UNIVERSITY
OF
JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF APPLIED PHYSICS AND ENGINEERING MATHEMATICS
NATIONAL DIPLOMA IN ENGINEERING:
ANALYTICAL CHEMISTRY

MODULE   MAT1YE2

CAMPUS   DFC

SUPPLEMENTARY EXAMINATION

DATE 30 NOVEMBER 2015

ASSESSOR   **MR EZ MORAPELI**

INTERNAL MODERATOR   **MR CGJ LOCK**
DURATION   3 HOURS   **MARKS   100**

SURNAME AND INITIALS: _____

STUDENT NUMBER: _____

COURSE: _____

LECTURER: _____

CONTACT NO: _____

NUMBER OF PAGES: 15

INSTRUCTIONS   : ANSWER ALL THE QUESTIONS
                               : ENSURE THAT YOUR PAPER HAS ALL PAGES
                               : *ALL WORKING INCLUDING GRAPHS SHOULD BE WRITTEN IN PEN*
                               : DO NOT REMOVE ANY PAGE FROM THIS PAPER
REQUIREMENTS   : NON-PROGRAMMABLE SCIENTIFIC CALCULATOR

SECTION A[20]

INSTRUCTIONS

USE THE TABLE ON PAGE 4 TO MARK THE LETTER (X) CORRESPONDING TO THE CORRECT ANSWER. DO YOUR ROUGH WORK ON THE BLANK PAGES.

1. If $b^{x^2-x} = 1$, then x is equal to :

    A   1   B   1 and 0

    C   0   D   0

2. $\dfrac{\cos 45° - j\sin 45°}{\cos 90° - j\sin 90°} = $:

    A $\underline{|45°}$ B $\underline{|135°}$

    C $\underline{|-45°}$ D $\underline{|90°}$

3. If $\log(\log\dfrac{1}{x}) = 1$;   then $x =$

    A   100   B 10^{10}

    C   0.01   D 10^{-10}

4. The value of $\dfrac{\log_3 81}{\log_3 \sqrt[3]{9}}$, is equal to:

    A $\dfrac{8}{3}$ B   6

    C   4   D   Undefined

5. The phase shift of the wave equation $y = 3\sin 2\left(t + \dfrac{\pi}{3}\right)$ is:

    A $\dfrac{2\pi}{3}$ units left   B $\dfrac{\pi}{6}$ units right

    C $\dfrac{\pi}{3}$ units left   D $\dfrac{\pi}{3}$ units right

6. If $z_1 = 4.0|\underline{1.05}$ and $z_2 = 2.5|\underline{-0.79}$ then $z_1 - z_2$ is equal to:

    A $1.496 - 3.75j$ B $1.496 + 0.108j$

    C $-1.69 - 0.108j$ D $1.496 - 0.108j$

7. The value of $\cot^{-1}(3.1) + e^{\ln 4} = :$

    A   5.26

    C   1.7

    B   4.31

    D   4.79

8. If $\tan\left(e^{\pi \ln x}\right) = 3$ then x is:

    A   undefined

    C   3.45

    B   3

    D   1.07

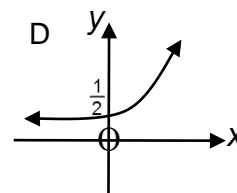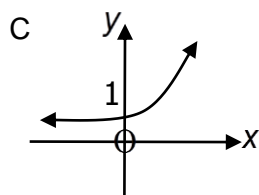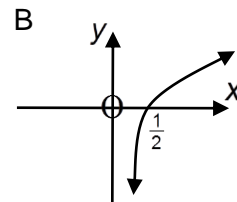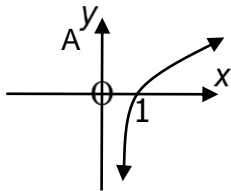9. If z=1, then one eighth root of z is

    A   0.125

    B $\dfrac{-1+j}{\sqrt{2}}$

    C   2.828

    D   none of the above

10. If $f(x) = \ln x^2$ then the graph of $f(x)$ is given by

A

B

C

D

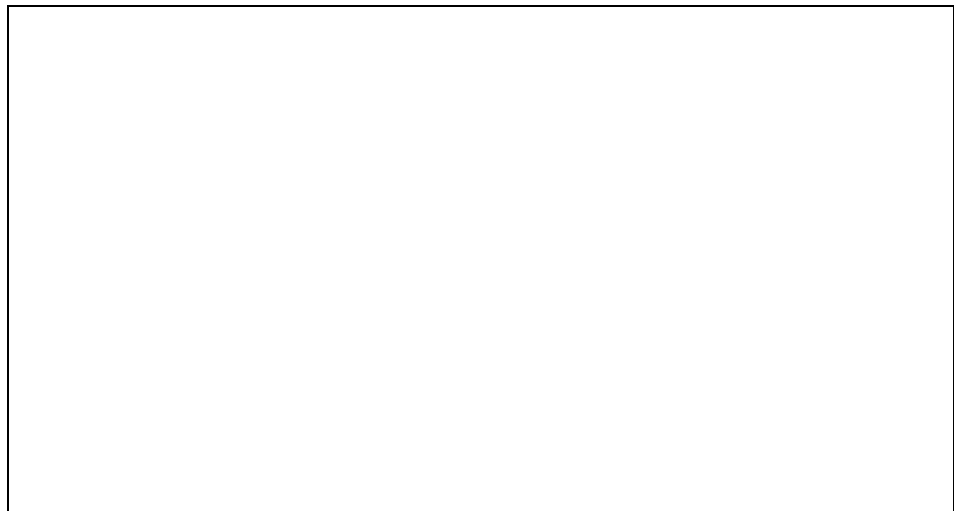|	A	B	C	D		A	B	C	D
1.	A	B	C	D	6.	A	B	C	D
2.	A	B	C	D	7.	A	B	C	D
3.	A	B	C	D	8.	A	B	C	D
4.	A	B	C	D	9.	A	B	C	D
5.	A	B	C	D	10.	A	B	C	D

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SECTION B[35]

INSTRUCTIONS

GIVE ONLY THE FINAL SIMPLIFIED ANSWER (CORRECT TO TWO DECIMAL PLACES WHERE APPLICABLE) IN THE SPACE PROVIDED. DO YOUR ROUGH WORK ON THE BLANK PAGES.

11. Compute $[-1+3j].[2\,|\,\underline{0.785}]$ and express
the final answer in rectangular form.   (3)

12. Make neat sketch graph of each of the following indicating clearly the intercepts:

    12.1 $y = 5\sin(\pi x - 0.5\pi)$ (5)

    12.2 $y = \log_{\frac{e}{\pi}} 3x$ (3)

12.3 $y = \dfrac{4}{3}(0.75)^{-x+1}$ (3)

13.   The displacement x measured in meters, of an oscillating mechanism after time t
      seconds is given by the equation $x = 2.4\sin(5t - 0.1),$ where t is in seconds.
      Find:

      13.1 the maximum displacement   (1)

      13.2 the time at which this occurs   (1)

      13.3 the displacement after 0.2 seconds   (2)

14.   Write as a single logarithm and simplify :

      14.1 $\log_2(x+y) - \log_2(x^3 + y^3)$ (2)

14.2 $\log(x-1) - \dfrac{1}{2}\Big[\log(2x+1) - \log(2x^2 - x - 1)\Big]$

(3)

15. The total resistance of two resistors Connected in series whose resistances are 0.8 $\underline{|40°}$ ohms and 1.4$\underline{|25°}$ ohms is:

(2)

16. Simplify the following :

16.1 $\dfrac{7^x \times 7^{x+2} \times \left(5^x\right)^2}{35^{2x+2}}$

(3)

16.2 $\left[\dfrac{2^{n+4} - 5 \times 2^{n+1}}{6 \times 2^{n+3}}\right]^2$

(4)

16.3 $\dfrac{2 \times 3^{n+1} + 3^{n+2}}{2 \times 3^{n+3} + 3^n}$

(3)

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SECTION C[45]

INSTRUCTIONS

SHOW ALL THE STEPS TAKEN AND GIVE YOUR FINAL ANSWERS CORRECT TO TWO DECIMAL PLACES WHERE APPLICABLE. USE PAGE 15 TO RE-DO ANY QUESTION YOU MAY HAVE CANCELLED.

17.   Solve the following equation for x

17.1 $4x^3e^{-3x} - 3x^4e^{-3x} = 0$ (6)

17.2 $1 + \cos x = \sin x,$ $0 \leq x \leq 2\pi.$ (6)

17.3 $\ln x + \ln(x+1) = 1.$ (4)

17.4   Determine the value of p in the formula $\dfrac{D}{d} = \sqrt{\dfrac{f + p}{f - p}}$ (5)

18. In the diagram below, the circumference is $20\ cm$ and the area of the shaded sector is $6\ cm^2$.
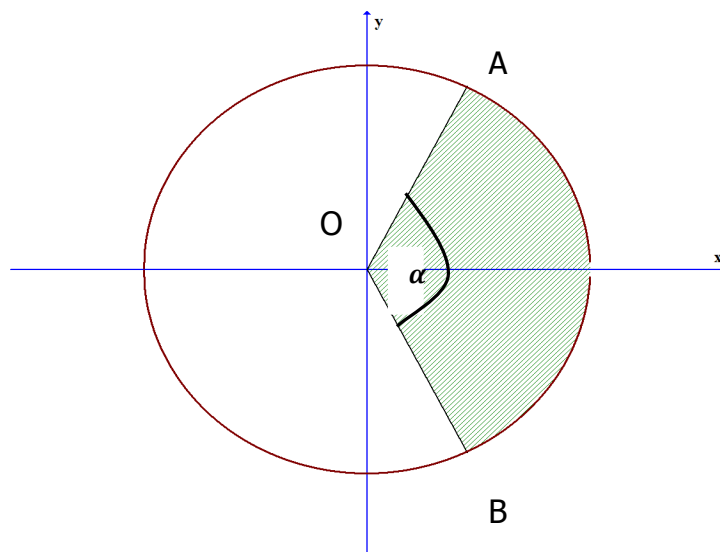
Calculate:

18.1 the radius (OA) (2)

18.2   the acute angle α in radians   (2)

18.3   the length of the major arc AB   (2)

19.   Use De Moivre's theorem to evaluate:

$$\left[\frac{4\left(\cos 120° - j \sin 120°\right)}{1+2j}\right]^2$$ (Answer in exponential form).   (6)

20. Find all the values of z, in rectangular form, that solve the equation:

$$z^8 - 1 = 0.$$ (12)

RE-DO ANY QUESTION THAT YOU MAY HAVE CANCELLED: