STUDENT NAME: ___________________________ **TEACHER:**_______________

VICTORIAN CERTIFICATE OF EDUCATION
2022

MATHEMATICS METHODS

School Assessed Coursework
Application Task

PRACTICE SAC 4: CALCULUS (CAS)

Reading time: 10 minutes

Total writing time: 80 minutes

QUESTION AND ANSWER BOOK

Structure of book

Number of questions	Number of questions to be answered
4 Extended Response Questions	4

Materials permitted

- CAS Calculator
- Log Book

Instructions

- Write your **name** and **teacher's name** in the space provided above on this page.
- All written responses must be in English.

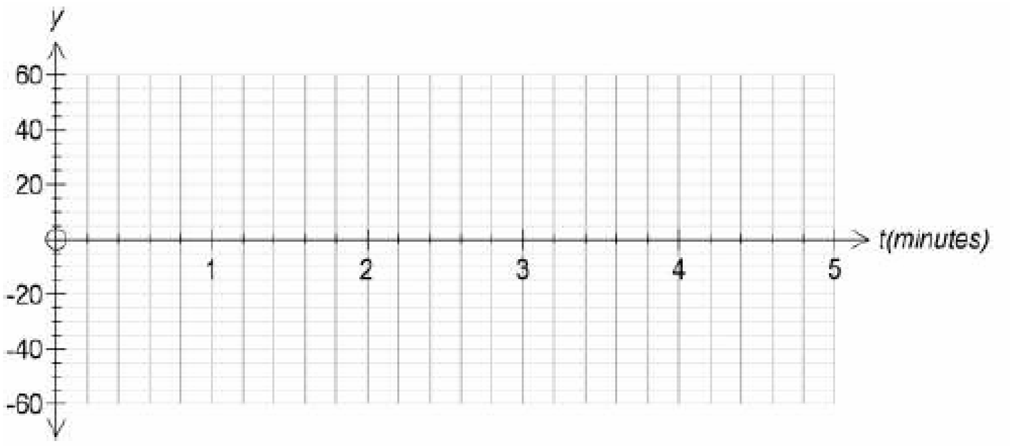
Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Question 1

Jacqueline is interested in exploring the polynomial function that represents a ride in a theme park. The ride **goes for 3 minutes** and follows the polynomial model:

Where is the height above the ground after minutes. The ride starts at a height of 59m.

a) Assume . Sketch the graph labelling key features, correct to two decimal places



b) Using the graph, explain what is happening during the first minute of the ride.

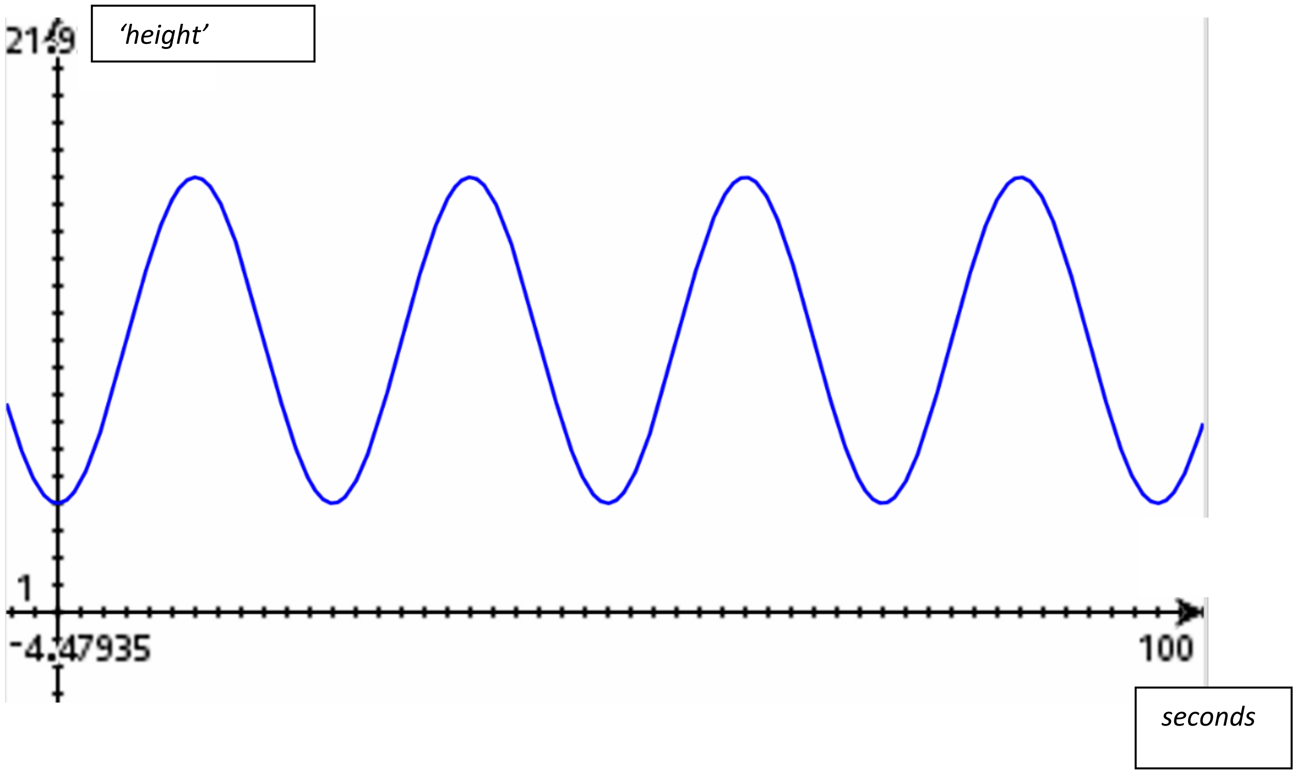
c) Find the rate of change of height and sketch a graph of this below, labelling key features correct to two decimal places.

d) Find the rate of change of height of the ride halfway through the ride

e) After how many minutes does the rate of change of height of the ride have a local maximum? Give your answer to the nearest second

Question 2

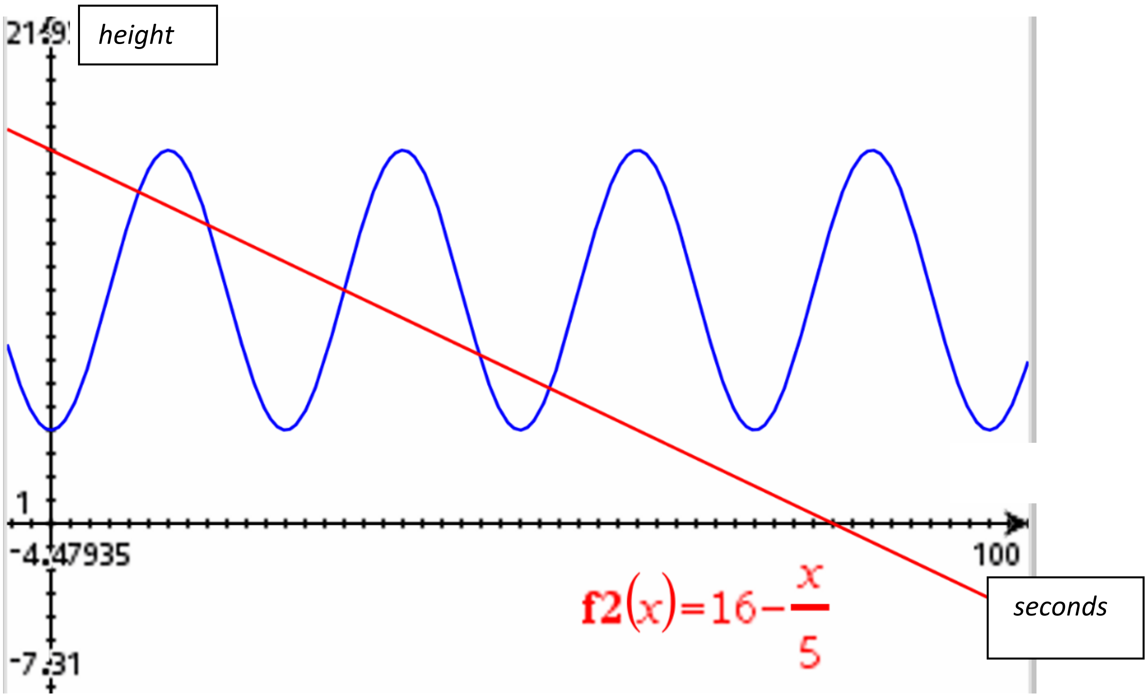
Genevieve is interested in finding the area between two rides. For the first ride, which follows a cosine rule, the height, metres, of a person above ground after seconds can be modelled by the following equation



b. Find the area bounded by this ride and the ground over the interval [0,90]

c. Find the average height of the person above ground level in the first 48 seconds

A cable ride, in the form of a straight line, is also shown below.



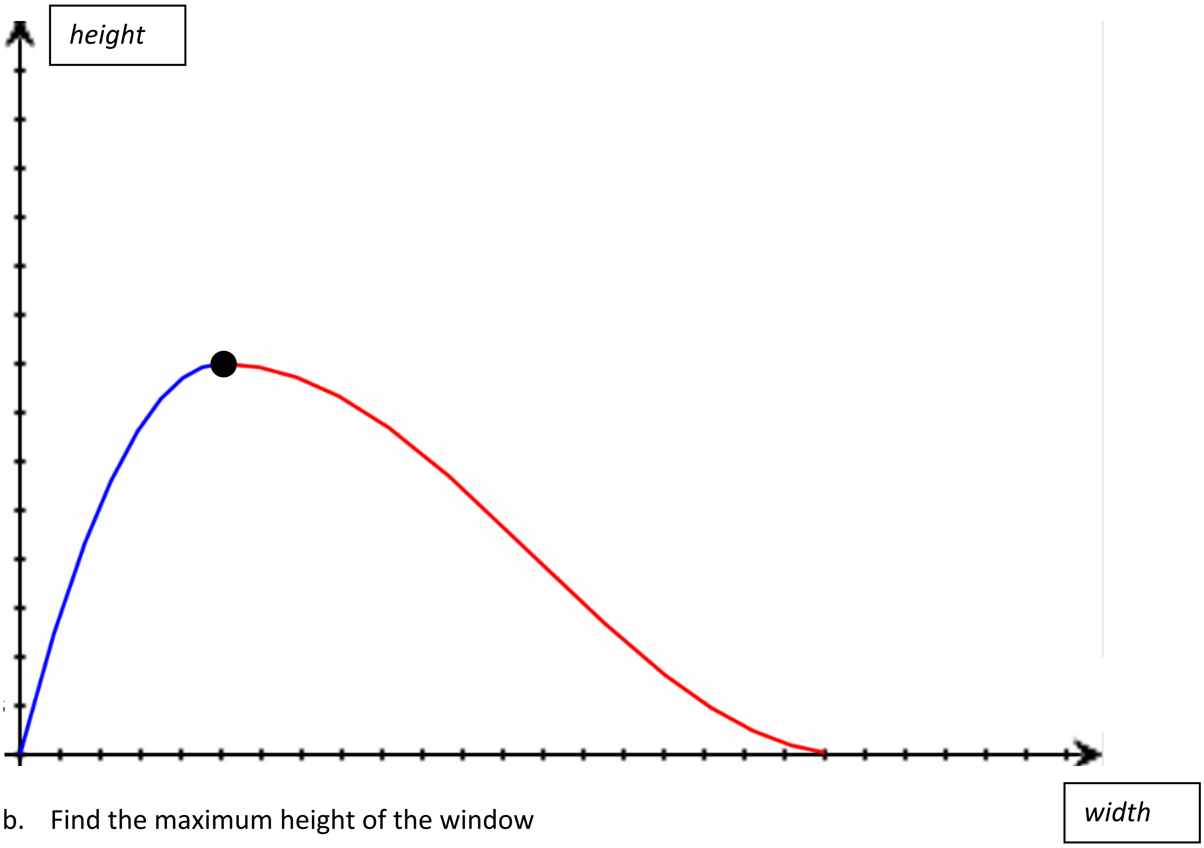
d. Find the times when both rides are at the same height

e. Write down an integral that finds the total area bounded by the two rides.

f. Hence, evaluate the area correct to two decimal places

Question 3

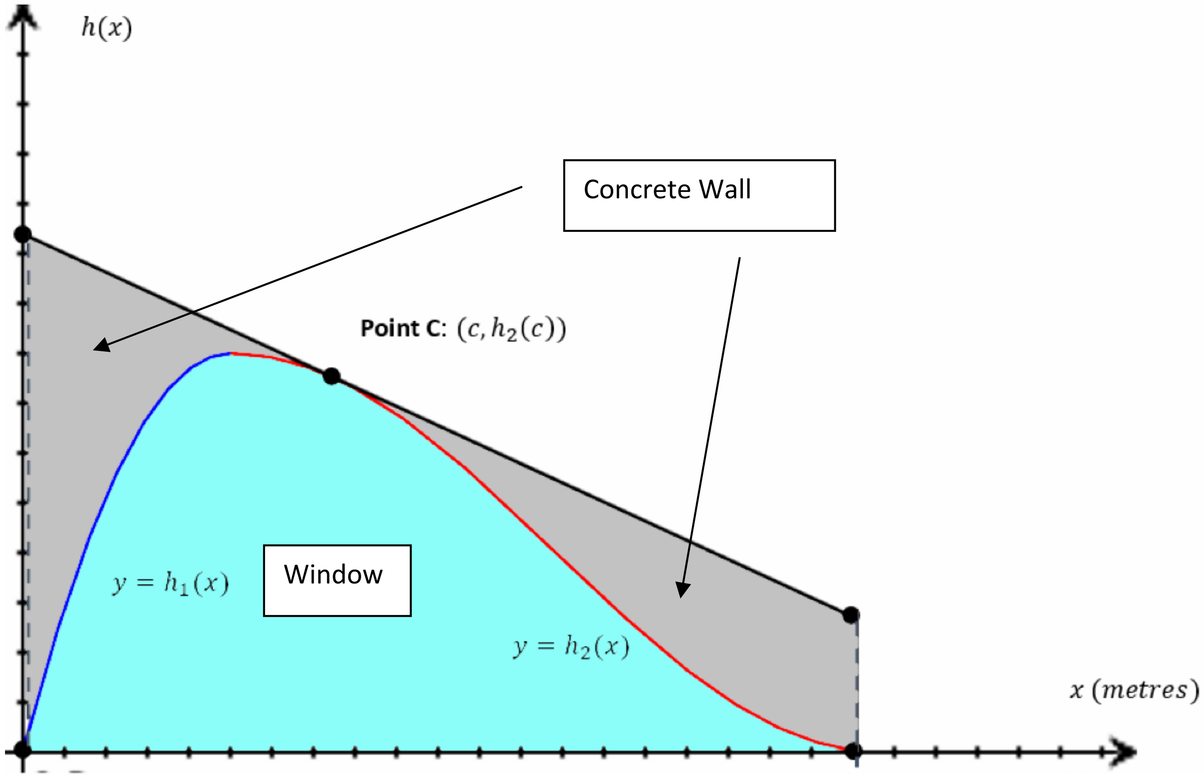
A window on a restaurant wall is in the shape of a wave which can be modelled by the two functions shown below. Let be the height above the ground, in metres; and be the width in metres.



b. Find the maximum height of the window

c. Using a width size of 0.5m, estimate the area of the window using the **left-endpoint rectangle** method of approximation. Give your answer to the nearest square metre

The concrete wall surrounding the window, is in the shape of a trapezium (as shown below) bounded by the axis and the tangent at point , where



d. Find the width, to the nearest metre, of the horizontal base of the window.

e. Find the equation of the tangent at point C if the -coordinate of point C is 1.5. Write the coefficients to two decimal places

f. Using the horizontal base found in question a or otherwise, create an integral that will calculate **only the area of the concrete section** of the wall (ie. do not include the window glass). (Note: Area of a trapezium is:)

g. Evaluate the integral to find the area of the concrete section of the wall to the nearest metre.

Question 4

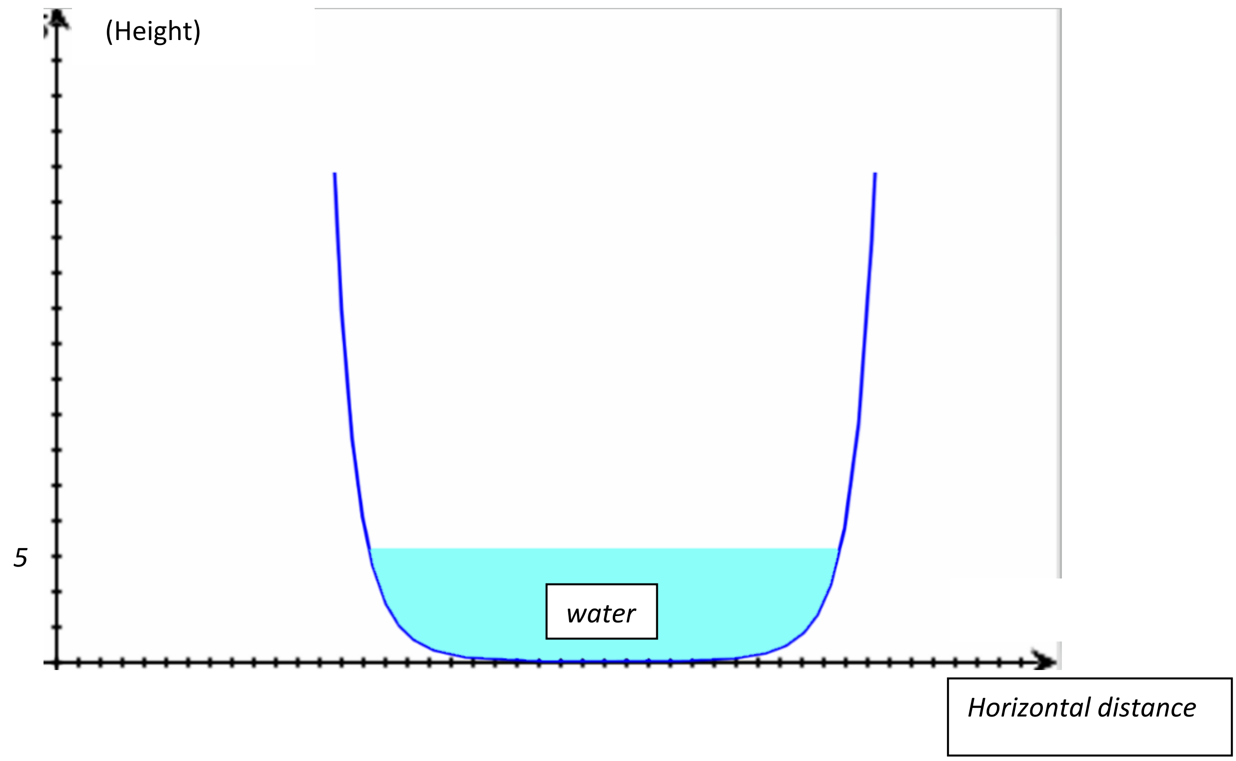
The seating arranged in stadiums are staggered so that the audience seats further away from the stadium are higher than those closest to stage (in the centre of the stadium) as shown below in a cross-section of the stadium:

An open stadium in the theme park can be modelled by the following rule:

Where is the height of a person above the ground level at a fixed point *O* when they are a horizontal distance of metres from O

a. Daphne is sitting at a height of 24m above the ground. How far away could she be horizontally from point *O*?

The audience seats in the stadium only start from 5 metres above the ground as the area below 5 metres is water as shown below: (diagram is not to scale)



b. Find the horizontal distances from point O for the start of the audience seats.

c. Calculate the total cross-sectional area of the water (i.e. the area that is shown in the graph above), correct to one decimal place