

| A               | T               | C              |
|-----------------|-----------------|----------------|
| $\overline{16}$ | $\overline{16}$ | $\overline{8}$ |

**Unit 6 Assignment**  
**Rates of Change and Combination of Functions**

- 1) Recall that two functions can be combined by adding, subtracting, multiplying, dividing or a process called composition.

[4T]

- a) Is it possible for two functions  $f$  and  $g$  where the domain for both functions are  $\{x \in \mathbb{R}\}$  such that when the two functions are combined, the domain of the resultant function is restricted? Justify your reasoning with an example. State the equation for each function, and the domain of the combined function.

[4T]

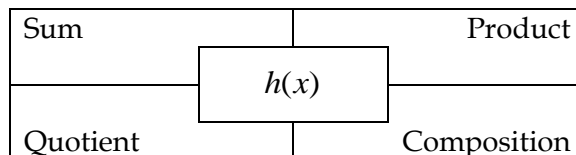
- b) Is it possible for two functions  $f$  and  $g$  where one of the domain is restricted such that when the two functions are combined, the domain of the resultant function is  $\{x \in \mathbb{R}\}$ ? Justify your reasoning with an example. State the equation and domain for each function and demonstrate why the resultant function is the domain  $\{x \in \mathbb{R}\}$ .

- 2) Create a function  $h(x)$ .

- a) Place  $h(x)$  in the center of the given chart. Then determine two functions  $f$  and  $g$  to express  $h(x)$  in each of the following way (note: the sets of functions  $f$  and  $g$  can be different in each part). Justify your solution with detail.

[8T]

- i. Sum  $h(x) = f(x) + g(x)$   
 ii. Product  $h(x) = f(x) \cdot g(x)$   
 iii. Quotient  $h(x) = \frac{f(x)}{g(x)}$   
 iv. Composition  $h(x) = f(g(x))$



[2A]

- b) Determine the average rate of change of your function  $h(x)$  for the interval  $-2 \leq x \leq 1$ . *If your function is undefined either at  $x = -2$  or  $x = 1$ , then pick a different interval.*

[2A]

- c) Estimate the instantaneous rate of change of your function  $h(x)$  at  $x = 1$ .

- 3) Create a function  $h(x)$  that is combined using at least two different **types** of functions.

[4A]

Sketch the graph of the function and describe its features and uniqueness in comparison to the original functions. (i.e. if  $f(x) = \sin x$ ,  $h(x)$  may have sinusoidal behaviours)

- 4) Provide an example of a **non-linear** application in the world where it can be modelled using a combination of functions. Provide a descriptive explanation of how the functions are combined and what each function represents in the context. Demonstrate the application using an equation as an example. (i.e. the application of music discussed in class)

[4A]

- 5) Sketch a possible graph for the function that satisfies all of the following criteria and justify your sketch by clearly labelling each of the given information.

[4A]

- ☐ Average rate of change = 5 for  $t \in [1, 5]$
- ☐ Average rate of change = -20 for  $t \in [1, 10]$
- ☐ Average rate of change = 0 for  $t \in [2, 9]$
- ☐ Instantaneous rate of change = -10 at  $t = 2$
- ☐ Instantaneous rate of change = 0 at  $t = 3$

**Unit 6 Assignment**  
*Rates of Change and Combination of Functions*

| <b>Thinking</b>                        |            |
|--|------------|
| 1a) Resultant has restricted domain    | /4         |
| 1b) Resultant has no restricted domain | /4         |
| 2a) i) Sum                             | /2         |
| 2a) ii) Product                        | /2         |
| 2a) iii) Quotient                      | /2         |
| 2a) iv) Composition                    | /2         |
| <b>Total</b>                           | <b>/16</b> |

| <b>Application</b>          |            |
|-----------------------------|------------|
| 2b) AROC                    | /2         |
| 2c) IROC                    | /2         |
| 3) Features and Uniqueness  | /4         |
| 4) Application in the World | /4         |
| 5) Sketch a possible graph  | /4         |
| <b>Total</b>                | <b>/16</b> |

**Communication**

These marks will be awarded for mathematical form and presentation of solutions.

Checklist:

- |  |   |
|--|---|
| <input type="checkbox"/> Graphical representation presents good mathematical form  | <input type="checkbox"/> Adequate amount of work shown                      |
| <input type="checkbox"/> Symbols and notations are used effectively and accurately | <input type="checkbox"/> Work follows good mathematical form and convention |
| <input type="checkbox"/> Good use of brackets and equal signs                      | <input type="checkbox"/> Proper and appropriate units used                  |
| <input type="checkbox"/> Work is easy to follow                                    | <input type="checkbox"/> Final statements provided where appropriate        |