GIRRAWEEN HIGH SCHOOL

YEAR 11 MATHEMATICS EXTENSION 1

TASK 2

2023

ANSWERS COVER SHEET

Name: _____

QUESTION	MARK	ME11-1	ME11-2	ME11-3	ME11-4	ME11-5	ME11-6	ME11-7
1-3	/3					√		√
4	/1		√					√
5	/1	√						√
6	/19		√					√
7	/21					√		√
8	/16					√		√
9	/16	√						√
10	/6							√
11	/8					√		√
TOTALS	/91	/17	/20			/48		/91

Year 11 Mathematics Extension 1 outcomes

A student:

ME11-1 uses algebraic and graphical concepts in the modelling and solving of problems involving functions and their inverses

ME11-2 manipulates algebraic expressions and graphical functions to solve problems

ME11-3 applies concepts and techniques of inverse trigonometric functions and simplifying expressions involving compound angles in the solution of problems

ME11-4 applies understanding of the concept of a derivative in the solution of problems, including rates of change, exponential growth and decay and related rates of change

ME11-5 uses concepts of permutations and combinations to solve problems involving counting or ordering

ME11-6 uses appropriate technology to investigate, organise and interpret information to solve problems in a range of contexts

ME11-7 communicates making comprehensive use of mathematical language, notation, diagrams and graphs

GIRRAWEEN HIGH SCHOOL

MATHEMATICS EXTENSION 1

2023 Year 11 Task 2

Name:_____

This Booklet contains the answer sheet for Part A and Writing Booklet for Part B.

Part A ANSWER SHEET

Select the alternative A, B, C or D that best answers the question.

1.	A	○	B	○	C	○	D	○
2.	A	○	B	○	C	○	D	○
3.	A	○	B	○	C	○	D	○
4.	A	○	B	○	C	○	D	○
5.	A	○	B	○	C	○	D	○

Instructions

- If you need more paper for Part B, please ask your supervisor.
- Write your name on every booklet you use.
- Write on both sides of each sheet of paper.
- Start each question on a new page.

Total number of booklets used _____.

GIRRAWEEN HIGH SCHOOL

YEAR 11 TASK 2 2023

MATHEMATICS

EXTENSION 1

Time allowed – 90 Minutes

DIRECTIONS TO CANDIDATES

- Attempt ALL questions.
- All necessary working should be shown in every question. Marks may be deducted for careless or badly arranged work.
- Board-approved calculators may be used.
- Each question attempted is to be marked clearly Question 6, Question 7 etc. Each question is to be returned on a separate page in your answer booklet.
- You may ask for spare answer booklets if you need them.
- For Multiple choice: Fill in the circle corresponding to the correct answer on the multiple choice answer sheet in your answer booklet.

Multiple Choice begins on the following page

Question 1

One way of selecting car number plates in NSW is a pattern of 3 letters, followed by 2 numbers, then 2 more letters. If repetition is allowed, how many different number plates are possible this way?

(A) 1 188 137 600 **(B)** 710 424 000 **(C)** 67 600 000 **(D)** 1 757 600

Question 2

$\frac{(n+1)!}{(n-1)!}$ is NOT equal to

(A) ${}^{(n+1)}\mathrm{P}_2$ **(B)** n^2+n **(C)** $2\times {}^{(n+1)}\mathrm{C}_2$ **(D)** ${}^{(n+1)}\mathrm{P}_{(n-1)}$

Question 3

5 numbers are to be SELECTED from the numerals 0 to 9. The number of ways of doing this (they're being selected so there is no repetition) if two of the numerals are 6 and 7 is

(A) 252 **(B)** 120 **(C)** 56 **(D)** 45

Question 4

A relation between x and y has parametric equations $x=t^2+1, y=2t$. The Cartesian equation for this relation is

(A) $y=\pm 2\sqrt{x}-1$ **(B)** $y=\pm 2\sqrt{x-1}$ **(C)** $y=\pm 4\sqrt{x}-1$ **(D)** $y=\pm 4\sqrt{x-1}$

Question 5

The inverse function of $y=2x+3, x\geq 1$ is

(A) $y=\frac{1}{2}x-3, x\geq 5$ **(B)** $y=\frac{1}{2}x-3, x\geq 1$

(C) $y=\frac{1}{2}x-\frac{3}{2}, x\geq 5$ **(D)** $y=\frac{1}{2}x-\frac{3}{2}, x\geq 1$

Examination continues on the following page

Question 6 ***(19 marks) (Start solutions on a new page)*** **Marks**

(a) Solve for x:

(i) $8 + 2x - x^2 \leq 0$ **3**

(ii) $\left|\frac{3x-1}{5}\right| < 7$ **4**

(iii) $\frac{3}{2x-1} > 2$ **4**

(iv) $\frac{2x+1}{x-3} \leq 5$ **5**

(b) Find the Cartesian equation for the relation represented by the parametric equations $x = 3\cos\theta + 1, y = 3\sin\theta - 2$. **3**

Question 7 ***(21 marks) (Start solutions on a new page)***

(a) "Words" are to be made by arranging the letters of the chemical element MENDELEVIUM. How many different "words" are possible

(i) Without restriction? **1**

(ii) With the consonants together? **2**

(iii) Starting and ending with M? **2**

(iv) With the letters arranged in alphabetical order? **1**

(v) With vowels and consonants alternating? **2**

(vi) With the E's together? **2**

(vii) With the M's separate? **2**

(viii) With the E's separate? **2**

Question 7 continues on the following page

Question 7 (continued) **Marks**

(b) A committee of 10 is to be selected from a class of 24 students (15 boys, 9 girls)

In how many ways can this be done

(i) Without restriction? **1**

(ii) If four particular people are already selected? **1**

(iii) If two particular students refuse to sit on the committee together? **2**

(iv) If the committee is chosen at random, what is the probability that it contains at least 8 girls? **3**

Question 8 ***(16 Marks) (Start solutions on a new page)***

(a) 10 people (5 women, 5 men) are seated at a round table. In how many ways can this be done

(i) Without restriction? **1**

(ii) With one particular woman and man opposite each other? **2**

(iii) With women and men alternating? **2**

(iv) The actual group consists of 5 couples who wish to sit side by side with their partner. In how many ways can this be done? **2**

(v) The group is now moved to two five seat tables, one of redgum and one of Huon pine. In how many ways can our 10 people be seated at these tables without restriction? **3**

Question 8 continues on the following page

Question 8 (continued) **Marks**

(b) A standard deck of cards (no jokers) consists of

4 cards of each kind (Ace, 2, 3, ….King)

13 of each suit (Spades, Clubs, Diamonds, Hearts)

26 of each colour (black, red)

52 cards altogether

Three players are being dealt cards one at a time (so that Player 1 receives a card, then Player 2, then Player 3, then back to Player 1).

(i) If 13 cards have been dealt altogether , explain why we can be certain that at least one player has cards of different kinds? **2**

(ii) If 40 cards have been dealt altogether, explain why we can be certain that at least one player has cards of different suits? **2**

(iii) What is the minimum number of cards that can be drawn before we can be certain that at least one player has cards of both different colours? **2**

Examination continues on the following page

Question 9 ***(16 Marks) (Start solutions on a new page)*** **Marks**

(a) For the function $f(x) = x^2 - 6$

(i) Find the inverse relation of $y = f(x)$ **3**

(ii) Sketch $y = f(x)$ and its inverse relation showing all turning points and intercepts with the co-ordinate axes. **5**

(iii) Restrict the domain of $f(x)$ so that the inverse relation becomes a function $y = f^{-1}(x)$ with the most possible positive y values. **1**

(b) For $f(x) = \frac{1}{x-2} + 4$

(i) Find the inverse relation in the form $y = f^{-1}(x)$. **3**

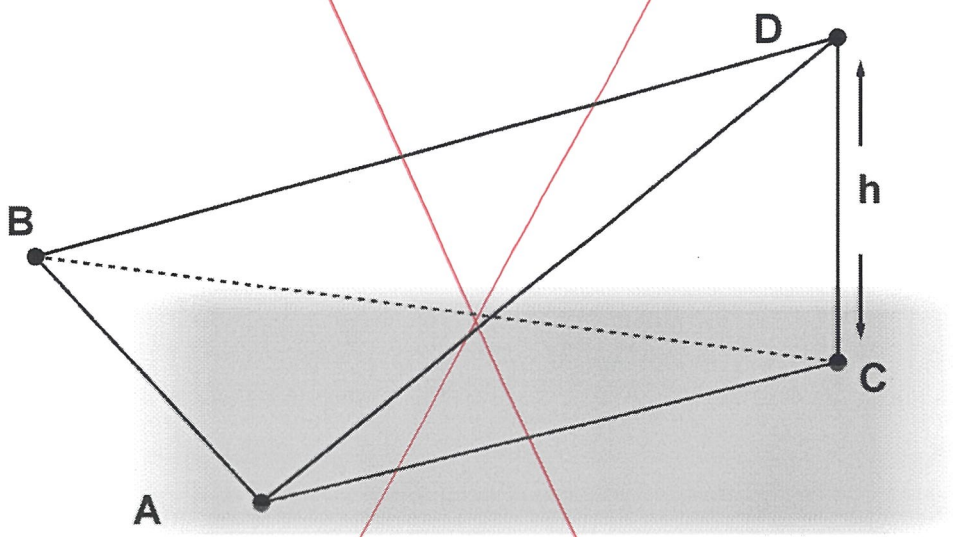
(ii) Find the points of intersection of $y = f(x)$ and $y = f^{-1}(x)$. **4**

Examination continues on the following page

Question 10 ***(6 Marks) (Start solutions on a new page)*** **Marks**

Sailing off the coast of an island, an observer on a ship located at A sees the top of a mountain on a bearing of 060^oT at an angle of elevation of 1^o. After the ship has sailed for $112.4km$ to B, the mountain is now seen on a bearing of 110^oT at an angle of elevation of 2^o.

If A is the ship's starting point, B is the ship's finishing point, C is the base of the mountain and D is the mountain's top (see diagram)



(a) Show that $\angle ACB = 50^o$ **1**

(b) Show that $AC = h\tan 89^o$ and write a similar expression for BC. **2**

(c) Show that if the measurements are all in metres,

$$h^2 = \frac{112\,400^2}{tan^2 89^o + tan^2 88^o - 2tan89^o tan88^o cos50^o}$$ **2**

(d) Find the height of the mountain to the nearest metre. **1**

Examination continues on the following page

Question 11 ***(8 marks) (Start solutions on a new page)*** **Marks**

(a) A group of 5 backpackers have a choice of 4 different hostels to stay at in a city. How many different ways can they do this if

(i) There is no restriction? (so all 5 can choose to stay at the one backpackers if they like!) **1**

(ii) If one pair of backpackers are brother and sister and wish to stay at the same hostel as each other and the other 3 backpackers choose to stay at any of the other hostels (so two can stay at one, etc). **2**

(b) A Viking longboat has 5 seats on each of the starboard (right) side and the port (left) side. In how many ways can 10 Vikings sit in the boat if Sven, Eric and Anders can only sit on the Starboard side while Bjorn and Lars can only sit on the port side? **3**

(c) A certain teacher has 3 pairs of identical shirts, each pair of a different colour. He wishes to hang them so that after each shirt is another one with a different colour. In how many ways can this be done? **2**

END OF EXAMINATION