

**MATH 110-001 HOMEWORK 2**  
**Due date: Friday, October 13, 2017**

*Hand in full solutions to the questions below. Make sure you justify all your work and include complete arguments and explanations. Your answers must be clear and neatly written, as well as legible (no tiny drawings or micro-handwriting please!). Your answers must be stapled, with your name and student number at the top of each page.*

1. The position of the newest space rocket made by SpaceX can be described by the function

$$h(t) = t^2 + \frac{1}{t}$$

where  $t$  is time in seconds, and  $h(t)$  is the position of the rocket in meters.

- a) Use the limit formula to find the instantaneous rate of change in position at exactly  $t=10$ .
- b) What is the unit to your answer in a)?

2. For the function  $g(t)$  with:

- Domain= $\mathbb{R}$ ,
- For any value of  $t$ ,  $g(t) \neq -1$

as well as the following properties:

- |   |   |
|---|---|
| i) $g(0) = g(5)$                          | ii) $\lim_{t \rightarrow 0} g(t) = 4$   |
| iii) $\lim_{t \rightarrow 5^-} g(t) = -1$ | iv) $\lim_{t \rightarrow 5^+} g(t) = 3$ |

- a) Sketch the graph of  $g(t)$ .
- b) Find an algebraic formula for  $g(t)$ .

3. Let  $f(x)$  be the function defined by:

$$f(x) = \begin{cases} -x - 4 & x < -4 \\ 2ax^2 + b & -4 \leq x < 5 \\ 11 + \frac{3}{2}x & x \geq 5 \end{cases}$$

Find the values of  $a$  and  $b$  such that this function is continuous over all  $\mathbb{R}$ .

4. You are playing Bumper Cars at PNE with your friend. The position of your and your friend's cars can be described by

Your car:  $f(t) = \sqrt[3]{t}$   
Your friend's car:  $g(t) = 1 - t$

Will you bump into each other? Make sure to state any assumptions you are making, or any theorems you are using.