

# SOLUTIONS

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Yr 12 Mathematics Applications Test 4

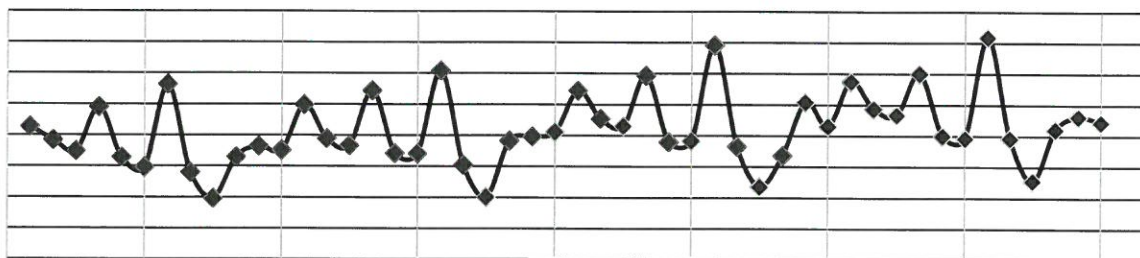
4 RESOURCE ASSUMED

Time:	42 minutes	Marks:	46 50
Reading:	2 minutes	Equipment Allowed:	½ page notes (A4 one side), CAS calculator
Working:	40 minutes		

Answers should be rounded appropriately. All working should be shown in the space provided. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.

### Question 1

Part of the graph of the original estimates of the short-term departures from Australia from June 2011 to May 2015 is reproduced below.



- (a) Name three items missing from the graph (3)

- LABEL FOR HORIZONTAL AXIS ✓✓  
- " " VERTICAL AXIS ✓  
- TITLE  
- UNITS FOR AXES VERTICAL  
- & TIME UNITS - HORIZONTAL

- (b) Select and describe two pieces of evidence on this graph that suggests the data are seasonal and in your description, identify the length of each season. (3) ✓✓✓

- MONTH 7, 19, 31, 43 THERE ARE PEAKS EVERY 12 MONTHS  
- LOWEST DATA POINTS - MONTHS 9, 21, 33, 45 - 12 MONTHLY  
- EVERY 12 MONTHS THERE ARE 3 PEAKS IN DATA  
- PATTERN REPEATS EVERY 12 MONTHS

- (c) What evidence on this graph suggests that there is an overall positive trend in short-term departures. (1) ✓

NUMBERS FORMING PEAKS & TROUGHS  
EVERY 12 MONTHS ARE INCREASING

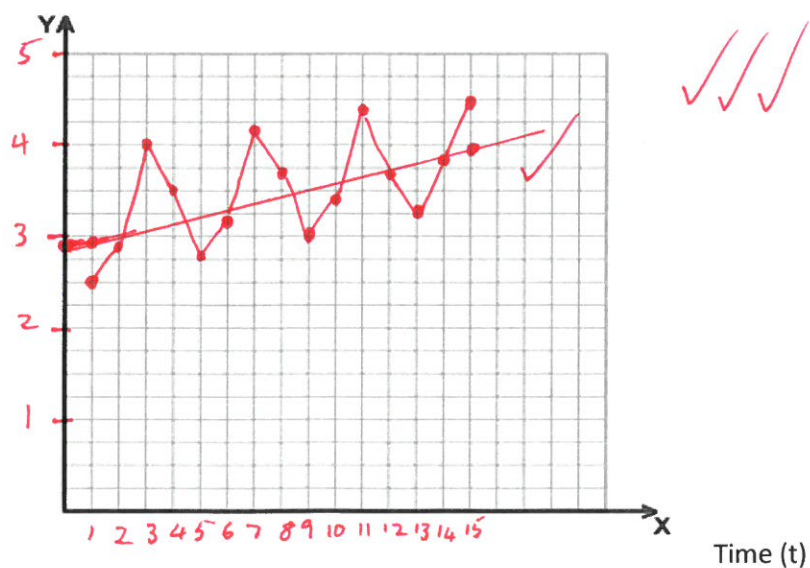
## Question 2

The table and graph below show the average price per kilogram of pineapples, on a quarterly basis, over the time period Summer 2007 to Winter 2010.

Year	Season	Time (t)	Price \$/kg
2007	Summer	1	2.5
	Autumn	2	2.9
	Winter	3	4
	Spring	4	3.5
2008	Summer	5	2.8
	Autumn	6	3.2
	Winter	7	4.2
	Spring	8	3.7
2009	Summer	9	3
	Autumn	10	3.4
	Winter	11	4.4
	Spring	12	3.7
2010	Summer	13	3
	Autumn	14	3.6
	Winter	15	4.5

(a) Plot the data average price per kilogram of pineapples, on a quarterly basis, over the time period Summer 2007 to Winter 2010. on the graph below (3)

Cost per kg



(b) Determine the equation for the least squares regression line. Write the equation below and then draw it on the graph. (2)

$$\text{cost} = 0.06428x + 2.97905 \quad \checkmark \quad \text{ON GRAPH}$$

(c) i) Use the line to predict the price of pineapples in winter 2011 (to the nearest cent).

$$t = 19 \Rightarrow 0.064286(19) + 2.97905 \\ = 4.20048 \quad \checkmark$$

ii) Is the prediction reliable? Explain. (3)

NO - OUTSIDE DATA RANGE EXTRAPOLATION!   
  $\checkmark$   $\checkmark$

### Question 3

The table show the percentage of total retail sales that were made in a department store over an 11 year period.

Sales (%) (S)	12.3	12	11.7	11.5	11	10.5	10.6	10.7	10.4	10	9.4
Year (t)	1	2	3	4	5	6	7	8	9	10	11

(a) Construct a time series plot on your CAS calculator. Comment on the data. (2)

NEGATIVE TREND   
 DECREASING  $\checkmark$



(b) Write down the equation of the trend line. (1)

$$S = -0.26t + 12.5 \quad \checkmark$$

(c) Interpret the slope of the trend line. (1)

ON AVERAGE THE % OF SALES ARE DECREASING   
 BY 0.26 % PER YEAR  $\checkmark$

(d) Use the trend line equation to forecast the percentage of retail sales which will be made by the department store in year 15. (1)

$$8.6 \% \quad \checkmark$$

#### Question 4

The data shows the number of female students in a Year 12 Statistics class over a period 1960 to 2010, shown in five-year period.

Complete the table for values A,B,C,D,E,F

(6)

Year (t)	Number of female students, y	Three point moving average	Three moving average with centering
1	2		
2	1	2	
3	A 3 ✓	3	3.56
4	5	5.7	E 5.56 ✓
5	9	C 8 ✓	7.1
6	10	7.7	7.46
7	4	D 6.7 ✓	6.9
8	6	6.3	7.3
9	9	9	F 9.1 ✓
10	12	12	
11	B 15 ✓		

#### Question 5

Table 1 gives the data for number of blanket sales in each of the four seasons for the years 2010 to 2012 for a Rug Company.

Year/Season	Summer	Autumn	Winter	Spring	Average
2010	446	1085	1241	920	923
2011	541	1180	1356	1033	1028
2012	659	1234	1450	1299	1161
Seasonal Index (SI)	0.52	1.15	1.30	1.03	

(a) What is the average number of sales per season for the year 2012? (1)

1161 ✓

(b) What is the seasonal index for Winter? (1)

1.30 ✓



(c) What does the seasonal index of 0.52 indicate about the sales of blankets during summer?(1)

SUMMER SALES ARE ABOUT HALF THE AVERAGE FOR THE YEAR. ✓

The deseasonalised data of sales for the four seasons are shown in Table 2

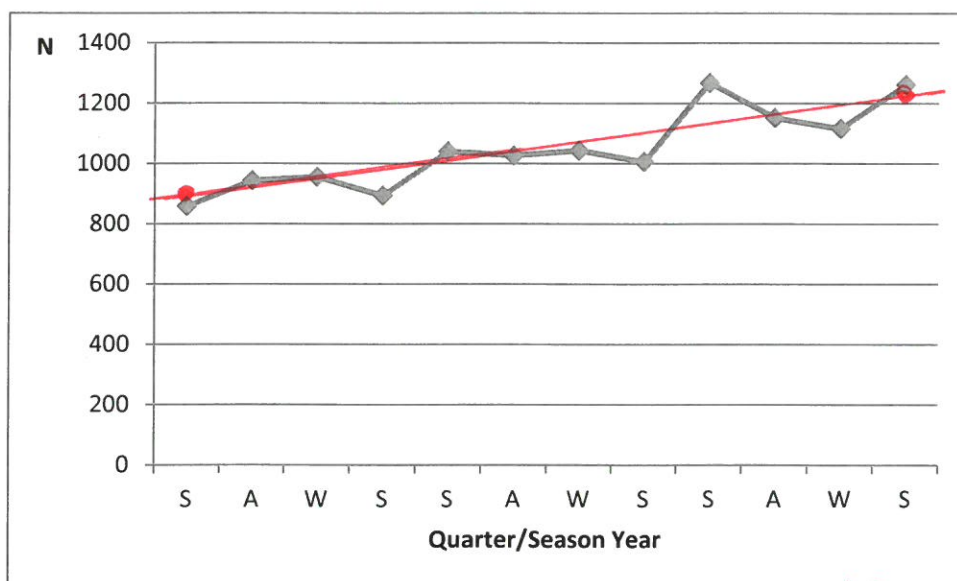
Year/Season	Summer	Autumn	Winter	Spring
2010	858	943	955	893
2011	1040	1026	1043	1005
2012	1267	1151	1115	1261

(d) Complete the table for Summer and Autumn. ✓

858 1026

(1)

The graph below shows the deseasonalised data for blanket sales.



DESEASONALISED SALES =  $838.8 + 31.94 \times \text{Quarter Number}$  (1) ✓

(e) Use the data in Table 2 and work out the equation of the trend line. (1)

$t(1) = 871$   
 $t(12) = 1222$

(f) Draw the trend line on the graph. (1)

(g) Use the trend line equation to calculate the value of N for Winter 2013. (1)

$t(15) \Rightarrow 838.8 + 31.94(15) = 1317.9$  ✓

(h) Using the value in (g), estimate the number of blankets sales in Winter 2013. (1)

SALES = DESEASON VALUE  $\times$  S.I.  
 $= 1317.9 \times 1.3$   
 $= 1713.27$  ✓

Question 6

(12)

The data shows the takings for a swimming pool company over 4 years in millions, by seasons

- Calculate the seasonal index for each season
- Calculate and give the deseasonalised takings for each season
- Determine the regression line for the deseasonalised data.

$$S = 0.0145301t + 1.1218712 \quad \checkmark \checkmark$$

- Use the regression equation and the seasonal index to predict the takings for spring in the 4<sup>th</sup> year.

$$t=16 \quad S = 0.0145301(16) + 1.1218712 = 1.354 \quad \checkmark$$

$$\therefore 1.354 \times 1.2365 = 1.67 \quad \checkmark$$

$\therefore 1.67$  MILLION

Year (t)	Season	Sales in millions	Year Average	Sales as from 4 mth mean	Seasonal index	Deseasonalised Sales
1	Summer	1.84	1.1625 ✓	1.5827	1.5503	1.1868
	Autumn	0.52		0.4473	0.4988	1.0425
	Winter	0.85		0.7312	0.7143	1.1899
	Spring	1.44		1.2389 ✓	1.2365 ✓	1.1646 ✓
2	Summer	1.88	1.215	1.5473		1.2127
	Autumn	0.63		0.5185		1.2630
	Winter	0.83		0.6831		1.1619
	Spring	1.52		1.2510 ✓		1.2293 ✓
3	Summer	1.92	1.2625	1.5208		1.2385
	Autumn	0.67		0.5307		1.3432
	Winter	0.92		0.7287		1.2879
	Spring	1.54		1.2198 ✓		1.2455 ✓