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| **Year 11 Specialist Mathematics**  Semester 1, March 2020  **Test 1: Combinatorics and Introduction to Proofs Weighting: 6%**  **[Australian Curriculum Reference Numbers: 1.3.1-1.3.5, 1.1.1-1.1.9, 2.1.5]** |

**Total Time: 50min Total Marks =**

**Student Name: \_\_\_\_\_\_\_\_\_**

**Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**TO BE PROVIDED BY THE STUDENT**

Standard Items: Pens, pencils, eraser, sharpener, correction tape/fluid, highlighters, ruler.

Special Items:

* Drawing instruments, templates
* A maximum of three CAS calculators satisfying the conditions set by the Curriculum Council ***for use in the Calculator Allowed section only***

**TO BE PROVIDED TO THE STUDENT**

* A formula sheet will be provided

**INSTRUCTIONS TO STUDENTS:**

You are required to attempt ALL questions.

Write answers in the spaces provided beneath each question.

Marks are shown with the questions.

**Show all working** clearly, in sufficient detail to allow your answers to be checked readily and for marks to be answered for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.

It is recommended that students **do not use a pencil,** except in diagrams

**Part A – Calculator - Free (25 minutes)**   
**Part B – Calculator Assumed (25 minutes)**

**Final mark**

1. Consider the statement:

*“If a quadrilateral has all four sides with equal length, then it is a square”*

* 1. State the inverse of the statement.
  2. State the converse of the statement.

* 1. Is the contrapositive of statement true or false? Justify your answer.

[1,1,2 = 4 marks]

1. A pencil case contains a variety of red, blue, black, and green pens.
   1. How many pens do you need to have to be certain of having three pens of the same colour?

* 1. What is the smallest number of pens you can have in the pencil case to ensure you have at least 4 red pens, or 3 green pens, or 2 blue pens, or 5 black pens?

[2,2 = 4 marks]

* 1. Prove the following by proving its contrapositive:
  2. Hence prove the equivalence statement:

[5,5 = 10 marks]

1. Evaluate the following:

[1,3 = 4 marks]

1. Determine the value of if it is known that for

[5 marks]

\*\*\* End of Calculator - Free Section \*\*\*

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| **Year 11 Specialist Mathematics**  Semester 1, March 2020  **Part B: Calculator Assumed Section**  **Time Allowed: 25 minutes** |

**Marks =**

**Student Name: \_\_\_\_\_\_\_\_\_**

**Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**INSTRUCTIONS TO STUDENTS:**

* You **are allowed** a CAS calculator
* You **are not allowed** any notes
* A formula sheet will be provided

You are required to attempt ALL questions.

Write answers in the spaces provided beneath each question.

Marks are shown with the questions.

**Show all working** clearly, in sufficient detail to allow your answers to be checked readily and for marks to be answered for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.

It is recommended that students **do not use a pencil,** except in diagrams

1. The school’s mixed basketball squad consists of 6 girls and 4 boys.
   1. How many teams are possible if you must have more girls than boys on a team of 5 players?

* 1. The school’s mixed basketball team won its tournament and is getting a photo taken with all 10 players. How many photos are possible if the photo consists of two rows of 5, and the captain Emma must be “front and centre” with the vice-captain Hashva and MVP Alex on either side of her?

[4,3 = 7 marks]

* 1. How many “words” can be formed using the letters from the word SLEEPLESS if you must use every letter?
  2. How many 4-letter “words” can be formed using the letters from the word SLEEPLESS?
  3. How many 4 letter ‘words’ can be made from the word if must be followed by , and you cannot have last?

[2,5,4 = 11 marks]

1. There are 255 Year 11 students at Melville Senior High School. Of these students, 68 study Physics and 44 study Computer Science. 29 students study Chemistry and Physics, 14 study Physics and Computer Science and 19 study Computer Science and Chemistry. 9 students study all 3 subjects and 120 students study none of these subjects.   
     
   Use the inclusion-exclusion principle to determine the probability that a Year 11 student chosen at random studies chemistry but not Physics or Computer Science.

[5 marks]

**\*\*\* End of Calculator Assumed Section \*\*\***