NAME: _____ **TEACHER:** _____

MELBOURNE HIGH SCHOOL

MATHEMATICAL METHODS UNIT 3
Formative Assessment task 1

DUE DATE: Monday 4th May, 3.30pm

Dear Mathematical Methods students,

This is a formative-assessment task that forms part of your school-assessed coursework for Methods 3/4. It is designed to prompt you to investigate a section of the course in greater depth.

We anticipate that there will be two such tasks for SAC 1, depending on the duration of school closures due to the COVID-19 pandemic. We are anticipating the assessment data from these tasks may be validated after normal school operations. This validation could take the form of Assessment task run concurrently under exam conditions for all students.

We encourage you to examine the material in detail – investigating, exploring, and testing conjectures – rather than completing the tasks in a rush with little thought. Do not copy somebody else's responses, because you will then not only break MHS and VCAA rules for school-assessed coursework (thereby exposing yourself to the consequences of doing so) but also forfeit the opportunities the task provides for you to learn concepts and practice mathematical and other skills that will be useful later in the course and in your university studies.

Please submit your completed tasks via Canvas. Either print a hard copy, complete it by hand, and submit a high-quality scan in pdf format (*not* a photograph taken with a mobile-phone camera), or else write in this document electronically using your touchscreen laptop and stylus and submit your work as a pdf via Canvas.

We encourage you to use any suitable technology. Consider using Mathematica (which is free to all Victorian students under licence from DET) and Desmos in addition to, or instead of, your CAS calculator. You may also choose to use the TI CAS computer software instead of the handheld calculator.

Kind regards,
Ms Rawson and the Mathematical Methods Team

Part A: Investigation

Consider the following function:

$f(x) = Ax^n \sin(mx)$, where A, n and m are all parameters to be investigated.

This is the product of 2 separate functions: $g(x) = x^n$, $n \in Z$ and $h(x) = A\sin(mx)$

Question 1:

Briefly describe how the value of $n \in Z$ effects the shape of the function $g(x) = x^n$.

Illustrate with 2 to 4 well-chosen graphs. Hint: $n \in Z$, therefore n can be positive and negative.

Question 2:

Briefly describe how the parameters A and m change the shape of the function $h(x) = A\sin(mx)$

Question 3: Sketch the product function $f(x) = Ax^n \sin(mx)$ when $A = m = n = 1$

Show key points on the sketch and choose an appropriate domain (No more than a domain of $x \in [-3\pi, 3\pi]$*) that highlights the key features.*

The key points of the function could include intercepts and turning points.
Describe if possible, the different effects each function $g(x)$ *and* $h(x)$ *has on the overall product function f(x).* All answers should be given to 3 decimal places

Question 4: Sketch the product function $f(x) = Ax^n \sin(mx)$ when $A = m = 1$ and $n = -1$.

Show key points on the sketch and choose an appropriate domain that highlights the key features.
The key points of the function could include intercepts and turning points.
Do the different effects of each function $g(x)$ *and* $h(x)$ *described in Q3 above still hold for this function f(x)?*
All answers should be given to 3 decimal places.

Question 5: Systematically investigate the parameters A, n and m, describe, using some mathematics how these parameters change the shape of the graphs.

(Use the mathematics you know ie dilations, translations, reflections, gradients, turning points and intercepts)

Sketch 2 or 3 graphs to support your comments.

Part B: The design

Choose the best parameter values that could model the side on view of the chair (as indicated by the blue line) in the picture below.
Sketch your model function; you may need to restrict the domain and you can include any translations that will assist with the model. Include all appropriate points on your sketch.
You may choose a different chair, but you will need a copy of the chair as well as the model function.