



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

## Year 11 2019 Extension 1 Mathematics Assessment Task 2

### Investigative Assignment

**Task number:** 2

**Weighting:** 30%

**Due Date:** Wed 26/6/19

**Outcomes assessed:**

- ME11-5 Uses concepts of permutations and combinations to solve problems involving counting or ordering.
- ME11-6 Uses appropriate technology to investigate, organize and interpret information to solve problems in a range of contexts.
- ME11-7 Communicates making comprehensive use of mathematical language, notation, diagrams and graphs.

**Nature and description of the task:**

As a result of completing this Investigative Assignment, students should be familiar with combinatorics. They should be able solve problems and prove results using the pigeon-hole principle. They should have an understanding of Venn diagrams and the ability to determine and use formulas for finding the number of elements in the union of two or three sets.

The Investigative Assignment will consist of two parts:

- Part 1 Preparation Activity (value >> 50% of the overall Investigative Assignment) – completed at home. The suggested time for the Preparation Activity is one week, although you will have 2 weeks to complete it. All answers will need to be completed on your own paper and attached to this booklet. The marks allocated to each question is shown next to the question. All necessary working will need to be shown and answers /responses should be correct / detailed to obtain full marks.
- Part 2 Validation Task (value >> 50% of the overall Investigative Assignment) – to be conducted in class for a period of 50 minutes. The Preparation Activity can be used during the Validation Task and will be handed in together with the Validation Task at the conclusion of the task. Calculators should also be used and all marks for each question will be clearly shown next to each question on the task.

**Non-Completion of Task:**

If you know you are going to be away on the day of the Validation Task and are unable to hand in / complete both parts of the Investigative Assignment on the due day, then you must have supportive documentation. *Zero marks will apply if the Assessment Task is submitted/completed late, unless an Illness/ Misadventure or Application for Extension form has been submitted.*

## Part 1 Preparation Activity (38 Marks)

Extended investigation – Answer on your own paper and show all working

### FUND RAISING

#### Question 1 (24 marks)

Members of a committee who were organising a fund-raising function were planning the activities and for some of these, prizes were to be given for answering questions correctly.

- (a) A prize is to be given to the person who determines the number of people that would need to attend a function before you can be certain that at least two people have the same birthday? What is that number? Explain. (2)

The committee decided that since only 50 people were expected to attend, they could not guarantee that two people attending the function would actually have the same birthday. Hence, the committee proposed other questions that were more likely to result in two or more of the people at the function fitting that description.

Two questions considered were

1. *How many people in the room were born on a Monday?*
2. *How many people in the room were born on the 5<sup>th</sup> day of a month?*

- (b) Which of these questions is most likely to result in the lesser number of people attending the function fitting the description? Explain your choice of question.

(3)

Other questions considered were

3. *How many people in the room have a car with 7 as the last digit of its number plate?*
4. *How many people in the room live at a property where the last digit of their street number is equal to 7?*
5. *How many people in the room have a mobile where either of the last two digits is 1 or 2?*
6. *How many people in the room have a mobile where the last two digits are 1 and 2 in any order?*

(c) Consider questions 3 and 4. Which question is the more suitable one to ask to give the maximum possible number of people a chance to fit that description? Justify your choice of question. (1)

(d) Consider questions 5 and 6.

(i) Which question has the most number of possible answers? Explain fully. (3)

(ii) How many people of the expected 50 would be expected to fit each of the descriptions outlined in questions 5 and 6? Explain. (2)

One member of the committee suggested an even more complex question.

*How many people live at an address that has a street number that is not divisible by 2 or 3 or 5?*

It was assumed that all street numbers had only one or two digits.

(e) (i) Given the integers 1- 99, what is the probability that none of these numbers are divisible by 2, 3 or 5. (11)

(ii) Estimate the number of people attending the function who would fit this description.

Comment on any possible problems with the fairness of this question. (2)

**Question 2 (6 marks)**

At the start of the evening, Jim wanted to photograph some of the children of the three families who had contributed the most to the earlier fund-raising activities. One family had three children, one had four and the third had two.

What is the least number of these children that Jim will have to have in a photograph to ensure

- (a) he has at least one pair of siblings in the photograph? (2)

[For a pair of siblings there needs to be two children from the same family]

- (b) he has at least one child from each family in the photograph? (2)

There are two other families at the fund raiser who have two sets of twins each.

- (c) How many of these 8 children does Jim need to select to ensure his photograph will contain at least one set of twins? (2)

**Question 3 (8 marks)**

Penny was given the task of serving drinks to the people attending the fund raiser. The drinks on offer were white wine, tea coffee and orange juice.

Penny's son Ben was a crazy mathematician and gave her the following information:

Of the 50 people that finally attended the function, 28 people would drink orange juice but of those people 13 would be happy with coffee. 22 people would drink coffee but of those people, 7 would also drink tea. 17 people in all would drink tea but of those people 6 would have orange juice. 5 people didn't want a drink at all, and 4 people would be happy with any drink.

(a) Penny created a Venn diagram. Use the information above to complete the diagram. (4)

Penny decided to use the coffee first and that provided for all the coffee drinkers. She then had enough stock for 15 people to have orange juice, and 10 people to have tea.

(b) Did Penny have enough to cater for everyone? Explain. (4)

**End of Preparation Activity**