past four weeks. The attendance data and associated moving averages for the first four weeks have been plotted below.



(a) What moving average is most appropriate for this data? [2]

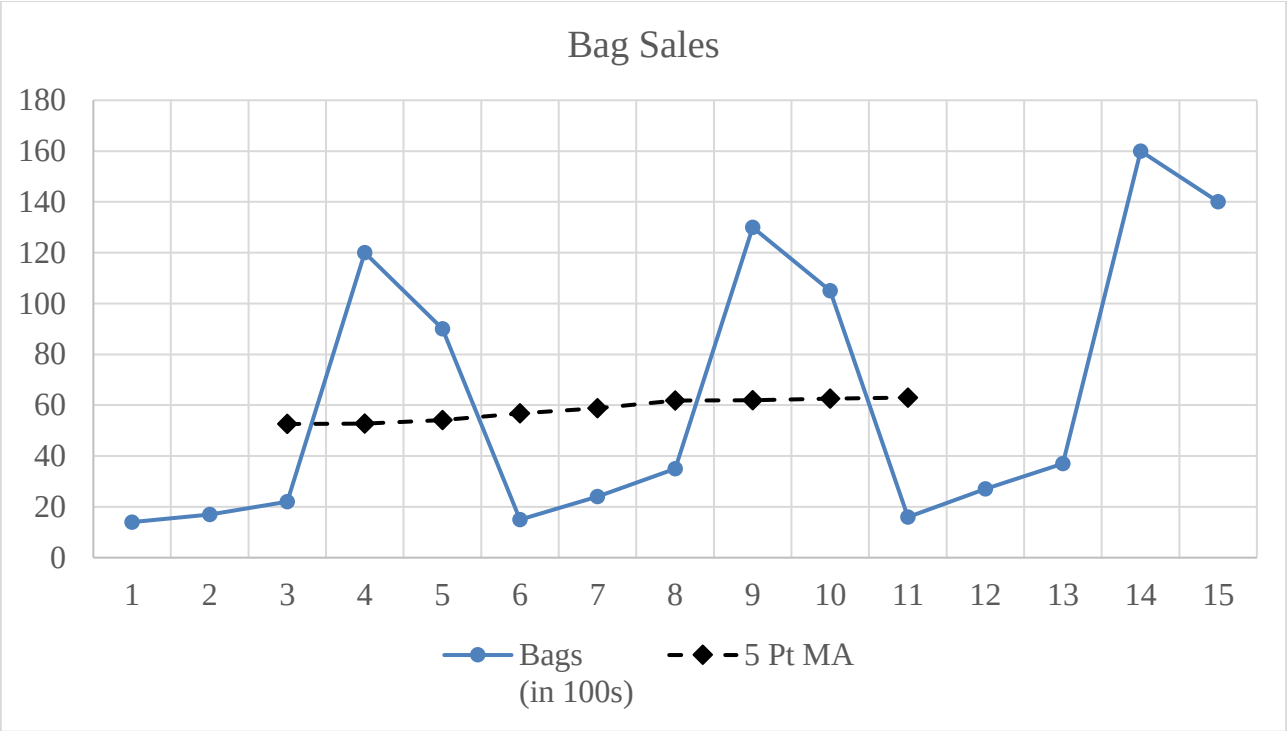
(b) Describe the trend in attendance over these four weeks. [1]

(c) Cirque De Moon need 1000 attendees on average per day to make their performance financially worthwhile. Should the company continue its performances into a 5^{th} week? Explain your answer. [2]

3. (17 marks)

The table below shows the number of plastic bags purchased during the week (Mon to Fri) over a three-week period.

Week	Day	Time (t)	Bags (in 100s)	5 Pt MA	Cycle Mean	Seasonal Effect	Seasonally Adjusted Data
1	Monday	1	14			26.62%	58.4
	Tuesday	2	17			32.32%	47.8
	Wednesday	*a*	22	53	*b*	41.83%	44.9
	Thursday	4	120	53		228.14%	55.5
	Friday	5	90	54		171.10%	51.4
2	Monday	6	15	57		24.27%	62.6
	Tuesday	7	24	59		38.83%	67.5
	Wednesday	8	35	62		56.63%	71.4
	Thursday	9	*c*	62		*d*	60.1
	Friday	10	105	63		169.90%	60.0
3	Monday	11	16	63		21.05%	66.7
	Tuesday	12	27	*e*		35.53%	75.9
	Wednesday	13	37	76	76	48.68%	75.4
	Thursday	14	160			210.53%	74.0
	Friday	15	140			184.21%	80.0



(a) Determine the values of *a*, *b*, *c*, *d*, and *e* in the table on the previous page. [5]

(b) Complete the table showing the seasonal index for each season. [2]

Monday	Tuesday	Wednesday	Thursday	Friday
24.0%		49.0%	216.3%	

(c) Complete the graph on the previous page by plotting the last two moving averages. [2]

(d) Show how the seasonally adjusted figure of 55.5 for Thursday week 1 was calculated. [2]

(e) Determine the least squares line using the seasonally adjusted figures. [2]

(f) Using your line from part (e), estimate the number of bags that will be purchased on Wednesday of week 4. [4]

4. (10 marks)

The quarterly seasonal index for the number of visitors to the local swimming pool for the 2nd quarter of the year is 0.73.

(a) Comment on the number of visitors to the pool in the 2nd quarter of the year in relation to the average quarterly number. [2]

(b) The number of visitors to the pool in the 2nd quarter of 2019 was 21 000.

(i) Determine the seasonally adjusted number of visitors to the pool in this quarter. [2]

(ii) Give an estimate for the total number of visitors to the pool in 2019. [1]

(c) The least squares line through the seasonally adjusted figures (s) for the quarterly visitors for 2017 to 2020 is $s = 1400t + 13\,000$ where the 1st quarter of 2017 is $t = 1$. Predict the number of visitors to the pool in 2nd quarter of 2025. [3]

(d) Comment on the reliability of your prediction in part (c). [2]

End of questions