UNIVERSITI SAINS MALAYSIA

First Semester Examination
2013/2014 Academic Session

Jan 2014

MAA 101 - Calculus For Science Students
[Kalkulus Untuk Pelajar Sains]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of <u>SEVEN</u> pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi <u>TUJUH</u> muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **all six** [6] questions.

[**_Arahan:_**   *Jawab **semua enam** [6] soalan.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

SECTION A (40 marks) Write down your answer in OMR form.

1. Let $f(x) = -\dfrac{21}{x}$. What is the value of $f(-\dfrac{1}{3})$?

   (A) -63　　　(B) 63　　　　(C) 7　　　　(D) -7

2. Evaluate $\lim\limits_{t \to -2} \dfrac{\sqrt{x^2}}{|x|}$.

   (A) -1　　　(B) 1　　　　(C) 0　　　(D) Does Not Exists

3. Find $\lim\limits_{h \to 0} \dfrac{f(1+h) - f(1)}{h}$ if $f(x) = 2x^5 - 3x + 1$.

   (A) 1　　　(B) 0　　　(C) -3　　　(D) 7

4. What is the domain of $f(x) = \sqrt{1 - x^2}$

   (A) $(-\infty, -1] \cup [1, \infty)$　　　(B) $[-1,1]$　　　(C) $(-1,1)$　　　(D) $[0,1]$

5. Find the slope of the curve $4y^4 + 5x^8 = 3y + 6x$ at the point $(0,0)$.

   (A) -1　　　　　(B) 2　　　(C) -2　　　(D) UNDEFINED

6. Which one is concave up in an interval containing $x = 0$.

   (A) x^3　　　(B) $\cos x$　　　(C) x^2　　　(D) x

7. Find the value of m so that the function $f(x) = \begin{cases} x^2 + 1, & x \geq 1 \\ 3mx + m, & x < 1 \end{cases}$ is continous at $x = 1$.

   (A) 1　　　(B) 2　　　(C) $\dfrac{1}{2}$　　　(D) no such m exists.

8. Let f be a function given by $f(x) = \begin{cases} 6 - x^2, & x \geq 2 \\ 7 - 2x, & x < 2 \end{cases}$.

   At $x = 2$ the function is

   (A)　differentiable.
   (B)　continuous but not differentiable.
   (C)　differentiable but not continuous.
   (D)　not diffrentiable and not continuous.

9. Let f be differentiable at $x = 3$, and $\lim\limits_{x \to 3} \dfrac{f(x) - f(3)}{x^2 - x - 6} = 1$. Find $f'(3)$.

      (A) -5 (B) 5   (C) $\dfrac{1}{5}$ (D) $-\dfrac{1}{5}$

10. Evaluate $\int_0^1 f(2x)\,dx$ if $\int_0^2 f(x)\,dx = 4$.

      (A) 4   (B) 2   (C) 0   (D) $\dfrac{1}{4}$

11. Evaluate $\int_{-\pi}^{\frac{\pi}{2}} (\cos x)\,dx$.

      (A) 2   (B) 0   (C) 1   (D) -1

12. Evaluate $\int_{-2}^{2} \dfrac{x}{x^2 + 2}\,dx$.

      (A) 4   (B) 2   (C) 0   (D) $2\ln 6$.

13. Evaluate $\int_{2}^{2} \dfrac{e^x}{x^5 + 2}\,dx$.

      (A) 4   (B) 0   (C) 1   (D) 2

14. Evaluate $\int_{1}^{e^2} \dfrac{1}{x}\,dx$.

      (A) 0   (B) 1   (C) 2   (D) e

15. Let $f'(t)$ be a continuous function and using the table below evaluate $\int_{-1}^{3} f'(t)\,dt$.

t	-1	0	2	3
$f(t)$	2	1	-2	5

      (A) 2   (B) 4   (C) -3 (D) 3

16. $\lim\limits_{h \to 1^+} \dfrac{1 - h}{|1 - h|} = 1$

      (A) TRUE   (B) FALSE

17. If $f(x)$ and $g(x)$ are two odd functions then $h(x) = f(x) + g(x)$ is also an odd function.

      (A) TRUE   (B) FALSE

18. If $f(x) = \dfrac{x^2}{2}$ then $\int_0^1 f(1)\,dx = \dfrac{1}{6}$.

      (A) TRUE   (B) FALSE

19. If $f(x) = \int\limits_{1}^{3x} (t^2 + \sqrt{t})dt$ where $x \geq 0$, then $f(x)$ is not differentiable.

    (A)   TRUE   (B)   FALSE

20. If given a function $f(x)$ such that $f(2) = 2$ and $f'(x) = \sqrt{5 + x^2}$, then the estimated value of $f(2.01)$ is 2.03.

    (A)   TRUE   (B)   FALSE

SECTION B (60 marks)

1.   (a) Let $f(x) = \begin{cases} x^2, & x \geq -1 \\ \dfrac{|x|}{x} + a, & x < -1 \end{cases}$

    (i) Find $\lim\limits_{x \to -1^+} f(x)$.

    (ii) What is the value of a if f is continuous at $x = -1$?

                                                                     [8 marks]

    (b) Find the following limits if exist.

      (i) $\lim\limits_{t \to 0} \dfrac{1 - t^2}{t - 1}$

      (ii) $\lim\limits_{t \to 1} \dfrac{1 - t^2}{t - 1}$

      (iii) $\lim\limits_{x \to -\infty} \dfrac{(\sqrt{x^2 + x} - x)}{x}$

                                                                      [12 marks]

2.   (a) (i) Evaluate $\int\limits_{1}^{2} x\sqrt{x-1}\, dx$.

      (ii) Let $f(x) = \begin{cases} \dfrac{x^3}{|x|}, & x \neq 0, \\ 0, & x = 0. \end{cases}$

        Evaluate $\int\limits_{-1}^{1} f(x)\, dx$.

                                                                        [10 marks]

(b) Let $f(x) = x^3 + x^2 - x - 2$.

   (i) Find the critical numbers of f.

   (ii) Find the local maximum and local minimum of f.

<div align="right">[10 marks]</div>

5.   Let $\Re$ be the region bounded by the graphs of $f(x) = 2x^2 - 1$ and $g(x) = x.$

   (a) Find the area of $\Re$.

<div align="right">[8 marks]</div>

   (b) Find the volume of a solid obtained by rotating the region $\Re$ about the line $y = -1$.

<div align="right">[12 marks]</div>