MINDARIE
SENIOR COLLEGE
WHERE YOUR FUTURE BEGINS NOW

Resource Assumed

Time Allowed: 45 minutes   Total Marks: 35

1.   [1, 1, 2, 2, 1 marks]

   (a)   How many four letter 'words' can be formed using the letters from the word TRIANGLE if

   (i)   each letter may be used more than once?

   $\underline{8}\ \underline{8}\ \underline{8}\ \underline{8}\ = 4096$ ✓

   (ii)   each letter may only be used once?

   $\underline{8}\ \underline{7}\ \underline{6}\ \underline{5}\ = 1680$ ✓

   (b)   (i)   How many ways can the letters in the word MISSISSIPPI be arranged in a row?   ✓✓ $I \times 4 \quad S \times 4 \quad P \times 2$

   $$\frac{11!}{4!\ 4!\ 2!} = 34650$$

   (ii)   How many of the ways from (b) (i) begin with the letter S?

   $\frac{10!}{4!\ 3!\ 2!} = 12600$ $I \times 4 \quad S \times 3 \quad P \times 2$ ✓✓

   (c)   Towards the end of a game of Scrabble, only the letters A, T, Y, R, P, B and N remain in the bag. A player must select four letters from the bag. How many different groups of letters can the player select?

   $\binom{7}{4} = 35$ ✓

2. [4 marks]

A three-letter code word is to be chosen from the letters of the word THERAPY or from the word TRIANGLE.

How many different code words are possible?

TERA

$$\frac{7}{THERAPY} \; \frac{6}{} \; \frac{5}{} \; + \; \frac{8}{TRIANGLE} \; \frac{7}{} \; \frac{6}{} \; - \; \frac{4}{TERA} \; \frac{3}{} \; \frac{2}{}$$

$$210 \quad + \quad 336 \quad - \quad 24 = 522 \;\checkmark$$

3. [2, 2, 2 marks]

(a) A class of 22 Mathematics: Specialist students sit a test. The test has 20 questions that are either true or false. What can be concluded about the marks obtained from this test? Briefly explain your reasoning.

At least two students get the same score ✓
as 22 students and 21 scores ✓

(b) A school has 1000 students. What is the greatest number of students that we can be certain had their birthday in the same month?

$$1000 \div 12 = 83\tfrac{1}{3} \;\checkmark$$

$$\therefore 84. \;\checkmark$$

(c) At the College sports carnival, every student belongs to one of the five houses: Arctic, Atlantic, Indian, Pacific or Southern. What is the least number of students that could be in a race to be certain of having at least three from the same house?

worst case – 2 in each i.e. 10 students

∴ need 11 students ✓✓

4. [3 marks]

In Year 11, 38 students study Mathematical Methods, 32 study Physics while 40 study Chemistry. 15 students study both Methods and Physics, 14 study Physics and Chemistry, while 17 study Methods and Chemistry. 12 students study all three subjects. An assembly is held for any student who studies Mathematical Methods, Physics, or Chemistry. How many students would be expected to attend the assembly?

$$n(M \cup P \cup C) = n(M) + n(P) + n(C) - n(M \cap P) - n(M \cap C) - n(P \cap C) + n(M \cap P \cap C)$$

$$= 38 + 32 + 40 - 15 - 17 - 14 + 12$$

$$= 76 \;\checkmark$$

5. [2, 3 marks]

(a) How many four digit even numbers can be made from the digits 1, 2, 3, 4, 5, 6, and 7 if no digit can be used more than once?

$$\underline{6}\ \underline{5}\ \underline{4}\ \underline{3}\ \underset{2,4,6}{} = 360\ \checkmark\checkmark$$

(b) How many of the even numbers from part (a) are greater than 5000?

$$\underset{5,7}{\underline{2}}\ \underline{5}\ \underline{4}\ \underset{2,4,6}{\underline{3}} + \underset{6}{\underline{1}}\ \underline{5}\ \underline{4}\ \underset{3,4}{\underline{2}}$$

$$120\ \checkmark\quad +\ 40\ \checkmark\qquad = 160\ \checkmark$$

6. [1, 2, 2, 2, 1, 2 marks]

The five members of One Direction (OMG! Swoon!) arrange themselves in a line for a photograph. The members are Niall, Zayn, Liam, Harry and Louis.

How many arrangements are there in which

(a) Zayn is in the middle?

$$\underline{4}\ \underline{3}\ \underset{Z}{\underline{1}}\ \underline{2}\ \underline{1}\ = 24\ \checkmark$$

(b) Liam and Louis are on each end?

$$\underset{L,L}{\underline{2}}\ \underline{3}\ \underline{2}\ \underline{1}\ \underset{L,L}{\underline{1}}\ = 12\ \checkmark\checkmark$$

(c) Harry is next to Zayn?

$$\underline{4}\ \underline{3}\ \underset{HZ}{\underline{2}}\ \underline{1} \times 2! = 48\ \checkmark\checkmark$$

(d) Niall and Louis are not next to each other? $\checkmark$

$$5! - 48\ \checkmark = 72\ \checkmark$$

Whilst in Perth for a concert, three of the members do a radio promotional interview.

(e) How many different groups could do the interview?

$$\binom{5}{3} = 10\ \checkmark$$

(f) How many different groups are possible if their manager doesn't want both Niall and Harry to do the interview?

$$\begin{matrix} & NH & ZLL \\ BOTH & \binom{2}{2} \cdot \binom{3}{1} = 3 \end{matrix} \qquad 10 - 3 = 7\ \checkmark\checkmark$$