UNIVERSITI SAINS MALAYSIA

First Semester Examination
2012/2013 Academic Session

January 2013

MAA 101 – Calculus for Science Students I
[Kalkulus untuk Pelajar Sains I]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of FIVE pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **all nine** [9] questions.

*[**Arahan:** Jawab **semua sembilan** [9] 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].

1. Identify the values of x for which $\frac{3}{x-1} < \frac{2}{x+1}$.

[7 marks]

1. Kenalpasti nilai-nilai x yang mana $\frac{3}{x-1} < \frac{2}{x+1}$.

[7 markah]

2. Show that $f(x) = \begin{cases} x^2 - 2, & x \le 1 \\ x - 2, & x > 1 \end{cases}$ is continuous but not differentiable at $x = 1$.

[10 marks]

2. Tunjukkan bahawa $f(x) = \begin{cases} x^2 - 2, & x \le 1 \\ x - 2, & x > 1 \end{cases}$ *adalah selanjar tetapi tidak terbezakan pada* $x = 1$.

[10 markah]

3. Evaluate, if it exists.

(a) $\lim_{x \to 0} (1 - 2x)^{1/x}$

(b) $\lim_{\theta \to \pi/2} \frac{1 - \sin\theta}{1 + \cos 2\theta}$

(c) $\lim_{x \to \sqrt{5}} g(x)$ where $\lim_{x \to \sqrt{5}} \frac{1}{x + g(x)} = 2$.

[15 marks]

3. Nilaikan, jika ianya wujud.

(a) $had_{x \to 0} (1 - 2x)^{1/x}$

(b) $had_{\theta \to \pi/2} \frac{1 - \sin\theta}{1 + \cos 2\theta}$

(c) $had_{x \to \sqrt{5}} g(x)$ *yang mana* $had_{x \to \sqrt{5}} \frac{1}{x + g(x)} = 2$.

[15 markah]

4. Suppose that $f'(x) \le 1$ for $1 \le x \le 4$. Show that $f(4) - f(1) \le 3$.

[5 marks]

4. Katakan $f'(x) \le 1$ bagi $1 \le x \le 4$. Tunjukkan bahawa $f(4) - f(1) \le 3$.

[5 markah]

5. Let $f(x) = 2 - x$ and $g(x) = \begin{cases} -x, & -2 \le x < 0 \\ x - 1, & 0 \le x \le 2 \end{cases}$.

Evaluate:

(a) $f\left[g\left(\frac{1}{2}\right)\right]$ (b) $g[f(0)]$

[4 marks]

5. Biar $f(x) = 2 - x$ dan $g(x) = \begin{cases} -x, & -2 \le x < 0 \\ x - 1, & 0 \le x \le 2 \end{cases}$.

Nilaikan:

(a) $f\left[g\left(\frac{1}{2}\right)\right]$ *(b)* $g[f(0)]$

[4 markah]

6. The graphs of $y = \sqrt{x}$ and $y = 3 - x^2$ intersect at one point $x = r$. Use the Newton's method to estimate the value of r correct to four decimal places.

[7 marks]

6. Graf $y = \sqrt{x}$ dan $y = 3 - x^2$ bersilang pada satu titik $x = r$. Gunakan kaedah Newton untuk menganggar nilai r tepat kepada empat tempat perpuluhan.

[7 markah]

7. Let $f\ x = 1 + \frac{1}{x} + \frac{1}{x^2}$. Find,

(a) the domain and all the asymptotes.
(b) the intervals on which f is increasing or decreasing.
(c) the local maximum and minimum value of f, if any.
(d) the intervals of concavity and inflection points, if exists.

Hence, sketch the graph of f.

[20 marks]

7. Biar $f\ x = 1 + \frac{1}{x} + \frac{1}{x^2}$. *Dapatkan,*

(a) domain dan semua asimptot.
(b) selang yang mana f *adalah menokok atau menyusut.*
(c) nilai maksimum dan minimum tempatan bagi f*, jika ada.*
(d) selang kecekungan dan titik lengkok balas, jika wujud.

Seterusnya, lakarkan graf bagi f.

[20 markah]

8. Evaluate the integrals.

(a) $\int \frac{x}{x^2 + 4x + 3}\, dx$

(b) $\int \frac{\sin^3 \sqrt{x}}{\sqrt{x}}\, dx$

(c) $\int_1^4 \sqrt{x} \ln x\, dx$

[20 marks]

8. Nilaikan kamiran.

(a) $\int \frac{x}{x^2+4x+3}\,dx$

(b) $\int \frac{\sin^3 \sqrt{x}}{\sqrt{x}}\,dx$

(c) $\int_1^4 \sqrt{x}\ln x\,dx$

[20 markah]

9. Set up, but do not evaluate the integral for

(a) the volume of the solid generated by revolving the region in the first quadrant bounded by the curve $y = x^2$, the x - axis and the line $x = 1$ about the line $x = -1$.

(b) the area of the region bounded by $y^2 = 4 - x$ and $x + 2y - 1 = 0$.

(c) the length of the curve $y = \int_0^x \sqrt{\cos 2t}\,dt$ from $x = 1$ to $x = \pi/4$.

[12 marks]

9. Nyatakan kamiran, tanpa menilaikannya bagi

(a) isipadu pepejal yang dihasilkan dengan memutar rantau dalam sukuan pertama yang dibatasi oleh lengkung $y = x^2$, *paksi - x dan garis* $x = 1$ *sekitar garis* $x = -1$.

(b) luas rantau yang dibatasi oleh $y^2 = 4 - x$ *dan* $x + 2y - 1 = 0$.

(c) panjang lengkung $y = \int_0^x \sqrt{\cos 2t}\,dt$ *dari* $x = 1$ *ke* $x = \pi/4$.

[12 markah]

- ooo O ooo -