TRINITY COLLEGE

Year 12 Mathematics Applications
Test 1 2017

Calculator Assumed

Categorical & Numerical Data and Recursion

STUDENT'S NAME _____

DATE: Thursday 2nd March **TIME:** 50 minutes **MARKS**: 50

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. (4 marks)

For each of the following sequences determine, with an appropriate calculation, whether the sequence is arithmetic, geometric or neither of these two types.

(a) 7, -14, 21, -28, 35 … [2]

(b) $\frac{10}{3}, \frac{10}{9}, \frac{10}{27}, \frac{10}{81}, \ldots$ [2]

2. (7 marks)

John's vintage car is valued each year for insurance purposes. The value of John's car at the end of the first year is \$22 000. It was valued at \$23 650 and \$25423.75 at the end of the second and third years respectively.

(a) Show that the car values form a geometric sequence. [2]

(b) Assuming that the value of the car continues to increase in this way,

(i) Determine the increase in the car value from the end of the first year until the end of the fourth year. [2]

(ii) Determine the value of the car at the end of the 7^{th} year. [1]

(iii) For how many years does John need to own the car for it to double in value? [2]

3. (4 marks)

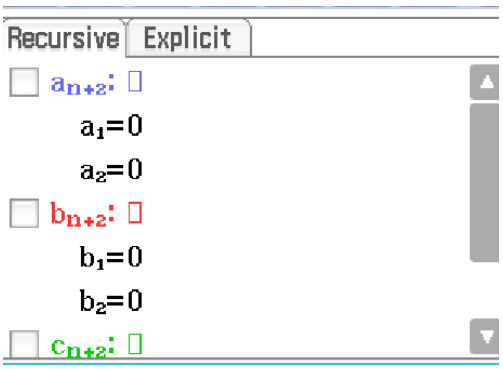
A sequence has the recursive rule $T_n = aT_{n-1} + 3$ with $T_1 = 2$ and $T_2 = 25$.

(a) Determine the value of a. [3]

(b) Determine T_4 [1]

4. (4 marks)

A sequence has the recursive form $T_n = 3T_{n-1} - T_{n-2} + n$ where $T_1 = 7$ and $T_2 = 12$.
Rewrite the sequence in the form A_{n+2} so that is can be entered into the classpad.



5. (7 marks)

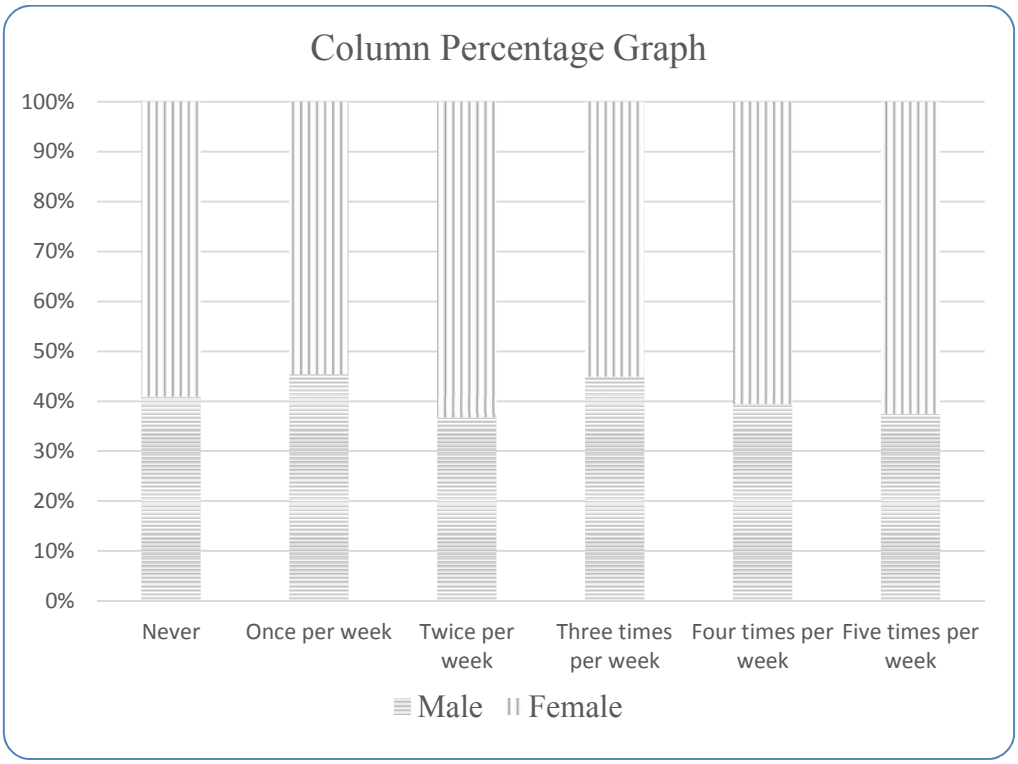
A survey was conducted to investigate whether the frequency with which an adult engaged in sport or exercise was associated with gender. A number of people were asked how many time they engaged in sport or exercise in the course of an average week. The responses are recorded below.

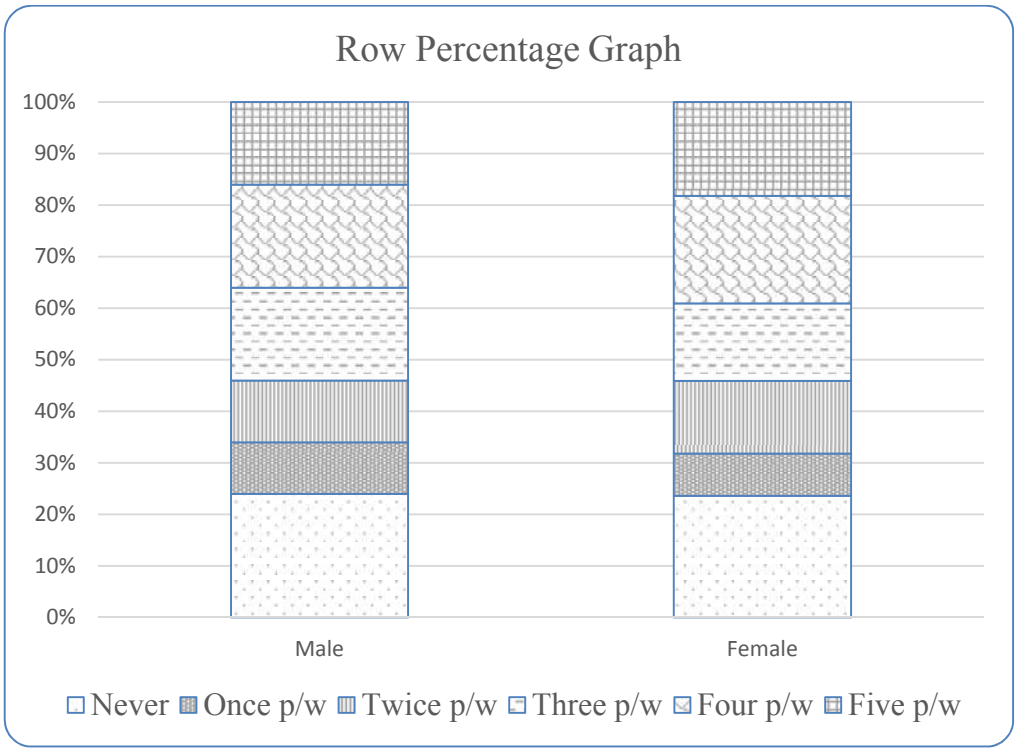
	Never	Once per week	Twice per week	Three times per week	Four times per week	Five times per week
Male	36	15	18	27	30	24
Female	52	18	31	33	46	40

(a) State the explanatory variable and response variable. [2]

(b) Convert the table above into a column or row percentage table as appropriate. [2]

	Never	Once per week	Twice per week	Three times per week	Four times per week	Five times per week	
Male							
Female							

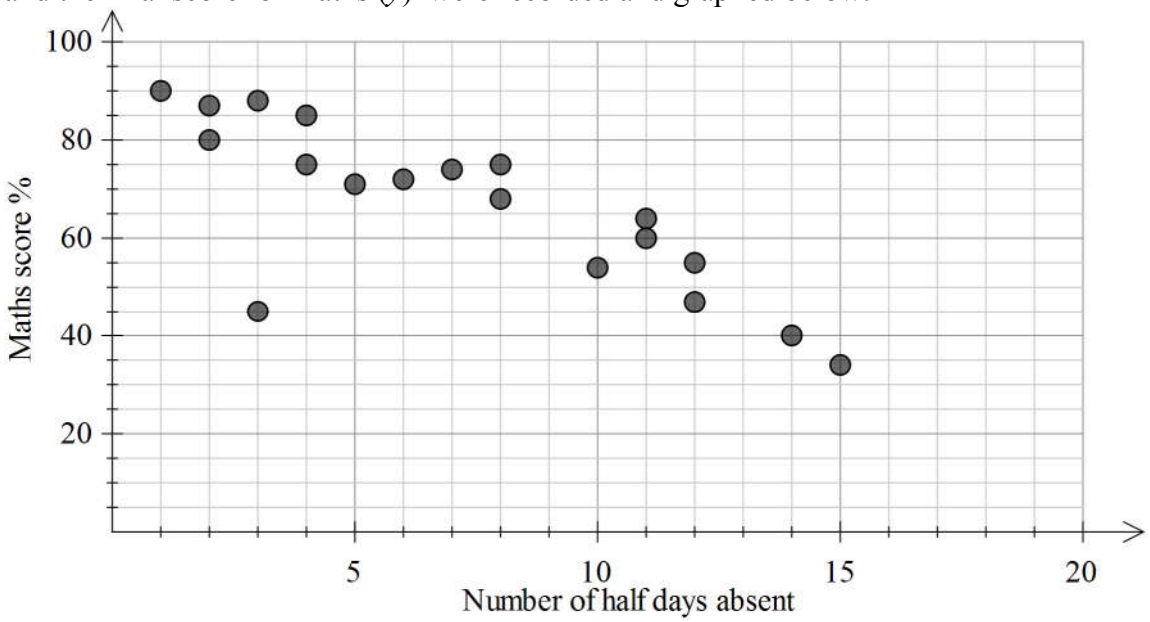




(e) Determine, with reference to the appropriate graph, whether or not the results suggest that the frequency with which an adult engages in sport or exercise is associated with gender. [3]

6. (20 marks)

In a recent survey of 19 students to determine if there is any relationship between maths results and the number of absences from class, the number of half days absent from school in 2016 (x) and the final score for maths (y) were recorded and graphed below.



(a) Highlight the outlier on the graph above. [1]

(b) Data for a 20th student was gathered. They scored 65 for maths and had 7 half days absent from school. Add this point to the graph. [1]

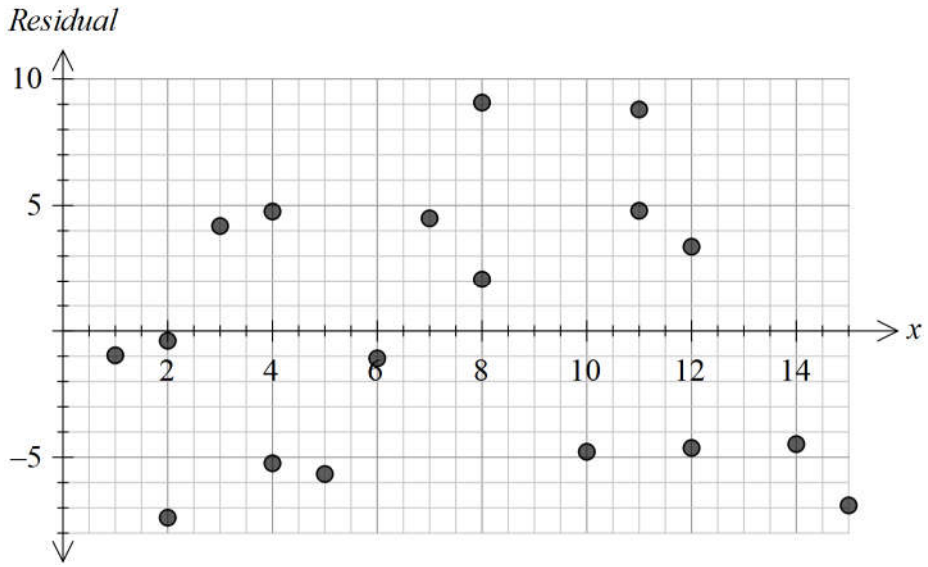
The outlier from part (a) has been removed and the result for the 20th student in part (b) has been included for all further calculations. Linear regression was performed on the 19 data points and the result are shown below.

$$r^2 = 0.8916$$
$$\hat{y} = 94.2545 - 3.5693x$$

(c) State the correlation coefficient and comment on its value. [3]

(d) State the coefficient of determination and comment on its value in the context of the question. [2]

(e) Plot the line of regression on the axes above and interpret the slope in the context of the question. [3]



(f) Add the residual for the student in part (b) to the residual plot above. [2]

(g) Comment on the information the residual plot reveals to the researchers. [2]

(h) Predict the maths score for a student that had 20 half days absent in 2016 and comment on the prediction. [3]

(i) Given the mean number of half days absent is 7.4737 determine $\overline{y}$. [1]

(j) The researchers concluded that the higher maths scores are due to the low number of absences. Comment on this statement. [2]

7. (4 marks)

A sequence with recursive form $P_n = b + aP_{n-1}$ has is such that $P_1 = 16, P_2 = -5$ and $P_3 = 10.75$. Determine the values of *a* and *b* and hence state the recursive rule.