MAT1330 D - Assignment 7 - Winter 2016 (due March 30th at 16 :00)

Calculus for the Life Sciences I

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Last name :_____ First name :_____

Student number :_____ DGD number : 1 2

1. (a) State the Mean Value Theorem.

   (b) Given a function $f(x)$ such that : $0 < f'(x) < 1$ for all $x \in \mathbb{R}$. Show that

   $$0 < f(10) - f(1) < 9.$$

2. (a) State Rolle's Theorem.

   (b) Show that $f(x) = \sqrt{16 - x^2}$ satisfies the conditions of Rolle's Theorem on the interval [-2, 2]. Then find all numbers c that satisfy the conclusion of Rolle's Theorem.

3. Let $f(x) = 1 - (2 - x)^{2/3}$

   (a) Show that $f(1) = f(3)$.

   (b) Show that $f'(c) \neq 0$ for all $c \in (1, 3)$.

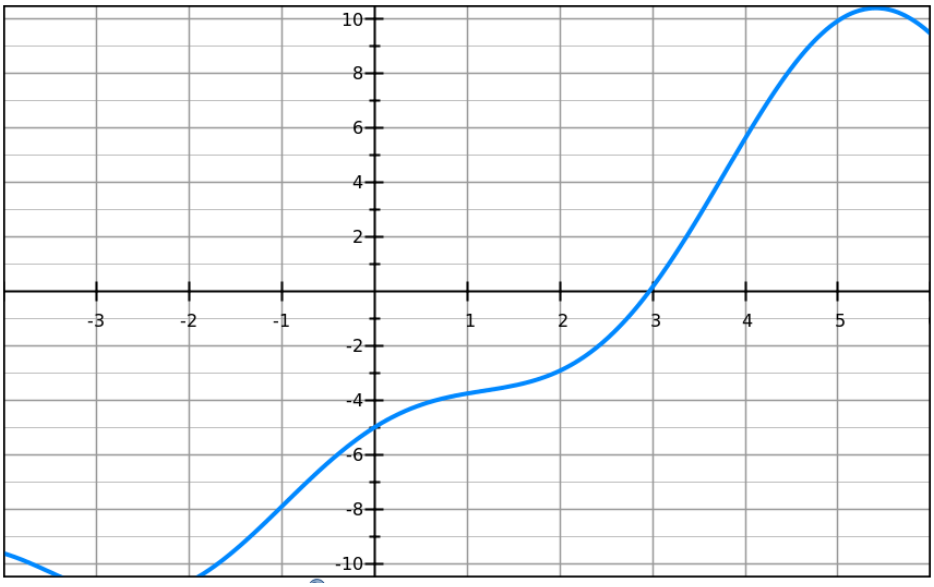
   (c) Does this contradict Rolle's theorem ? Justify your answer.

4. Let $f(x) = x^3 + 7x^2 - 5$ and $g(x) = 5 - x - 2x^2$. Use the Intermediate Value Theorem to show that the graphs of f and g intersect.

5. Use Newton's Method to approximate $\sqrt{3}$. (Hint : Use $f(x) = x^2 - 3$ with $x_0 = 1$)

6. The graph of $f(x) = 2x+x\sin(x+3)-5$ is given below. Use Newton's Method to approximate the root of $f(x)$ to 7 significant digits.

FIGURE 1 – The graph of $f(x) = 2x + x\sin(x + 3) - 5$ for $-4 \leq x \leq 6$



Sir Isaac Newton (1642–1727) An English mathematician and scientist known as the co-inventor of calculus. In a 2-year period from 1665 to 1667, Newton made major discoveries in several areas of calculus, as well as optics and the law of gravitation. Newton's mathematical results were not published in a timely fashion. Instead, techniques such as Newton's method were quietly introduced as useful tools in his scientific papers. Newton's *Mathematical Principles of Natural Philosophy* is widely regarded as one of the greatest achievements of the human mind.