CONFIDENTIAL

UNIVERSITI KUALA LUMPUR

FINAL EXAMINATION
JANUARY 2014 SEMESTER

SUBJECT CODE	:	**WQD10203**
SUBJECT TITLE	:	**TECHNICAL MATHEMATICS 2**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**9.00 am – 11.30 am (2 ½ HOURS)**
DATE	:	**27 MAY 2014**

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 10 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. Determine the amplitude of $4\cos 2(x-\pi)$.

   A. 2

   B. 4

   C. π

   D. x

2. Simplify the trigonometric expression: $(1-\sin^2\theta)\cos^2\theta$

   A. $\cot\theta$

   B. $2\cot\theta$

   C. $2\cos\theta$

   D. $\cos^4\theta$

3. Solve $3\tan\theta-1=0$, for $0° \le x \le 360°$.

   A. 161.565°,341.565°

   B. 18.435°,341.565°

   C. 18.435°, 198.435°

   D. 161.565°,198.435°

4. Which one is the correct representation for $f \circ g(x)$

   A. $f(x)\times g(x)$

   B. $f[g(x)]$

   C. $f(x)+g(x)$

   D. $f^{-1}g(x)$

5. If $f(7)=7k-2$ and $f^{-1}(5)=7$, then k is

   A. 5

   B. -5

   C. 1

   D. -1

6. $\lim_{x \to 3} 3x^2 - 27 =$

   A. - 3

   B. 27

   C. 0

   D. undefined

7. The derivative of $y=5x+11$ is given by

   A. 5

   B. 16

   C. $\frac{5x^2}{2} + 11x + C$

   D. 11

8. $f'(x)=1-7x$ is the derivative of the function $f(x)$, determine the value of the gradient of the function at $(-2,3)$

   A. - 20

   B. - 6

   C. 12

   D. 15

9. Determine $\frac{dy}{dx}$ if given $y = e^{2x}$.

   A. $2e^{2x}$

   B. $\frac{e^{2x}}{2}$

   C. e^{x^2}

   D. e^{2x1}

10. Let $y = 2e^{\tan x}$. Find $\frac{dy}{dx}$

A. $2e^{\tan x} \cdot \sec^2 x$

B. $2\tan x \cdot e^{\tan x}$

C. $2e^{\tan x} \cdot \cot x$

D. $2\sec^2 x$

11. The differentiation of $\sin 3x$ with respect to x is

A. $-3\cos 3x$

B. $3\cos 3x$

C. $\frac{\cos 3x}{3}$

D. $3\sin 3x$

12. The expression for $\int 3x + 7\ dx =$

A. 3 + C

B. $3x^2 + 7x + C$

C. $\frac{3x^2}{2} + 7x + C$

D. $3x^2 + 7 + C$

13. The area given by $\int_1^7 9 - 2x\,dx =$

A. 35 units^2

B. 7 units^2

C. 5 units^2

D. 6 units^2

14. If $f(x)=\int f'(x)dx$ and $f(x)=\dfrac{x}{x^2-1}$. Determine $\int_0^3 f'(x)\,dx$

A. $\dfrac{1}{3}$

B. 0

C. $\dfrac{3}{8}$

D. None of the above

15. The volume of the solid obtained by rotating the region bounded by $y=x^2$ and $y=x$ over the interval [0, 1] around the x- axis is given by;

A. $\int_0^1 \pi(x^2-x^4)\,dx$

B. $\int_0^1 \pi(x-x^2)^2\,dx$

C. $\int_0^1 \pi(x^2-x)^2\,dx$

D. $\int_0^1 \pi(y-y^2)\,dy$

PART B (Total: 45 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Solve the equation $4\tan\theta + 2 = 2\tan\theta$ for $0^0 \le \theta \le 360^0$ [7 marks]

Question 2

Given $f(x) = x^2 + 3x - 2$ and $g(x) = 2x + 3$,

a. Determine $(g \circ f)(x)$

[3 marks]

b. Hence, evaluate $(g \circ f)(2)$

[2 marks]

Question 3

Given the function defined by the graphs below:

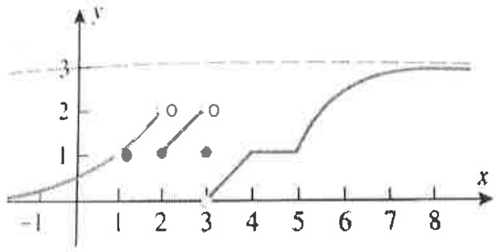

Figure 1

a. Determine $f(1)$

[1 mark]

b. Determine $\lim_{x \to 1} f(x)$

[2 marks]

c. Hence, determine whether the function f is continuous at $x = 1$. Explain.

[2 marks]

Question 4

Differentiate the following functions:

a. $y = \ln\left(x^3 - 5x\right)$

[2 marks]

b. $y = \dfrac{x^2}{x+3}$

[4 marks]

Question 5

a. Differentiate $y = \sin(5x) \cdot e^{2x}$ by using the product rule.

[4 marks]

b. Evaluate the value of $\dfrac{dy}{dx}$ at $x = 3$ if given $y = 2x^3 + 5x^2 + 25$

[3 marks]

Question 6

Integrate the following functions:

a. $y = 11 + 3x^3$

[2 marks]

b. By using suitable substitution, solve $\int \dfrac{x-1}{\left(x^2 - 2x\right)^3} dx$.

[5 marks]

Question 7

a. Integrate $y = (5x - 1)^4$

[3 marks]

b. Determine the value of k if $\int_{2}^{4} 8 + k\,x\,dx = 40$.

[5 marks]

PART C (Total: 40 marks)

INSTRUCTION: Answer TWO questions.
Please use the answer booklet provided.

Question 1

a. The formula $K(C) = C + 273$ converts Celsius temperature to Kelvin. The formula $C(F) = \frac{5}{9}(F - 32)$ converts Fahrenheit temperature to Celsius.

i. Determine the value in Celsius if the temperature in Fahrenheit is 95^0

[3 marks]

ii. Write a composite function that will convert Fahrenheit temperature to Kelvin.

[5 marks]

iii. By using your answer in **part ii.**, convert the freezing point of water (32° F) to Kelvin.

[2 marks]

b. i. Sketch graph of $y = 3\sin 4\left(x - 45^0\right)$ for 1 cycle starting from $x = 0^0$.

[7 marks]

ii. On the same axes, sketch the graph of $y = -5\sin 4\left(x - 45^0\right)$

[3 marks]

Question 2

a. By using implicit differentiation, determine slope of the tangent line to the curve $x^2y + y^4 = 4 + 2xy$ at point $(-1,1)$.

[10 marks]

b. Grain pouring from a chute at the rate of 8 ft^3/ min forms a conical pile whose height is always twice its radius (Figure 1). Calculate how fast is the height of the pile increasing at the instants when the pile is 6 ft. [Hint : Volume of cone $= \frac{1}{3}\pi r^2 h$]

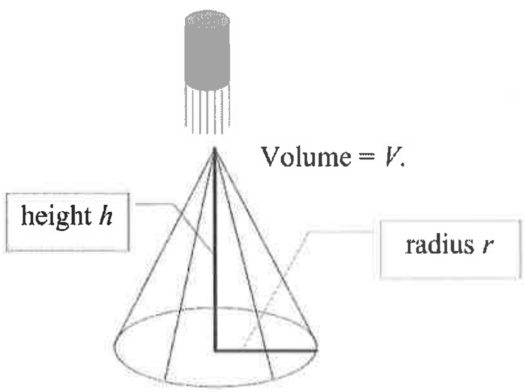

Figure 1

[10 marks]

Question 3

a. By using partial fractions, $\int \frac{11x+17}{2x^2+7x-4}dx$

[13 marks]

b. Calculate the volume of the solid generated when the region between by the graphs of the equations $y = \frac{1}{2} + x^2$ and $y = x$ over the interval $[0,2]$ is revolved about the $x-$axis as shown in the Figure 2 below:

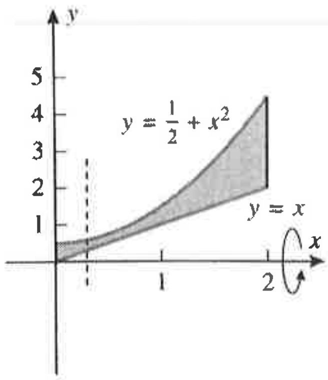

Figure 2

[7 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
$\sin(A+B) = \sin A\cos B + \cos A\sin B$	$\sin(A-B) = \sin A\cos B - \cos A\sin B$
$\cos(A+B) = \cos A\cos B - \sin A\sin B$	$\cos(A-B) = \cos A\cos B + \sin A\sin B$
$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A\tan B}$	$\tan(A-B) = \dfrac{\tan A - \tan B}{1 + \tan A\tan B}$

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

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

INTEGRATION BY PART

$\int u \, dv = uv - \int v \, du$