



FACULTY OF SCIENCE

SM	
EM	
FM	

## DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

NATIONAL DIPLOMA:

*ELECTRICAL/MECHANICAL/INDUSTRIAL/MINING ENGINEERING, MINERAL SURVEYING AND ANALYTICAL CHEMISTRY*

**MODULE:** MAT2AW2  
ENGINEERING MATHEMATICS 2

**CAMPUS:** DFC

NOVEMBER EXAMINATION

**DATE:** 09 NOVEMBER 2019  
**DURATION:** 3 HOURS

**TIME:** 08:30 – 11:30  
**MARKS:** 100

**ASSESSOR:** VL SIXABA  
**MODERATOR:** MP SELOANE

INITIALS AND SURNAME: \_\_\_\_\_

STUDENT NUMBER: \_\_\_\_\_

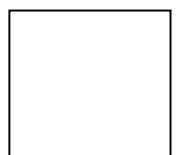
CONTACT NUMBER: \_\_\_\_\_

NUMBER OF PAGES: 18

INSTRUCTIONS: ANSWER ALL QUESTIONS IN THE SPACES PROVIDED.

USE THE BACK OF EACH PAGE FOR ROUGH WORK USE ONLY A PEN FOR WRITING AND DRAWING (BLACK OR BLUE).

**REQUIREMENTS:** NON PROGRAMMABLE CALCULATORS.  
FORMULA BOOKLET (PROVIDED).



**SECTION A [20 MARKS]****INSTRUCTIONS**

**GIVE ONLY THE FINAL SIMPLIFIED ANSWER (CORRECT TO TWO DECIMAL PLACES WHERE APPLICABLE) IN THE SPACE PROVIDED**

1. Find  $\frac{dy}{dx}$  if  $y = 3\ln(\cos(x))$ . (2)

2. Find  $\frac{dy}{dx}$  when  $y = 6\sin(x)\sin^{-1}(x)$  (2)

3. Find  $\frac{dy}{dx}$  if  $x = \ln(\tan(\theta))$  and  $y = \tan(\theta) - \theta$ . (2)

4. Find  $\frac{\partial z}{\partial y}$ , if  $y = e^{x\ln(z)}$ . (2)

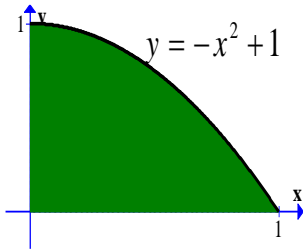
5. If  $\int_0^4 f(x)dx = 6$ , evaluate  $\int_0^2 f(2x)dx$  (2)

6. Evaluate  $\int \frac{\sin^{-1}x}{\sqrt{1-x^2}} dx$ . (2)

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7. Evaluate  $\int \frac{e^{\sqrt{5y-2}}}{\sqrt{5y-2}} dy$ . (2)

8. The figure below shows the graph of  $y = -x^2 + 1$ . (2)

Calculate the area of the shaded region.



9. Solve the separable DE:  $e^{-y} \sin(x) + \frac{dy}{dx} = 0$ . (2)

10. Solve the separable DE:  $\frac{dy}{dx} = (x - 4)e^{-2y}$ . (2)

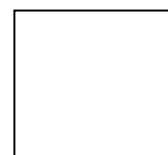


**SECTION B [82 MARKS]****INSTRUCTIONS**

**SHOW ALL THE STEPS TAKEN AND GIVE YOUR FINAL ANSWER CORRECT TO TWO DECIMAL PLACES WHERE APPLICABLE. SIMPLIFY YOUR ANSWERS FULLY.**

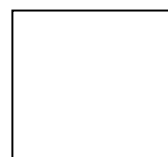
11. Find  $\frac{dy}{dx}$  if  $y = (\ln(x))^{\sec(x)}$  by using implicit differentiation. (4)


12. Determine  $\frac{dy}{dx}$  of the curve  $e^{xy} = e^{4x} - e^{5y}$  (4)

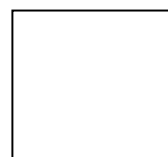

13. Find  $\frac{dy}{dx}$  if  $y = \sin^{-1}(\tanh x)$

(5)


**14.** Consider the set of parametric equations  $x = te^t$  and  $y = te^{-t}$

14.1. Find the coordinates of the turning point on the parametric curve when  $t = 1$  (4)

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14.2. Find  $\frac{d^2y}{dx^2}$

(5)

[illegible]

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16. Determine the following integrals

16.1.  $\int \frac{\cos(t)}{(7\sin(t)+3)^2} dt.$  (3)


16.2.  $\int \ln(x-1)dx$  by using integration by parts. (5)




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16.3.  $\int \frac{x^3-1}{x^2+1} dx.$

(4)


16.4.  $\int (\operatorname{sech} x)^4 dx.$

(5)




(6)

[illegible]

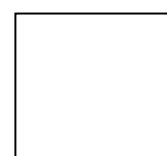
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16.6.  $\int \frac{1}{6x + 4\sqrt{x}} dx.$

(3)


16.7.  $\int \frac{1}{x^2\sqrt{x^2+4}} dx$  by using trig substitution.

(5)

16.8. Determine the **mean value** of the function  $y = \sin(x)$  from  $x = 0$  to  $x = \frac{\pi}{2}$  (4).

[illegible]

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- 17.** Find the volume of the solid obtained by revolving the area bounded by the two graphs

$$y = x^2 + 2 \text{ and } 2y - x = 2$$

Between  $x = 0$  and  $x = 1$  about the x-axis. Sketch the said area.

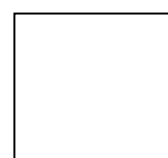
(5)

[illegible]

11

**18.** Solve the Homogenous differential equation:  $(y^2 - x^2)dx - 2xy dy = 0$  (5)





19.1. Linear Differential Equation  $\frac{dy}{dt} - y = e^t + 12e^{7t}$ , where  $y(1) = 2$ . (5)

[illegible]

10



19.2. Exact DE:  $7x \frac{dy}{dx} = 2xe^x - 7y + 6x^2$ . (5)

[illegible]

**End of assessment – Total 100 marks (102 available marks)**

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**Use this space if you want to redo any question(s). Please indicate clearly at the relevant question(s) that the solution is on this page.**

[illegible]

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