TRINITY COLLEGE

Mathematics Specialist Units 1,2
Test 1 2017

Section 1 Calculator Free

Counting, Basic Vectors

STUDENT'S NAME _____

DATE: Friday 3 March **TIME:** 20 minutes **MARKS**: 18

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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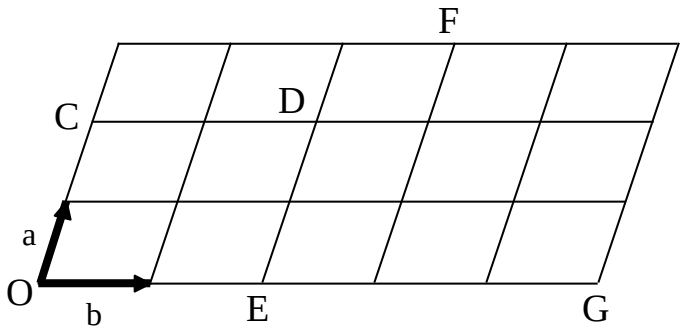
1. (2 marks)

   There are 27 people in a room. Explain why there are at least 2 people whose first name starts with the same letter of the alphabet.

2. (2 marks)

   From the set of counting numbers, 8 different numbers are chosen at random. Explain why at least 2 of these numbers must differ by a multiple of 7.

3. (7 marks)



Determine expressions for each of the following in terms of **a** and/or **b** as shown in the diagram.

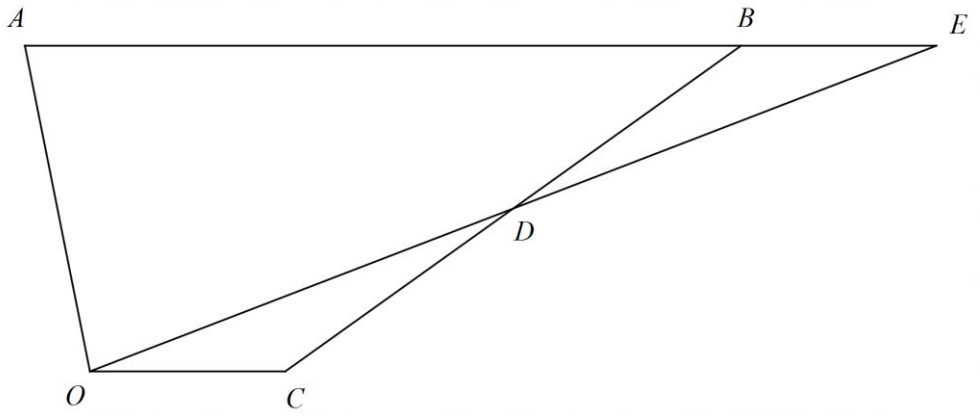
(a) $\overrightarrow{OC}$ [1]

(b) $\overrightarrow{OF}$ [2]

(c) $\overrightarrow{CE}$ [2]

(d) $\overrightarrow{GD}$ [2]

4. (7 marks)



For the trapezium $OABC$ above, $\overrightarrow{OA} = \underset{\sim}{a}$, $\overrightarrow{OC} = \underset{\sim}{c}$, $\overrightarrow{AB} = 3\underset{\sim}{c}$, and $\overrightarrow{CD} = \frac{1}{2}\overrightarrow{CB}$.

If $\overrightarrow{OE} = h\overrightarrow{OD}$ and $\overrightarrow{AE} = k\overrightarrow{AB}$, determine the value of h and k.

TRINITY COLLEGE

Mathematics Specialist Units 1,2
Test 1 2017

Section 2 Calculator Assumed

Counting, Basic Vectors

STUDENT'S NAME _____

DATE: Friday 3 March **TIME:** 40 minutes **MARKS**: 40

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. (10 marks)

A committee consists of 5 women and 7 men. Sub-committees must be formed from this group. How many different sub-committees of 5 can be formed in each situation below.

(a) no restrictions [1]

(b) if the president must be included [2]

(c) two men refuse to be on the same committee [3]

(d) one woman will only serve on the committee if one particular man is also on the committee [4]

6. (11 marks)

Using only the digits 2, 3, 4, 5, 6 and 7, without repetition, how many different numbers

(a) have 4 digits [1]

(b) start with a 2 [1]

(c) start with a 2 or end with a 7 [3]

(d) are less than 600 [3]

(e) are less than 600 and even [3]

7. (4 marks)

Determine the value of λ and μ if $3\lambda\mathbf{a} + \mathbf{a} + 4\mu\mathbf{b} = \mathbf{b} - 2\mu\mathbf{a} - 7\lambda\mathbf{b}$ where **a** and **b** are non-parallel vectors.

8. (4 marks)

Prove $\binom{n}{r} + \binom{n}{r+1} = \binom{n+1}{r+1}$

9. (6 marks)

A boat has a speed of 12 km/hr in still water. It is to be driven so that it travels directly across a river 175 metres wide. The river is flowing at 2 km/hr.

(a) At what angle to the bank should the boat be steered? [3]

(b) How long will it take to reach the other side? [3]

10. (5 marks)

Calculate the magnitude of force P and the size of ϑ if the three forces shown in the diagram are in equilibrium.