JOHN MONASH SCIENCE SCHOOL

VICTORIAN CERTIFICATE OF EDUCATION

2024

STUDENT NAME:

TEACHER NAME: MAYR CVEK BERD KERJ MCLS XIAR SCHP
 (please circle)

MATHEMATICAL METHODS UNIT 3

SAC 1 (Tech-Active)

WILLY WONKERMOND AND THE CHOCOLATE FACTORY

PART 1

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	59
		Total 59

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, set squares, aids for curve sketching, 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.

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.

This page contains only white chocolate.

Charlethan Bucket is a poor, but hopeful, brave, wise and honest boy who lives with his mother and four grandparents. They don't have much money but support each other as best they can. On his way home from school one day, his newspaper route takes him past the gate of the town's mysterious, but highly regarded candy-maker, Willy Wonkermond's Chocolate Factory. As Charlethan peers through the gates, a tinker appears behind him and tells him that nobody ever goes into Wonkermond's Factory, and nobody ever comes out of it either.

Later that night, Charlethan's Grandpa JoeHill tells him that the tinker was right. Many years ago, other candy makers, especially Phil Schmidtworth, were sending in spies dressed as workers to steal Wonkermond's secret recipes. Finally, Wonkermond laid off all of his workers, closed the factory and vanished. Three years later, the factory started up again, and more candies and chocolates were coming out, but the gates stayed locked, so that no one would steal their recipes. The identities of Wonkermond's new workers remains a mystery.

The next day at school, word, news and announcements spread quickly that a contest has been launched, hidden among five out of billions of Wonkermond's chocolate bars are five golden tickets. The big prize is that those who find these tickets, will receive a lifetime supply of chocolate and get to visit Mr. Wonkermond's long-isolated factory for a free tour. The world then goes crazy, with Wonkermond chocolates being sold out at almost every store.

The first ticket is found by a greedy boy, named Dougustus Gloopericic. The second is found by a spoiled little girl named Verainy Salt, whose father utilized his peanut factory workers to open Wonkermond bars from dawn until dusk. The third is found by a girl named Kristina Beauregarde, who is an avid gum chewer. The fourth is found by a boy named McLean TeeVee, who is obsessed with guns and television, particularly westerns.

While these children claim the tickets in turn, and while various adults go to absurd lengths to find the tickets on their own, Charlethan spends his birthday money from Grandpa JoeHill to buy two Wonkermond bars, one at a time. Neither bar contains a ticket. But the bond between Charlethan and his Grandfather is all the stronger for trying.

Finally, a Paraguayan television network announces that a millionaire, living in the Andes, has claimed the fifth ticket. With (no more tickets to hunt for, the world gets back to normal. Charlethan is heartbroken at the chance he missed, but is back at school and then work the next day, doing his best to put it all behind him…

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.
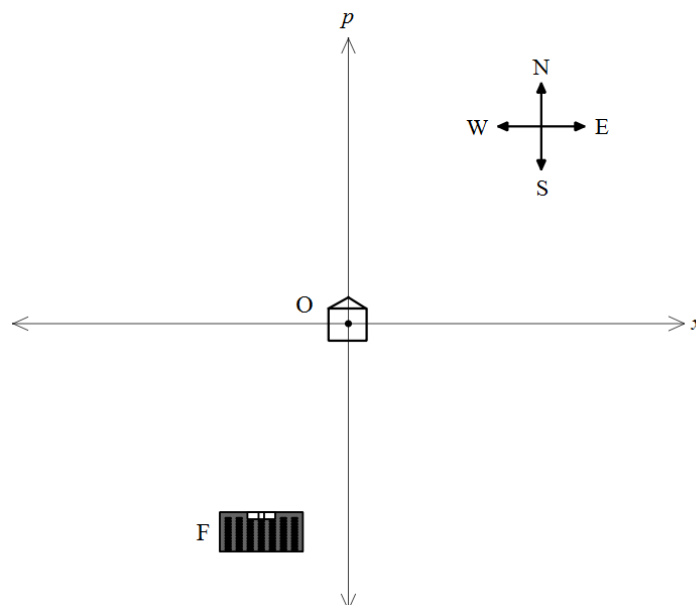
In questions where more than one mark is available, appropriate working **must** be shown.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (24 marks)

Charlethan is completing his daily rounds, delivering newspapers to nearby homes. As the work is rather dull and Charlethan is a very smart boy, he uses the time to mathematically model the path of his paper route.

Charlethan's home is located at the origin, $O(0,0)$. He walks from his home to the factory and then models his path with the function $p:[-3,\infty) \to R$, $p(x) = x^3 + 2x^2 + 1$, where $p(x)$ is the distance north of Charlethan's house and x is the distance east. All distances are measured in km.

The factory where Charlethan collects his papers is located 3 km west of his house at point *F*.

a.   State the coordinates of *F*.   1 mark

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b.   Find the straight-line distance, in km, between Charlethan's house and the factory.   1 mark

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