Name: ____________________________________ Date: _____________________________

Knowledge (23)	Application (20)	Communication (19)

Show ALL work for full marks.

1. Describe the process/principles of calculating derivatives (instantaneous rate of change) from first principles. Use a sketch to assist your explanation (5C)

2. Determine the slope of the tangent of each function at the given x value from first principles [1C each]

a) [3K] x^2 at x = -2

b) [4K] $2x^2-4x+3$ at x = 4

c) [4K] $\sqrt{(x-12)}$ at x=37

3. Determine the derivative for the following functions from first principles [4K 1A 2C each]

a) $4x^3 - 12x + 2$

b) $\frac{4}{2-x}$

4. A) [3A 1C] For the function $f(x) = 2x^2 - 8x + 3$, determine a simplified expression for

$$\frac{f(a+h)-f(a)}{h}$$

a) Evaluate where [2K each]

i) a = 3, h = 2

ii) a = -2, h = 0.5

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5. A weather balloon is rising vertically. After t hours, its distance above the ground, measured in kilometres, is given by the formula $s(t) = 15t - 1.5\,t^2$

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 5a, find the instantaneous rate of change at: [1C total]

i) t = 2 [2A]

ii) t = 7 [2A]

c. Determine the maximum height and the time it occurs. [4A 2C]

d. Set up an interval table showing increase or decrease of the function and the sign of the slope of the tangent on those intervals. [4A 2C]