
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2011/2012 Academic Session

January 2012

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 ten** [10] questions.

[Arahan: Jawab **semua sepuluh** [10] 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. Solve $|2x-1| - |x+5| = 3$.

[10 marks]

1. Selesaikan $|2x-1| - |x+5| = 3$.

[10 markah]

2. Determine whether $f(x) = \frac{x+3}{x-2}$, $x \neq 2$, is one-to-one function. If yes, find its inverse, domain and range.

[8 marks]

2. Tentukan sama ada $f(x) = \frac{x+3}{x-2}$, $x \neq 2$, adalah fungsi satu-ke-satu. Jika ya, dapatkan songsangan, domain dan julatnya.

[8 markah]

3. Evaluate, if it exists.

(a) $\lim_{x \rightarrow -2} \left(\frac{1}{x+2} + \frac{4}{x^2-4} \right)$

(b) $\lim_{x \rightarrow \infty} \sqrt{\frac{x+8x^2}{2x^2-1}}$

(c) $\lim_{x \rightarrow 0} \frac{e^x - 1 + x}{x^2}$

[10 marks]

3. Nilaikan, jika ianya wujud.

(a) $\lim_{x \rightarrow -2} \left(\frac{1}{x+2} + \frac{4}{x^2-4} \right)$

(b) $\lim_{x \rightarrow \infty} \sqrt{\frac{x+8x^2}{2x^2-1}}$

(c) $\lim_{x \rightarrow 0} \frac{e^x - 1 + x}{x^2}$

[10 markah]

4. Given $f(x) = x^3 - 8x + 10$. Show that there exists a value c for which $f'(c) = \pi$.
[4 marks]

4. Diberi $f(x) = x^3 - 8x + 10$. Tunjukkan bahawa wujud nilai c sedemikian $f'(c) = \pi$.
[4 markah]

5. Let $f(x) = x^2 + \frac{2}{x}$. 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]

5. Biar $f(x) = x^2 + \frac{2}{x}$. Dapatkan,
(a) domain dan semua asimptot.
(b) selang yang mana f adalah menaik 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]

6. Evaluate the integrals:

(a) $\int \frac{2x^3 - 2x^2 + 1}{x^2 - x} dx$

(b) $\int \frac{\ln x}{x^2} dx$

(c) $\int_0^{2\pi} \frac{\cos x}{\sqrt{4 + 3\sin x}} dx$

[20 marks]

6. *Nilaikan kamiran:*

(a) $\int \frac{2x^3 - 2x^2 + 1}{x^2 - x} dx$

(b) $\int \frac{\ln x}{x^2} dx$

(c) $\int_0^{2\pi} \frac{\cos x}{\sqrt{4 + 3\sin x}} dx$

[20 markah]

7. Find an equation of tangent line to the curve $2xy + \pi \sin y = 2\pi$ at the point $1, \pi/2$.

[7 marks]

7. *Dapatkan persamaan garis tangent ke lengkungan $2xy + \pi \sin y = 2\pi$ pada titik $1, \pi/2$.*

[7 markah]

8. Let f be a function for which $f(1) = 2$ and $f'(1) = -1/2$. If $g(x) = x^5 + f x^{-2}$, find $g'(1)$.

[5 marks]

8. *Biar f merupakan fungsi yang mana $f(1) = 2$ dan $f'(1) = -1/2$. Jika $g(x) = x^5 + f x^{-2}$, dapatkan $g'(1)$.*

[5 markah]

9. Show that the function $f(x) = \begin{cases} 5-x, & x < 4 \\ \frac{1}{5-x}, & x \geq 4 \end{cases}$ is not differentiable at $x = 4$.

[5 marks]

9. *Tunjukkan bahawa fungsi $f(x) = \begin{cases} 5-x, & x < 4 \\ \frac{1}{5-x}, & x \geq 4 \end{cases}$ tidak terbezakan pada $x = 4$.*

[5 markah]

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

- (a) the volume of the solid obtained by rotating the region bounded by the line $x = -1$, the x - axis and $y = -x^3$ about the line $x = -2$.
- (b) the area of the surface obtained by rotating the curve $xy = 1$, $1 \leq y \leq 2$ about the y - axis .
- (c) the length of the curve $x = \int_4^y \sqrt{\sec^2 t - 1} dt$, $-\pi/3 \leq y \leq \pi/4$.

[11 marks]

10. Nyatakan kamiran, tanpa menilaikannya bagi

- (a) isipadu pepejal yang dihasilkan dengan memutar rantau yang dibatasi oleh garis $x = -1$, paksi - x dan $y = -x^3$ sekitar garis $x = -2$.
- (b) luas permukaan yang dihasilkan dengan memutar lengkung $xy = 1$, $1 \leq y \leq 2$ sekitar paksi - y .
- (c) panjang lengkung $x = \int_4^y \sqrt{\sec^2 t - 1} dt$, $-\pi/3 \leq y \leq \pi/4$.

[11 markah]