Name: _____**MCV4U - Unit 3 Assignment – Rates of Change 35A 18C**

MULTI PART QUESTION

A science project studying catapults sent a projectile into the air with an initial velocity of 55 m/s. The formula for height (s) in meters with respect to time in seconds is $s = -4.9t^2 + 55t$.

1. Calculate the average rate of change of the height over the intervals listed. [A4 2C]

a) t=3 to t=5 b) t=4 to t=5 c) t=4.5 to t=5 d) t=4.9 to t=5

2. What do you think might be happening close to t=5? Why? [1A 3C]

3. At what time does the rocket reach its maximum height? Give an algebraic (non-Calculus) solution. [3A 2C]

4. a. Find the formula for the instantaneous rate of change (and thus the velocity at any time) using $\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$ [3A 1C]

b. Using the answer in 4a, find the instantaneous rate of change at:
i) t = 3 [2A] ii) t = 5 [2A]

c. Show/solve how you would use this to determine the time of the maximum height. [3A 2C]

5. For the function $f(x) = 2x^3 - 8x^2 + 3$, calculate $\frac{f(a+h)-f(a)}{h}$ where $a = 5$ and

   a. $h = 2$ b. $h = 0.5$

   Simplify the expression before substituting. [5A 2C]

6. Using the graph of the function $f(x) = x^3 - 2x + 1$ *(you may use Desmos and other graphing tools for this question) (6C overall)*

i. Find approximate *x* values for any local maximum or local minimum points. [2A]

ii. Set up a table showing intervals of increase or decrease and the slope of the tangent on those intervals. [4A]

iii. Set up a table of values showing *"x"* and its corresponding "slope of tangent" for at least 7 points [3A]

iv. Sketch the graph of the derivative using the table of values from (iii) (save and include the graph in your submission) [3A]