# Notice of Assessment Task
## Year 11 *Mathematics Advanced* 2025
## Functions Investigation

| Date of initial notification: | Date of submission of task: |
|---|---|
| Thursday 13 March 2025 | Thursday 27 March 2025 |
| Week 7, Term 1 | Week 9, Term 1 |

| Teacher: Mrs Habashi | Task Number: 1 |
|---|---|

| Time Allowed: 2 Weeks | Weighting of Task: 40% |
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**Course Component/Focus area/topic/module:**
F1.1 Algebraic Techniques, F1.2 Introduction to Functions
F1.3 Linear, Quadratic and Cubic Functions, F1.4 Further functions and Relations

**Task Description:**
This is a **take home task** that requires students to apply **algebraic and graphical techniques** to represent, analyse, and interpret a variety of functions. Students will demonstrate their understanding of key **function properties, transformations, and restrictions** by completing these three sections:

- <u>Section 1:</u> Assesses students' understanding of the fundamental **definition and characteristics of functions** through structured responses to four questions.
- <u>Section 2:</u> Evaluates students' ability to **identify and justify functions that satisfy specific criteria**, using appropriate mathematical reasoning and terminology.
- <u>Section 3:</u> Requires students to apply their knowledge of **different function types, transformations, and domain and range restrictions** to create an artwork using Desmos.

**How to submit:** Students need to submit a hard copy of their answers to questions in Section 1 & 2. For Section 3, students are required to submit their annotated sketch of their artwork plan, a table the records all the functions that they used with transformations and a link for teacher to view their Desmos artwork.

**Outcomes/Competencies to be assessed in this task:**
- Uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems **MA11-1**
- Uses the concepts of functions and relations to model, analyse and solve practical problems **MA11-2**
- Uses appropriate technology to investigate, organise, model and interpret information in a range of contexts **MA11-8**
- Provides reasoning to support conclusions which are appropriate to the context **MA11-9**

**Feedback: How will I receive feedback on this task?**

☐ Written
☐ Verbal
☐ Whole class

**Marking Rubric:**
Marks will be assigned based on the students' provided solutions and demonstrated working out, with reference to the marking rubric provided.

*If you are absent on the day that the task is due, you MUST see your teacher the next day (not your next lesson) that you are present at school to show your medical certificate or produce a misadventure form (refer to your Assessment Booklet for a copy of the form).*
*If you fail to show a medical certificate, marks will be deducted at 20% per day for the assessment task (please note that weekends count as two days). After the fifth day, if students have not completed the task, a mark of zero will be awarded and an N-Determination warning letter will be issued.*
*Exemptions and extensions for any other reason will only be determined at the discretion of the Head Teacher, and only in extenuating circumstances. You must advise the Head Teacher as soon as possible if you know you are unable to submit the task on the due date.*
*All appeals must be lodged within 48hrs of receipt of the task. Students who may consider an appeal are not permitted to take their task home. The original task cannot be altered in any way prior to the appeal process.* See Assessment booklet for details.

# Functions Investigation

**Section 1: Function Concepts**

Answer each question below and refer to the marking rubric for guidelines.

1. Briefly outline the different types of functions and provide examples for each.

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2. Describe the Vertical Line test and its purpose. Provide an example of a graph that passes the test and one that fail.

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3. Explain the algebraic and geometric differences between odd and even functions and provide examples of each.

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**Section 2: Identifying Functions**

In this section, you need to provide examples of functions that meet a certain criterion. You may also be expected to explain how your function satisfies the criteria.

1. Provide two examples of functions that satisfy the criteria below:
   - Odd function
   - Degree higher than 3
   - $x$-intercept of 3

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2. Give a function that satisfies the criteria below. Provide a brief explanation to explain how it meets each criterion.
   - Even function
   - Has a range $[a, \infty)$ where $a$ is a natural number.

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3. Give a function that satisfies the criteria below. Provide a brief explanation to explain how it meets each criterion.
   - Is many – to – many function
   - Has a range of $[-a, -b]$ where $a, b$ are natural numbers

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4. Give a function that satisfies the criteria below. Provide a brief explanation to explain how it meets each criterion.
   - Continuous, one – to – many function
   - Has 4 distinct intercepts (x or y – intercepts)

   Note: Leave answer in factored form.

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5. Give a function that satisfies the criteria below. Provide a brief explanation to explain how it meets each criterion.
   - Neither odd nor even
   - Has a restricted domain
   - Has a negative y-intercept

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**Section 3: Desmos Graphing Art**

In this section, you will use Desmos (online graphing calculator) to graph a variety of different functions with restricted domains and ranges to form a picture. Carefully follow the instructions below and refer to the marking rubric to guide your completion of this task.

Instructions on how to use Desmos:

1. Go to https://www.desmos.com/calculator and create a free account. This is necessary so that you can save your work. Be sure your username and password is school appropriate, and that you make note of it.

2. Use this link below if you have questions about how to create a particular graph. https://desmos.s3.amazonaws.com/Desmos_User_Guide.pdf
   HINT: Make sure that you read about sliders, they will help you quite a bit and can be used with either variables in the function or in the domain limits.

3. To limit the domain of a function:
   Type the function in, and then in curly brackets, type the limitation. For example if I want the quadratic parent function just between -2 and 2, I type: $y = x^2\{-2 \le x \le 2\}$. Try it and see how it works.

4. To shade a graph, write the function as an inequality.

**Task:**

You are to create an artwork using Desmos, online graphing calculator. Your ark work should contain 6 or more different functions and their transformations.

You will need to record:
   o   The equation of the function used.
   o   A description of the transformation.
   o   The equation of the transformed function.
   o   Record the information in a table like the example below

| Original Function | Description of the transformation | Equation of the transformed function |
|---|---|---|
| $x^2 + y^2 = 25$ | Origin is shifted right 2 and up 1 | $(x - 2)^2 + (y - 1)^2 = 25$ |

**Plan your artwork**

What, you say?  You are not an artist?  OK … let's brainstorm.  Maybe it is a logo for your favourite school or team.  Maybe it is a "shield" that represents who you are. Maybe it is a simple rendition of a piece of famous art. Maybe just simple patterns.

Create a simple pencil sketch work of your planned art on graph paper below.  Here's the catch … as you create your sketch, think about the functions you have learned (and their transformations).

Your Artwork must be original not a copy of the many artworks online that have been drawn on Desmos by other students.

**Create your Art on Desmos**
- Log in so that you will be able to save your work.
- Remember to limit the domain and range and to use the sliders
- You can change the colour of the lines you use.  Hold your cursor down on the colour button next to the equation and a menu of colours will pop up.  You can change your line from solid to dotted and change the colour.
- Make sure you refer to next page with the different function types as this will help you. Remember you should include 6 or more different function types.

**Submit your Artwork**

When your artwork is complete, use the share icon in the top right corner of the toolbar and email your graph to monica.sawiris1@det.nsw.edu.au or print it out, and submit with your assignment. If you choose to print out your artwork make sure that all your functions are visible.

Here's a fairly simple example of a design at:

https://www.desmos.com/calculator/6pwfnvhdei  (note the use of sliders and of domain limits).

Function Investigation - **Marking Rubric**

## Section 1: Function Concepts

| Question | Marks | | | | |
|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** |
| **1. Types of functions** | Does not provide correct answer or examples | Attempts to list some of the functions | Lists all the types of functions but does not provide examples | Lists all types of functions and attempts to provide examples for each. | Lists all types of functions and provides examples for each (no errors). |
| **2. Vertical Line Test** | Incorrect definition of vertical line test | Attempts to explain the vertical line test. Does not provide correct examples of functions that pass or fail. | Describes the vertical line tests and provides an example of a function that either passes or fails the test | Accurately describes the vertical line text and explains its significance. Provides a correct example of functions that pass and fail the test. | |
| **3. Odd & Even Functions** | Incorrect definition of odd or even function | Attempts to explain the difference between odd and even functions. | Explain the algebraic or geometric difference of odd and even functions with some examples. | Explains the algebraic and geometric difference between odd and even functions and provides an example for each. | |

**Total　　/10**

## Section 2: Identifying Functions

| Question | Marks | | | |
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| | **0** | **1** | **2** | **3** |
| **1.** | Provides functions that do not satisfy criteria | Provides one example of a function that meets criteria | Provides 2 functions that meet criteria | |
| **2.** | Provides a function that does not satisfy criteria | Gives an example of a function that satisfies criteria but with no explanation | Provides an example of function and attempts to explain how it meets each criterion. | Gives an example of a function with correct justification on how it meets each criterion |
| **3.** | Provides a function that does not satisfy criteria | Gives an example of a function that satisfies both criteria | Gives an example of a function with correct justification on how it meets each criterion | |
| **4.** | Provides a function that does not satisfy criteria | Gives an example of a function that satisfies both criteria | Gives an example of a function with correct justification on how it meets each criterion | |
| **5.** | Provides a function that does not satisfy criteria | Gives an example of a function that meets some of the criteria | Provides example of function that meets all criteria and attempts to explain how it meets each criterion. | Gives an example of a function with correct justification on how it meets all criteria. |

**Total        /12**

## Section 3: Desmos Graphing Art

| | Marks | | | |
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| | **0** | **1** | **2** | **3** |
| **Plan your art** | Does not provide sketch | Provides a sketch with no annotations of possible functions | Provide sketch and annotate possible functions for curves/lines | |
| **Use of function types** | Uses less than 3 function types | Use less than 5 function types | Uses 5 out of 12 function types | Uses 6 or more function types |
| **Describe the transformations for each function used** | Does not describe the transformation or is incorrect | Makes multiple errors | Makes a single error | Correctly described each transformation |
| **Uses all three types of transformations** | Does not use any transformation type | Uses only one type of transformation | Uses only two transformations | uses all three transformations at least once |
| **Includes inequalities so that the graph has shaded portions** | Does not use any inequalities | Uses one inequality | Uses two inequalities | Use three or more inequalities |
| **Includes different graphs** | Uses less than 10 graphs | Uses less than 15 graphs | Uses more than 15 graphs | Uses 20 or more graphs |
| **Restricted domain/range and uses sliders** | Does not use sliders and does not restrict domain/range | Limited use of domains /range and does not use sliders | Uses one or two sliders and restricts domain and range of some functions | Effective restricts domain and range of many functions and has many sliders |
| **Creativity and attention to detail** | Basic or simple artwork | Fair creativity and attention to detail | Good creativity and attention to detail | Very good creativity and attention to detail |

**Total        /23**

**Task Total        /45**