JOHN MONASH SCIENCE SCHOOL

VICTORIAN CERTIFICATE OF EDUCATION

2023

STUDENT NAME:

TEACHER NAME: **BOHL CVEK FINS KERJ MCLS PHIN ROSP SCHP**
(please circle)

MATHEMATICAL METHODS UNIT 3

SAC 1 (Tech-Active)

DUNGEONS & DRAGONS

CHAPTER ONE: THE DUNGEON MATHTER

Reading Time: 15 minutes
Writing time: 120 minutes

QUESTION AND ANSWER BOOK

Number of Questions	*Number of questions to be answered*	*Number of marks*
5	5	63
		Total 63

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, set squares, aids for curve sketching, one set of regular sized D&D dice (that is 1 x d4, 1 x d6, 1 x d8, 1 x d10, 1 x d12 and 1 x d20), one bound reference, one school supplied laptop with Mathematica and any number of Mathematica files on a USB.
- Students are NOT permitted to bring into the examination: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question and answer book of 19 pages.
- Formula sheet

Instructions

- Write your name in the space provided above on this page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the test room.

Roll for initiative…

"You should try it" they said.

"It'll be fun" they said.

You find yourself sitting in a darkened room lit only by flickering candles that have layers upon layers of wax drips clinging to their sides from years of past use. You sit at an ancient looking table of dark grained wood, its surface scarred by scratches and dents. Around the table sit some other JMSS students you recognise from your Maths Methods class. In the centre of the table in front of you lies a map of some sort of dungeon.

At the head of the table, a cloaked figure sits watching you from under their hood. Their eyes occasionally glint as the light of the candles reflect off them. Suddenly, the hooded figure speaks with a heavily Americanised accent and strong lisp. "I am the Dungeon Mathter!" they tell you all. "Prepare yourthelvth for an adventure of math murder and mythtery."

You glance uncertainly at the other students around the table. They look as nervous as you feel. This is your first time participating in a Unit 3 and 4 Mathematical Methods Dungeons and Dragons SAC Campaign and it feels as though the butterflies in your stomach are not only fluttering about uncontrollably but that they have sharp cusps on the corner of their wings that are poking into your stomach whenever they collide with the stomach wall as well. You begin to question your life choices.

"ROLL FOR INITIAITIVE!" the Dungeon Mathter suddenly screams making you all jump in your seats. Unsure of what the Dungeon Mathter means, you copy what the other students are doing. You pick up your D20 dice and roll.

The campaign has begun…

Instructions

Answer **all** questions in the spaces provided.
In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Every good adventure begins in a Tavern.

This, apparently, is <u>not</u> a good adventure as it starts with you and your fellow adventures first having to travel through a dark and dangerous forest to find said tavern.

Question 1 (25 marks)

You and your band of adventurers are located on a road at the point O with coordinates $(0,0)$. You are attempting to travel to the Tavern located at point T with coordinates $(20,15)$ but there is a dark and dangerous forest that you must pass through along the way.

The upper boundary of the forest can be described by the function

$$u:(9,20)\to R, u(x)=\frac{5}{x-9}+12\,.$$

The lower boundary of the forest can be described by the function

$$l:(0,20)\to R, l(x)=\frac{1}{80}\left(x^3-30x^2+153x+1200\right).$$

The road upon which you are travelling makes a straight line through open land from point O to point P on the lower boundary of the forest at coordinates $\left(12,\frac{111}{20}\right)$. It then travels directly from point P to point Q on the upper boundary of the forest located at coordinates $\left(13,\frac{53}{4}\right)$. It then travels in a straight line from point Q to the Tavern located at point T.

The diagram below shows a birds-eye view of the road and forest. All distances are in km and the x-axis represents the distance towards the East and the y-axis represents the distance towards the North from your original starting point at point O.