FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

NATIONAL DIPLOMA IN ANALYTICAL CHEMISTRY (4 YEARS)

MODULE: **MAT2WB2**
                MATHEMATICS 2B

CAMPUS: **DFC**

SUPPLEMENTARY EXAMINATION

DATE: **7 JANUARY 2020**   TIME: **11H30-13H30**
DURATION: **2 HOURS**   **MARKS: 66**
ASSESSOR: **DR B.P. NTSIME**

MODERATOR: **MR T. PAEPAE**

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: **14 INCLUDING COVER PAGE**
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 INFORMATION BOOKLET (PROVIDED).
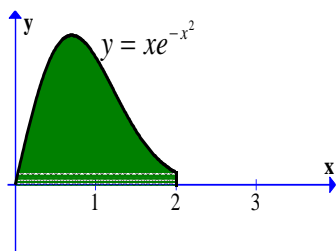
SECTION A [8]

INSTRUCTIONS

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

1. Evaluate $\int \dfrac{e^{\sin^{-1} x}}{\sqrt{1 - x^2}}\, dx$.   (2)

2. Evaluate $\int \dfrac{1}{x(1 + \ln x)}\, dx$.   (2)

3. Calculate the area of the region bounded by $y = xe^{-x^2}$, $x = 2$ and the $x-$axis (see figure below)   (2)

4. Solve the differential equation: $\dfrac{dy}{dt} = -\dfrac{y}{t}$.   (2)

SECTION B [61]

INSTRUCTIONS

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

5. Determine the following integrals

    5.1. $\int x^3 \ln x^2 \, dx$.   (4)

5.2. $\int_0^{\frac{\pi}{2}} x^2 \sin x \, dx$. (6)

5.3. $\int \dfrac{14x^2 - 7x - 3}{(x^2 - 1)(2x - 1)}\, dx$.   (7)

(7)

5.4. $\displaystyle\int \frac{3x-6}{x^2+10x+28}\,dx$. (5)

5.5. $\int \dfrac{t^3}{\sqrt{16-t^2}}\,dt$.

(6)

5.6. $\int \sin^4 x \, dx$.   (5)

6. Determine the **root mean value (rms)** of the function $y = x\sqrt{2x+1}$
    from $x = 0$ to $x = 2$.   (5)

7. Determine the volume of the solid obtained by rotating the region enclosed by

$y = \sqrt[4]{2x}$ and $y = \dfrac{x}{4}$ about the $x-$axis.   (5)
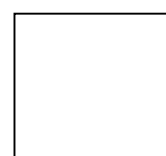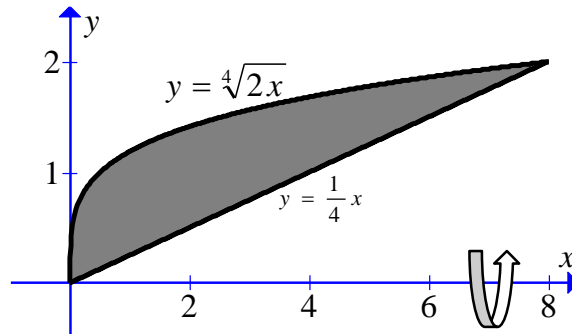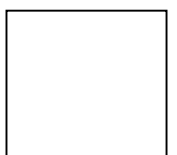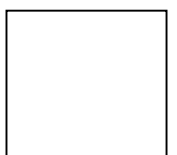
8. Suppose an experimental population of fruit flies increase according to the law of exponential growth. There were 33 flies the first day of the experiment and 100 flies after the 2nd day. Approximately how many flies will be in the population after the 5th day? Work accurately to three decimal places. Let the change in population (P) be $\dfrac{dP}{dt} = kp$ (5)

9. Solve the following ordinary differential equations

    9.1. $xy\dfrac{dy}{dx} = 2y^2 + 4x^2.$ (7)

        (Hint: Homogeneous differential equation)

9.2   Show that the differential equation
       $(2xy^2 - 3)dx + (2x^2 y + 4)dy = 0,$
       is exact and solve this differential equation subject to $y(0) = 1$.   (6)

End of assessment – Total 69 marks

USE THIS PAGE TO REDO ANY QUESTION(S). PLEASE INDICATE CLEARLY AT THE RELEVANT QUESTION(S) THAT THE SOLUTION IS ON THIS PAGE