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**MATHEMATICS  
APPLICATIONS**

**Test 6 – Time Series and Finance**

**Chapters 6 and 7**

**Semester 2 2016**

**Calculator Assumed**

Time allowed

Working time for this section: 50 minutes

Marks available: 47 marks

## Material required/recommended for this section

##### To be provided by the supervisor

This Question/Answer booklet

Formula sheet

##### To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this course.

## Important note to candidates

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

1. (3 marks)  
   Renee wants to earn $1000 interest in 2 years. She invests in an account earning 9.8% p.a. simple interest.

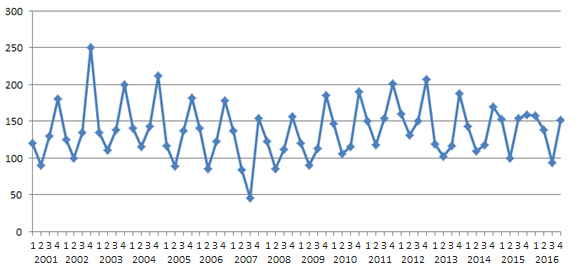
How much would she need to invest? Answer to the nearest one hundred dollars.

1. (4 marks)

Michael purchases office furniture valued at $3700 on terms of $370 deposit and 52 fortnightly installments of $71.56.

1. How much interest does he pay in total? [3]
2. Calculate the annual flat rate of interest charged. Write your answer as a percentage correct to two decimal places. [2]
3. (7 marks)

The graph below shows the sales of vehicles in a city for the various quarters between 2001 and 2016 inclusive.

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* 1. What moving average would you apply to this data? [1]
  2. What is the purpose of applying a moving average to this data? [1]
  3. Describe any long term fluctuations (cycles) in this time series. [2]
  4. Describe any unusual fluctuations in this time series. [3]

1. (3 marks)

Bradley invests $8000 in an account paying 7.8% p.a. compounded quarterly.

1. Write a recursive expression that can be used to find the value of his investment at the end of 3 years. [2]
2. Find the value of his investment at the end of 3 years. [1]

1. (4 marks)  
   Simon wants to loan money for a kitchen renovation. He has been given two options:
   * 1. Loan A – 11.3% p.a. compounded quarterly
     2. Loan B – 11.1% p.a. compounded monthly

Which is the better loan and why?

1. (5 marks)

The accountant of a company calculated the following seasonal components based on quarterly sales over a number of years of gathering data.

|  |  |  |
| --- | --- | --- |
| **Quarter** | **Seasonal Component (%)** | **Seasonal Component (Decimal)** |
| January | 70 | 0.7 |
| April | 130 | 1.3 |
| July | 110 | 1.1 |
| October |  |  |

* 1. Complete the table for October and giving justification for your decision below. [2]

The following table shows the sales for 2015.

|  |  |
| --- | --- |
| **Quarter** | **Sales ($)** |
| January | 15 000 |
| April | 18 000 |
| July | 12 000 |
| October | 19 000 |

Each quarter had a different sales team leader. A bonus is paid to that sales team leader whose sales figures (in seasonally adjusted terms) were the best.

* 1. Showing justification, which sales leader should receive the bonus? [3]

1. (12 marks)

A table of export data from Australia is given below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time Period (t)** | **Year** | **Quarter** | **Value of exports ($million)** | **4pt CMA** | **Yearly mean** | **% of the mean** |
| 1 | 2012 | 1 | **A** |  | 191.75 | 104.3 |
| 2 |  | 2 | 180 |  | 93.9 |
| 3 |  | 3 | 192 | 192.375 | 100.1 |
| 4 |  | 4 | 195 | 194.25 | 101.7 |
| 5 | 2013 | 1 | 205 | 195.875 | 196.5 | 104.3 |
| 6 |  | 2 | 190 | 196.375 | 96.7 |
| 7 |  | 3 | 195 | 198.375 | 99.2 |
| 8 |  | 4 | 196 | **B** | 99.7 |
| 9 | 2014 | 1 | 220 | 200.25 | **C** | 109.3 |
| 10 |  | 2 | 190 | 200.75 | 94.4 |
| 11 |  | 3 | 195 |  | 96.9 |
| 12 |  | 4 | 200 |  | 99.4 |

1. Determine the values of A, B and C. [3]

The following table shows the seasonal indices.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
| 2012 | 104.3 | 93.9 | 100.1 | 101.7 |
| 2013 | 104.3 | 96.7 | 99.2 | 99.7 |
| 2014 | 109.3 | 94.4 | 96.9 | 99.4 |
| Seasonal Index (%) | 106.0 | **D** | **E** | 100.3 |

1. Determine the values of D and E. [2]
2. Determine the deseasonalised values for:
   1. Quarter 1, 2012 [1]
   2. Quarter 3, 2013 [1]

A regression line is fitted to the deseasonalised values and its equation is 

1. Is the export value increasing or decreasing with time? Justify your answer with reference to the regression line. [2]
2. What is the potential value of the exports for Quarter 1, 2015? [3]
3. (9 marks)

$100 000 is invested at a rate of 4.75% per annum with interest compounding monthly.

1. Calculate the monthly interest rate. [1]
2. Calculate the value of the investment after 10 years and the total interest earned. [3]
3. Find the time taken for the investment to double its initial value. [2]
4. If the interest rate per annum were to be doubled, determine the time taken for the initial investment to double. Assume that the interest is compounded monthly. [3]

**End of Test**

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You may use this space to extend or re-attempt an answer to a question or questions and should you do so then number the question(s) attempted and cross out any previous unwanted working.