MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER JULY/AUGUST 2024 (TERM ID 2420)

CMT1124 – MATHEMATICS II

(All Sections / Groups)

5 OCTOBER 2024
9:00 a.m. - 11:00 a.m.
(2 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 5 pages with 9 Questions only in 2 Sections.
2. Answer **ALL** questions in Section A. This section carries 60 marks.
3. Answer any **TWO** out of THREE questions in Section B. This section carries 40 marks.
4. Please write all your answers in the Answer Booklet provided.

SECTION A (ANSWER ALL QUESTIONS)

QUESTION A1

If P (x , $-\frac{3}{7}$) is a point on the unit circle, what are the possible values of x?

[6 marks]

QUESTION A2

Given the following function:

$$y = 1 - 3\sin\left(2x - \frac{\pi}{3}\right)$$

a) Find the amplitude, period, phase, and vertical shift of the function y.

[4 marks]

b) Let g be the function of y without shift transformations. Write down the function g and graph the complete period of g beginning with $x = 0$. State clearly all x-intercepts.

[6 marks]

c) On the same axes, graph the complete period of y. State clearly all x-intercepts.

[4 marks]

QUESTION A3

Proof the following identity:

$$(\tan x + \sec x)(\sin x - 1) = -\cos x$$

[8 marks]

Continued .....

QUESTION A4

Solve triangle ABC given the following information:

$$a = 20, b = 30, \measuredangle C = 50^{\circ}$$

You can round your answers to two decimal places.

[8 marks]

QUESTION A5

(a) Find the following limit:

$$\lim_{x \to \infty} \frac{5x^3 + 3x^2 - 8}{2x^3 - x + 9}$$

[8 marks]

(b) Find the first and second derivatives of the following function:

$$y = (2x + 3)\cos x$$

[8 marks]

QUESTION A6

Find the values of zw and $\frac{z}{w}$ for the following complex numbers:

$$z = 2\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right), w = 5\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)$$

[8 marks]

Continued .....

SECTION B (ANSWER ANY 2 QUESTIONS)

QUESTION B1

(a) Find the exact value of the following expression:

$$\sin\left(\cos^{-1}\left(-\frac{12}{13}\right)+\tan^{-1}\left(\frac{3}{4}\right)\right)$$

[8 marks]

(b) If $\tan x = -\frac{12}{5}$, and x is in Quadrant II, find the values of $\sin 2x$ and $\cos 2x$.

[6 marks]

(c) Solve the following using De Moivre's Theorem:

$$\left(2+2\sqrt{3}i\right)^3$$

[6 marks]

QUESTION B2

(a) Find the derivative of the following function:

$$y = \sqrt[5]{x^2+2x-1}$$

[8 marks]

(b) Given the following function:

$$f(x) = x^2 - 3x - 3, \qquad [0,4]$$

i. Find the critical numbers and the end points.

[4 marks]

ii. Sketch the graph of *f*.

[4 marks]

iii. State the absolute maximum and minimum values of *f*, if they exist.

[4 marks]

Continued .....

QUESTION B3

(a) Evaluate the following integrals:

i.

$$\int_0^5 (2x^2 + 3)\,dx$$

[6 marks]

ii.

$$\int \frac{2}{(x+1)^2}\,dx$$

[6 marks]

(b) Find the area enclosed by $y = x^2 - 2x$ and $y = 2x$.

[8 marks]

End of Page

ADDITION AND SUBTRACTION FORMULAS

Formulas for sine:
$$\sin(s + t) = \sin s \cos t + \cos s \sin t$$
$$\sin(s - t) = \sin s \cos t - \cos s \sin t$$

Formulas for cosine:
$$\cos(s + t) = \cos s \cos t - \sin s \sin t$$
$$\cos(s - t) = \cos s \cos t + \sin s \sin t$$

Formulas for tangent:
$$\tan(s + t) = \frac{\tan s + \tan t}{1 - \tan s \tan t}$$
$$\tan(s - t) = \frac{\tan s - \tan t}{1 + \tan s \tan t}$$

DOUBLE-ANGLE FORMULAS

Formula for sine:
$$\sin 2x = 2 \sin x \cos x$$

Formulas for cosine:
$$\cos 2x = \cos^2 x - \sin^2 x$$
$$= 1 - 2 \sin^2 x$$
$$= 2 \cos^2 x - 1$$

Formula for tangent:
$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

HALF-ANGLE FORMULAS

$$\sin \frac{u}{2} = \pm \sqrt{\frac{1 - \cos u}{2}} \qquad \cos \frac{u}{2} = \pm \sqrt{\frac{1 + \cos u}{2}}$$

$$\tan \frac{u}{2} = \frac{1 - \cos u}{\sin u} = \frac{\sin u}{1 + \cos u}$$

The choice of the + or − sign depends on the quadrant in which $u/2$ lies.

PRODUCT-TO-SUM FORMULAS

$$\sin u \cos v = \tfrac{1}{2}[\sin(u + v) + \sin(u - v)]$$
$$\cos u \sin v = \tfrac{1}{2}[\sin(u + v) - \sin(u - v)]$$
$$\cos u \cos v = \tfrac{1}{2}[\cos(u + v) + \cos(u - v)]$$
$$\sin u \sin v = \tfrac{1}{2}[\cos(u - v) - \cos(u + v)]$$

SUM-TO-PRODUCT FORMULAS

$$\sin x + \sin y = 2 \sin \frac{x + y}{2} \cos \frac{x - y}{2}$$

$$\sin x - \sin y = 2 \cos \frac{x + y}{2} \sin \frac{x - y}{2}$$

$$\cos x + \cos y = 2 \cos \frac{x + y}{2} \cos \frac{x - y}{2}$$

$$\cos x - \cos y = -2 \sin \frac{x + y}{2} \sin \frac{x - y}{2}$$