TRINITY ✠ COLLEGE

Year 11 Mathematics Specialist
Test 1   2019

Section 1   Calculator Free
Combinatorics and Vector Basics

STUDENT'S NAME   _____

DATE: Wednesday 6 March   **TIME:** 15 minutes   **MARKS**: 15

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1.   (2 marks)

Express the following in factorial form

$$\frac{14 \times 13}{3 \times 2 \times 1}$$

2.   (5 marks)

(a)   Prove that $^nC_r = \frac{n}{r} \times {}^{n-1}C_{r-1}$ [3]

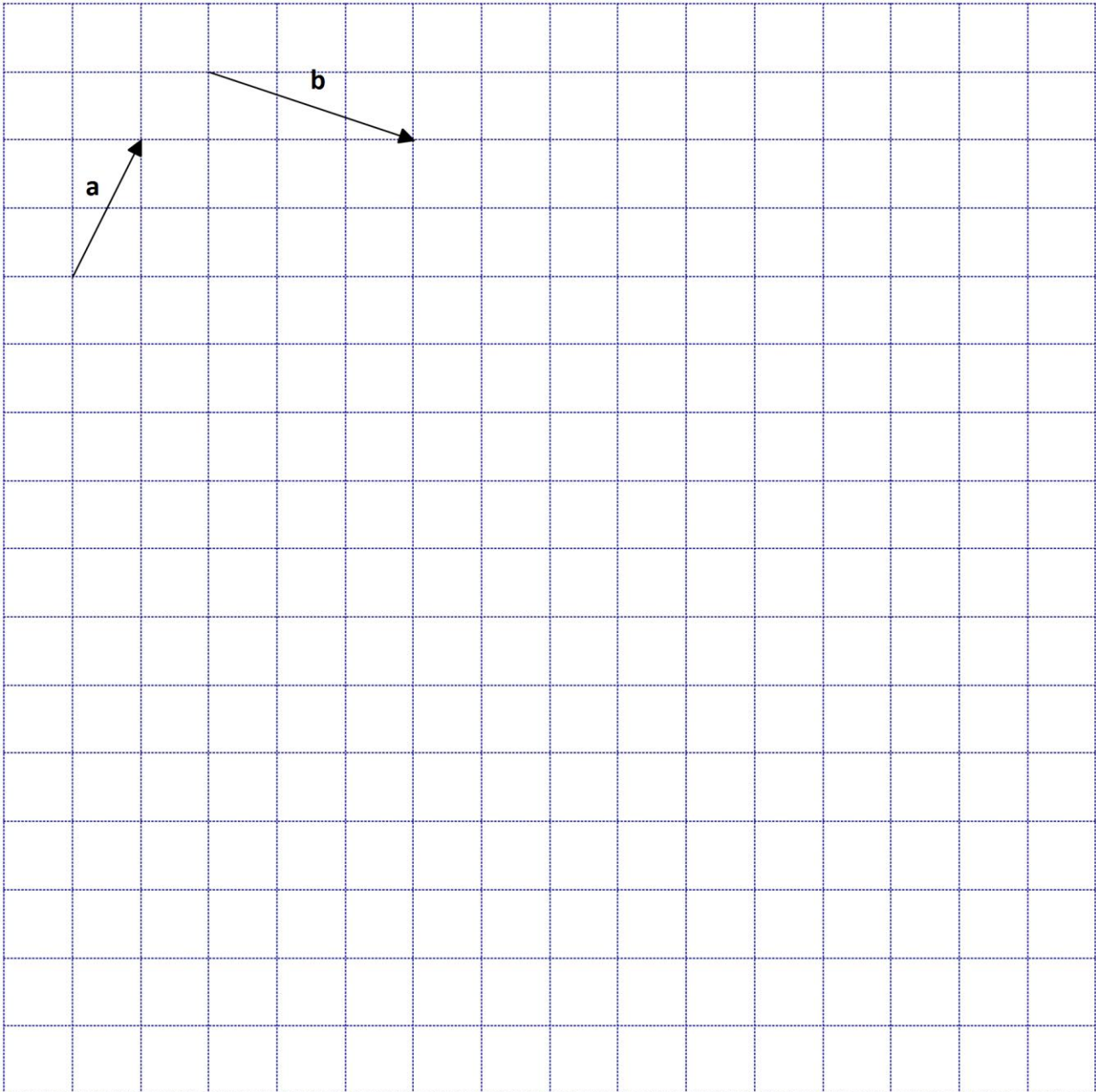(b)   Given that $^{14}C_5 = 2002$ and $^{15}C_5 = 3003$, determine $^{15}C_6$ [2]

3.   (4 marks)

On the grid below draw the following, given **a** and **b** as shown.

(a)   **a** + **b**   [1]

(b)   **a** − **b**   [1]

(c)   **b** − 2**a**   [2]

4.   (4 marks)

The letters of the word CYCLICAL are rearranged in a line. Determine the total number of 3 letter "words" that can be formed.

TRINITY COLLEGE

Year 11 Mathematics Specialist
Test 1   2019

Section 2   Calculator Assumed
Combinatorics and Vector Basics

STUDENT'S NAME   _____

DATE: Wednesday 6 March   **TIME:** 30 minutes   **MARKS**: 35

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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5.   (4 marks)

An ocean liner is travelling at 16 km/h on a course of 072°. However, it is drifting off-course
due to a 3 km/h ocean current which is flowing from the west. What is the actual speed and
direction of the ocean liner?

Draw a diagram to assist you.

6. (7 marks)

In still air an aircraft can maintain a speed of 285 km/h. The pilot wishes to fly the aircraft from Sydney to Fiji which is 1260 km away on a bearing of 065°. There is a wind blowing at 82 km/h from 195°.

(a) Draw a diagram to show all this information. The diagram does not have to be to scale.

[2]

(b) Determine the bearing on which the pilot should steer the aircraft so that is flies directly to its destination. [3]

(c) How long will the journey take, to the nearest minute? [2]

7.   (6 marks)

A passcode with 5-digits are made using the digits from 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. No repeats in digits are allowed.

(a)   How many different passcodes are possible?   [1]

(b)   How many of the passcodes start with the digit 4 or end with the digit 9?

                                                                                      [2]

(c)   How many of the passcodes are even and greater than 60000?   [3]

8.   (6 marks)

A committee of 9 people are to be selected from 10 Labor, 8 Liberal and 5 Greens politicians. How many different ways can the committee be selected if:

(a)   there are no restrictions?   [1]

(b)   the liberal representatives are in the majority?   [3]

(c)   a husband and wife pair, Alex and Alice, cannot be in the same committee?   [2]

9.   (4 marks)

Three Physics books, four Chemistry books and two Mathematics books are to be arranged in a book shelf. Determine the number of arrangements with either a Physics book on the extreme left or a Chemistry book exactly in the middle or a Mathematics book on the extreme right.

10.   (8 marks)

Hamish and Andy's Bitcoin account is protected by a 4 character password. The characters are chosen from the 26 letters of the alphabet (not case sensitive) and the digits 0 to 9 inclusive.

How many different passwords are there if

(a)   letters of the alphabet and digits are used   [1]

(b)   two letters and two digits are used, no character being used more than once   [2]

(c)   more letters than digits are used, no character being used more than once   [3]

(d)   there must be exactly two letters and the letters must be consecutive and adjacent and in ascending order, no character being used more than once   [2]