CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

FINAL EXAMINATION
JULY 2010 SESSION

SUBJECT CODE	:	WQD10202
SUBJECT TITLE	:	TECHNICAL MATHEMATICS II
LEVEL	:	DIPLOMA
TIME / DURATION	:	9.00 am – 11.00 am (2 HOURS)
DATE	:	9 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of THREE (3) parts. Part A, B and C. Answer all questions in Part A and B. For Part C, answer two (2) questions only.
6. Answer all questions in English.
7. Formula Sheet is appended.

THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

PART A (Total: 15 marks)

MULTIPLE CHOICE QUESTIONS

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

1. Given $f(x) = -x^2 + 5x - 13$, determine $f(-3)$.
   A. 37
   B. - 37
   C. 19
   D. - 19

2. Given $f(x) = 1 - x^2$ and $g(x) = \sqrt{x^2 + 4}$, compute $(f \circ g)(x)$.
   A. $x^2 - 3$
   B. $1 - \sqrt{x^2 + 4}$
   C. $-x^2 - 3$
   D. $1 - x^2\left(\sqrt{x^2 + 4}\right)$

3. Evaluate $\lim_{x \to 2} \frac{x + 2}{x^2 + 5x + 6}$.
   A. - 2
   B. $\frac{1}{5}$
   C. $-\frac{1}{5}$
   D. 2

4. The differentiation of $\ln(2x^2 - 3)$ is
   A. $4x \ln(2x^2 - 3)$
   B. $e^{2x^2 - 3}$
   C. $\frac{4x}{2x^2 - 3}$
   D. $4xe^{2x^2 - 3}$

5. Given that $g(x) = (4x-3)^4$. Determine $g'(x)$.

A. $\dfrac{1}{(4x-3)^3}$

B. $\dfrac{4}{(4x-3)^3}$

C. $4(4x-3)^3$

D. $16(4x-3)^3$

6. The second derivative of $y = -3x^3 + x^2 - x + 5$ is

A. $2-18x$

B. $-9x^2 + 2x - 1$

C. $9x^2 + 2x - 1$

D. $-9x^2 + 2x - x$

7. Calculate the slope of the function $y = x^3 + \frac{4}{3}x^2 - 5x + 1$ at the point $x = 2$.

A. $\frac{16}{3}$

B. $\frac{5}{3}$

C. $\frac{37}{3}$

D. $\frac{13}{3}$

8. The differentiation of $\cos^3\theta$ with respect to θ is

A. $\sin 3\theta$

B. $2\cos^3\theta$

C. $-\sin^3\theta$

D. $-3\cos^2\theta\sin\theta$

9. The integration of $y = \frac{4}{3}x^{\frac{3}{2}}$ is

A. $\frac{4x^{\frac{5}{2}}}{3} + C$

B. $\frac{10\sqrt{x^5}}{3} + C$

C. $\frac{8\sqrt{x^5}}{15} + C$

D. $\frac{2x^{\frac{5}{2}}}{5} + C$

10. Given:

$\int_3^6 (y^2 - y)dy = \frac{59}{2} + C$; determine the value of C.

A. 20

B. 25

C. $\frac{90}{2}$

D. $\frac{41}{2}$

11. $\int_1^3 \frac{1-2x}{3} dx$

A. $\frac{2}{3}$

B. $-\frac{2}{3}$

C. 2

D. -2

12. Determine the area A enclosed between the curve $y = x^2 - 4$ and the x – axis from $x = -1$ to $x = 2$.

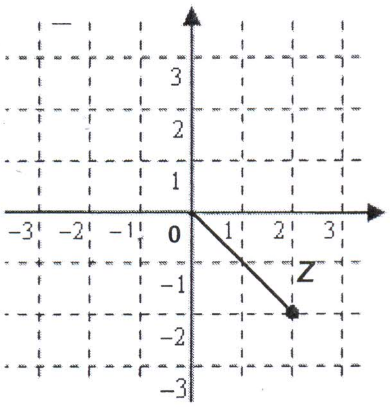
A. $-9\ unit^2$

B. $9\ unit^2$

C. $11\ unit^2$

D. $-11\ unit^2$

13. The Argand diagram below represents the complex number of



A. $Z = -1 + 2j$

B. $Z = 2 - j$

C. $Z = -2 + 2j$

D. $Z = 2 - 2j$

14. Evaluate $(2 + 4j)(3 - 2j)$.

A. $14 + 8j$

B. $6 + 8j$

C. $14 - 8j$

D. $6 - 8j^2$

15. Given that $Z = 2.82 - 0.64j$. Determine the modulus, r .

A. 2.75

B. 8.36

C. 1.88

D. 2.89

PART B (Total: 35 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

Let G be the function defined by : $G(x) = \begin{cases} \sqrt{\dfrac{2x^3 - 1}{x}} & ; x < 0 \\ 4x^3 & ; 0 \le x \le 1 \\ x^2 & ; x > 1 \end{cases}$

Determine

a) $G(15)$

b) $G(-4)$

c) $G(1)$

[3 marks]

Question 2

Given $f(x) = (4x^3 - 2)^4$. Determine:

a) $f'(x)$

b) $f'(-2)$

[4 marks]

Question 3

Determine $\dfrac{dy}{dx}$ if $y^4 + y^2 + 6x^2 = 7$ by using implicit method.

[4 marks]

Question 4

Determine the integration of $\int \frac{5x-4}{2x^2+x-1}dx$ by using partial fraction method.

[8 marks]

Question 5

Determine the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.

[8 marks]

Question 6

Draw on an Argand diagram this complex number, $Z = -3 - 2j$. Then convert Z to polar form.

[6marks]

PART C (Total: 30 marks)

INSTRUCTION: Answer TWO questions.

Please use the answer booklet provided.

Question 1

a) Determine the domains and range of each of the following functions.

i. $f(x) = x^2 + 2$

ii. $g(x) = \sqrt{x - 2}$

iii. Thus, solve for $(f \circ g)(2)$.

b) Simplify $\frac{4 + 3j}{1 - 2j}$ and express the answer in the form $a + bj$.

c) Determine $(-2 + 3j)^5$.

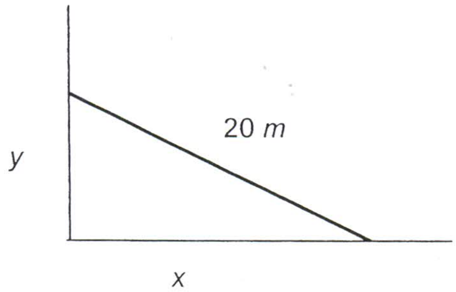
[15 marks]

Question 2

a) Determine $\frac{dy}{dx}$ using Implicit differentiation if $x^2 + y^2 = 2xy + 3$.

b) A 20 m ladder leans against a wall. The top slides down at a rate of 4 ms^{-1}. How fast is the bottom of the ladder moving when it is 16 m from the wall?

(Hint: $x^2 + y^2 = 400$)



[15 marks]

Question 3

a) Determine the volume obtained by rotating the area bounded by $y = 2x^2$ and $y = x + 1$ (as shown in Figure 1) around the x-axis.

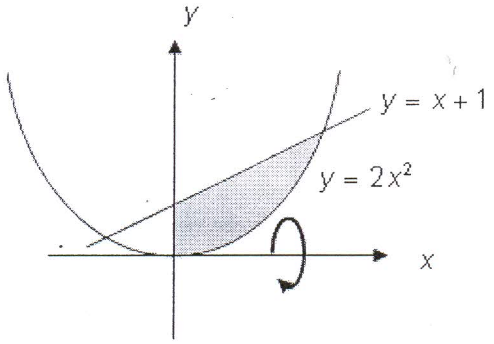


Figure 1

b) By using integration by part, evaluate the following integral: $\int x\sqrt{x+1}\,dx$.

(Hint : Use formula $\int u dv = uv - \int v du$)

[15 marks]

END OF QUESTION

FORMULA SHEET

TRIGONOMETRY IDENTITIES

FUNDAMENTAL IDENTITIES	FORMULAS FOR NEGATIVES
$\csc\theta = \dfrac{1}{\sin\theta}$	$\sin(-\theta) = -\sin\theta$
$\sec\theta = \dfrac{1}{\cos\theta}$	$\cos(-\theta) = \cos\theta$
$\cot\theta = \dfrac{1}{\tan\theta} = \dfrac{\cos\theta}{\sin\theta}$	$\tan(-\theta) = -\tan\theta$
$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$	$\csc(-\theta) = -\csc\theta$
$\sin^2\theta + \cos^2\theta = 1$	$\sec(-\theta) = \sec\theta$
$1 + \tan^2\theta = \sec^2\theta$	$\cot(-\theta) = -\cot\theta$
$1 + \cot^2\theta = \csc^2\theta$	

ADDITION FORMULAS	SUBTRACTION FORMULAS
$\sin(A+B) = \sin A\cos B + \cos A\sin B$	$\sin(A-B) = \sin A\cos B - \cos A\sin B$
$\cos(A+B) = \cos A\cos B - \sin A\sin B$	$\cos(A-B) = \cos A\cos B + \sin A\sin B$
$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A\tan B}$	$\tan(A-B) = \dfrac{\tan A - \tan B}{1 + \tan A\tan B}$

HALF-ANGLE FORMULAS	DOUBLE-ANGLE FORMULAS
$\sin\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1-\cos\theta}{2}}$	$\sin 2\theta = 2\sin\theta\cos\theta$
$\cos\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1+\cos\theta}{2}}$	$\cos 2\theta = \cos^2\theta - \sin^2\theta$ .... $= 1 - 2\sin^2\theta$ .... $= 2\cos^2\theta - 1$
$\tan\dfrac{\theta}{2} = \dfrac{1-\cos\theta}{\sin\theta} = \dfrac{\sin\theta}{1+\cos\theta}$	$\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$

PRODUCT-TO-SUM FORMULAS	SUM-TO-PRODUCT FORMULAS
$\sin\alpha\cos\beta = \frac{1}{2}[\sin(\alpha+\beta)+\sin(\alpha-\beta)]$	$\sin\alpha+\sin\beta = 2\sin\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}$
$\cos\alpha\sin\beta = \frac{1}{2}[\sin(\alpha+\beta)-\sin(\alpha-\beta)]$	$\sin\alpha-\sin\beta = 2\cos\frac{\alpha+\beta}{2}\sin\frac{\alpha-\beta}{2}$
$\cos\alpha\cos\beta = \frac{1}{2}[\cos(\alpha+\beta)+\cos(\alpha-\beta)]$	$\cos\alpha+\cos\beta = 2\cos\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}$
$\sin\alpha\sin\beta = \frac{1}{2}[\cos(\alpha-\beta)-\cos(\alpha+\beta)]$	$\cos\alpha-\cos\beta = -2\sin\frac{\alpha+\beta}{2}\sin\frac{\alpha-\beta}{2}$

DIFFERENTIATION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}(\sin x) = \cos x$	$\frac{d}{dx}(\sin f(x)) = f'(x)\cos f(x)$
$\frac{d}{dx}(\cos x) = -\sin x$	$\frac{d}{dx}(\cos f(x)) = -f'(x)\sin f(x)$
$\frac{d}{dx}(\tan x) = \sec^2 x$	$\frac{d}{dx}(\tan f(x)) = f'(x)\sec^2 f(x)$
$\frac{d}{dx}(\csc x) = -\csc x\cot x$	$\frac{d}{dx}(\csc f(x)) = -f'(x)\csc f(x)\cot f(x)$
$\frac{d}{dx}(\sec x) = \sec x\tan x$	$\frac{d}{dx}(\sec f(x)) = f'(x)\sec f(x)\tan f(x)$
$\frac{d}{dx}(\cot x) = -\csc^2 x$	$\frac{d}{dx}(\cot f(x)) = -f'(x)\csc^2 f(x)$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}e^x = e^x$	$\frac{d}{dx}e^{f(x)} = f'(x)e^{f(x)}$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}\ln x = \frac{1}{x}$	$\frac{d}{dx}\ln f(x) = \frac{f'(x)}{f(x)}$

INTEGRATION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \cos x \, dx = \sin x + c$	$\int \cos f(x) dx = \frac{\sin f(x)}{f'(x)} + c$
$\int \sin x \, dx = -\cos x + c$	$\int \sin f(x) dx = \frac{-\cos f(x)}{f'(x)} + c$
$\int \sec^2 x \, dx = \tan x + c$	$\int \sec^2 f(x) dx = \frac{\tan f(x)}{f'(x)} + c$
$\int \sec x \tan x \, dx = \sec x + c$	$\int \sec f(x) \tan f(x) dx = \frac{\sec f(x)}{f'(x)} + c$
$\int \csc x \cot x \, dx = -\csc x + c$	$\int \csc f(x) \cot f(x) dx = \frac{-\csc f(x)}{f'(x)} + c$
$\int \csc^2 x \, dx = -\cot x + c$	$\int \csc^2 f(x) dx = \frac{-\cot f(x)}{f'(x)} + c$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int e^x dx = e^x + c$	$\int e^{f(x)} dx = \frac{e^{f(x)}}{f'(x)} + c$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \frac{1}{x} dx = \ln\lvert x \rvert + c$	$\int \frac{1}{f(x)} dx = \frac{\ln\lvert f(x) \rvert}{f'(x)} + c$