OPTION B

DEPARTMENT OF MATHEMATICS
FACULTY OF PHYSICAL SCIENCES
UNIVERSITY OF BENIN, BENIN CITY

COURSE CODE: MATHEMATICAL MEYTHOD I (MTH 218 MOCK) **2019/2020** **TIME ALLOWED: 1 Hour :15mins**

INSTRUCTIONS: (i) Write and circle your attendance list serial number on the objective answer paper. (ii) Attempt all questions by SHADING (using HB pencil) the letter box that corresponds to the correct option. Information about your Mat. No., Name, Course code, Faculty code and Department code must be clearly written and **CORRECTLY SHADED. YOU MUST SUBMIT YOUR QUESTION PAPER ALONG WITH YOUR ANSWER SHEET.**

NAME_____ **MAT. NO.**_____

1. Solve $\int tan^7 x sec^2 x\, dx$ (a) $\frac{tan^4 x}{4} + \frac{sec^3 x}{3} + C$ (b) $\frac{tan^8 x}{8} + C$ (c) $\frac{sec^4 x}{4} - \frac{sec^2 x}{2} + C$ (d) $\frac{sec^8 x}{8} + C$ (e) none
2. Solve $\int sin^3 x cos^2 x\, dx$ (a) $\frac{sin^4 x}{4} + \frac{sin^6 x}{6} + C$ (b) $-\frac{cos^4 x}{4} - \frac{cos^6 x}{6} + C$ (c) $\frac{sin^4 x}{4} - \frac{sin^6 x}{6} + C$ (d) $\frac{cos^4 x}{4} - \frac{cos^6 x}{6} + C$ (e) none
3. Express the complex number $z = \frac{1}{\sqrt{2}} + i\frac{1}{\sqrt{2}}$ in polar form (a) $\cos\frac{\pi}{4} - i\sin\frac{\pi}{4}$ (b)$\sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$ (c) $\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}$ (d) $\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}$ (e) none of the above
4. If $z = x + iy$ then $z\bar{z}$ = (a) $x^2 - y^2$ (b) $x^2 + y^2$ (c) $x^2 + iy^2$ (d) $x^2 - iy^2$ (e) none of the above
5. Find the value of $\frac{z_1}{z_2}$ in polar form if $z_1 = 1 + i\sqrt{3}$ and $z_2 = 1 + i$ (a) $\frac{\sqrt{2}}{2}\left(\frac{\cos\pi}{12} + i\frac{\sin\pi}{12}\right)$ (b) $\sqrt{2}\left(\frac{\cos\pi}{12} + i\frac{\sin\pi}{12}\right)$ (c) $\sqrt{5}\left(\frac{\cos\pi}{6} + i\frac{\sin\pi}{6}\right)$ (d) $\sqrt{2}\left(\frac{\cos\pi}{12} - i\frac{\sin\pi}{12}\right)$ (e) none of the above
6. Express $cos^3\theta$ in terms of multiple angles (a) $\frac{1}{4}(cos3\theta + 3cos\theta)$ (b) $4cos^3\theta - 3cos\theta$ (c) $3cos\theta - 4cos^3\theta$ (d) $\frac{1}{4}(cos3\theta - 3cos\theta)$ (e) none of the above
7. Evaluate $\frac{cos4\theta + isin4\theta}{cos\theta - isin\theta}$ (a) $cos4\theta + isin5\theta$ (b) $cos4\theta - isin5\theta$ (c) $cos5\theta + isin5\theta$ (d) $cos5\theta - isin5\theta$ (e) none
8. Find the smallest value of the function $f(x, y) = x^2 + y^2$ subject to the constraint $y + 3x = 3$ (a) $(0.9, 0.3)$ (b) $(0.9, 0.3)$ (c) $(0.9, 0.3)$ (d) $(0.9, 0.3)$ (e) none of the above
9. Find the minimum and maximum values of $f(x, y) = xy$ subject to the constraint $x^2 + y^2 - 8$ (a) (8, 4) (b) (8, -1) (c) (4, -4) (d) (2, 1) (e) none of the above
10. Evaluate $Arg\left(\frac{\sqrt{3}+i}{1+i}\right)$ (a) $\tan^{-1}\left(\frac{\sqrt{3}+1}{1-\sqrt{3}}\right)$ (b) $\tan^{-1}\left(\frac{1-\sqrt{3}}{1+\sqrt{3}}\right)$ (c) $\tan^{-1}\left(\frac{1+\sqrt{3}}{1+\sqrt{3}}\right)$ (d) $\tan^{-1}\left(\frac{\sqrt{3}-1}{1-\sqrt{3}}\right)$ (e) none of the above
11. Solve $\int \sin x \cos x\, dx$ (a) $\frac{sin^2 x}{2} + C$ (c) $\frac{sin^2 x \cos x}{2} + C$ (c) $\frac{cos^2 x \sin x}{2} + C$ (d) $\cot x + C$ (e) none of the above
12. Let $z = z + iy$ be a complex number with the polar form given as $z = r(cos\theta + isin\theta)$, then θ is given as (a) $tan^{-1}\left(\frac{x}{y}\right)$ (b) $tan^{-1}\left(\frac{1}{y}\right)$ (c) $tan^{-1}\left(\frac{y}{x}\right)$ (d) $tan^{-1}\left(\frac{1}{x}\right)$ (e) none of the above
13. Find the first partial derivative of $f(x, y) = x^3y^3 - 3xe^{-y} + xcosy$ with respect to y. (a) $3x^3y^2 + 3xe^{-y} + xsiny$ (b) $3x^3y^2 + 3xe^{-y} - xsiny$ (c) $3x^3y^2 + 3xe^{-y} - xcosy$ (d) $3x^3y^2 - 3xe^{-y} - xsiny$ (e) none of the above
14. Solve $\int \frac{dx}{9-x^2}$ (a) $\frac{1}{6}\ln\left(\frac{3-x}{3+1}\right) + C$ (b) $\frac{1}{6}\ln\left(\frac{3+1}{3-1}\right) + C$ (c) $\frac{1}{3}\ln\left(\frac{3-x}{3+1}\right) + C$ (d) $\frac{1}{3}\ln\left(\frac{3+x}{3-1}\right) + C$ (e) none of the above
15. Solve $\int x^2 \sin(\pi + x^3)\, dx$ (a) $\frac{\cos(\pi+x^3)}{3} + B$ (b) $\frac{\sin(\pi-x^3)}{3} + B$ (c) $-\frac{\cos(\pi+x^3)}{3} + B$ (d) $-\frac{\sin(\pi-x^3)}{3} + B$ (e) none
16. Evaluate $J\left(\frac{x,y}{r,\theta}\right)$ where $x = rcos\theta$ and $y = rsin\,\theta$ (a) $1/r$ (b) $2r$ **(c)** r (d) $-r$ (e) none of the above
17. Solve $\int (cos^5 x + 2)sinx\, dx$ (a) $(\frac{cos^6 x}{6} - 2cosx) + C$ (b) $-(\frac{cos^6 x}{6} + 2cosx) + C$ (c) $-(\frac{2sinx}{6} + 2cos^6 x) + C$ (d) $(\frac{sin^6 x}{6} - 2sinx) + C$ (e) none of the above
18. Find the nth differential coefficient of $y = \log_e x$ (a) $(-1)^n n!\, x^{-n}$ (b) $(-1)^{n-1}(n-1)!\, x^{-n}$ (c) $n!\, x^{-n}$ (d) $(1)^n(n-1)!\, x^{-n}$ (e) none of the above

19. Obtain the formula for $\int x^n \ln x \, dx$. (a) $\frac{x^{n+1}}{(n+1)^2}(\text{nln}\, x + 1) + C$ (b) $\frac{x^{n+1}}{(n+1)^2}((\text{n} + 1)\ln x - 1) + C$ (c) $\frac{x^{n+1}}{(n+1)^2}((\text{n} + 1)\ln x + 1) + C$ (d) $\frac{x^{n+1}}{(n+1)^2}(\ln x + 1) + C$ (e) none of the above

20. If $f(x) = e^{ax}$. Find the nth derivative of $f(x)$. (a) $a^n e^{ax}$ (b) $2e^{ax}$ (c) $2^n e^{ax}$ (d) none of the above

21. Solve $\int sec^2x \, tanx dx$ (a) $\frac{tan^4x}{4} + \frac{sec^3x}{3} + \text{C}$ (b) $\frac{tan^2x}{2} - \frac{sec^2x}{2} + \text{C}$ (c) $-\frac{sec^2x}{2} + \text{C}$ (d) $\frac{sec^2x}{2} + \text{C}$ (e) none of the above

22. If $f = f(x, y, z) \; where \; x = x(t), y = y(t) and \; z = z(t)$ then (a) $\frac{dz}{dt} = \frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dt}{dt} + \frac{\partial f}{\partial z}\frac{dz}{dt}$ (b) $\frac{dz}{dt} = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy + \frac{\partial f}{\partial z}dz$ (c) $\frac{dz}{dt} = \frac{\partial f}{\partial x}dt + \frac{\partial f}{\partial y}dt + \frac{\partial f}{\partial z}dt$ (d) $\frac{dz}{dt} = \frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt} + \frac{\partial f}{\partial z}\frac{dz}{dt}$ (e) none of the above

23. If $I_n = \int x^n e^x dx$, obtain the reduction formula for I_n . (a) $(n-1)I_{\text{n-1}} - x^{n-1}e^x$ (b) $x^n e^x + nI_{\text{n-1}}$ (c) $x^n e^x - nI_{\text{n-1}}$ (d) $(n+1)I_{\text{n-1}} - x^n e^x$ (e) none of the above

24. A function $f(x, y)$ is said to have a maximum or minimum point at point (x_o, y_o) if which of the following condition holds.
(a) $f_x \cdot f_{yy} < (f_{xy})^2, f_{xx} < 0$ (b) $f_{xx} \cdot f_{yy} < (f_{xy})^2 , f_{xx} < 0$ (c) $f_{xx} < f_{xy}$ (d)) $f_x \cdot f_{yy} < f_{xy} , f_{xx} < 0$ (e) none of the above

25. Evaluate $\int x^9 \ln x \, dx$. (a) $\frac{x^{10}}{10}(\ln x + 1) + C$ (b) $\frac{x^{10}}{100}(10 \ln x + 1) + C$ (c) $\frac{x^3}{9}(3\ln x - 1) + C$ (d) $\frac{x^{10}}{100}(10 \ln x + 1)$ (e) none of the above

26. Solve $\int x(x^2 - 2)^3 dx$. (a) $\frac{(x^2-2)^4}{4} + C$ (b) $\frac{x(x^2-2)^4}{8} + C$ (c) $\frac{x(x^2-2)^4}{16} + C$ (d) $\frac{(x^2-2)^4}{8} + C$ (e) none of the above

27. If $z_1 = -1 + i$ and $z_2 = -1 + 5i$ find the complex part of $-z_1 - 5z_2$ (a) -24 (b) 0 (c) -25 (d) 24 (e) none of the above

28. Solve $\int tanx \, sec^2x \, dx$ (a) $\frac{tan^4x}{4} + \frac{sec^3x}{3} + \text{C}$ (b) $\frac{tan^2x}{2} - \frac{sec^2x}{2} + \text{C}$ (c) $-\frac{sec^2x}{2} + \text{C}$ (d) $\frac{tan^2x}{2} + \text{C}$ (e) none of the above

29. If $z = a + ib$ then $\bar{z}z =$ (a) $x^2 - y^2$ (b) $x^2 + y^2$ (c) $x^2 + iy^2$ (d) $x^2 - iy^2$ (e) none of the above

30. Determine the first root of the complex number given by $z^4 = 1$.
(a) $\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}$ (b) $\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}$ (c) $\cos\frac{5\pi}{4} + i\sin\frac{5\pi}{4}$ (d) $\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}$ (e) none of the above

31. Evaluate $\int x^7 \sin x \; dx$ (a) $\sin x\,(2 - x^2) + x\cos x + C$ (b) $\cos x\,(2 - x^2) + x\sin x + C$ (c) $\sin x\,(2 + x^2) - x\cos x + C$ (d) $\sin x\,(2 - x^2) + x\sin x + C$ (e) none of the above

32. Evaluate $\int xe^x \, dx$ (a) $(x-1)e^x + C$ (b) $(x+1)e^x + C$ (c) $\frac{x^2}{2}e^x + x + C$ (d) $x^2e^x + C$ (e) none of the above

33. Evaluate $\int \frac{x}{\sqrt{1-2x^2}} dx$. (a) $\frac{(1-2x^2)^{-1/2}}{2} + C$ (b) $\frac{(1+2x^2)^{1/2}}{2} + C$ (c) $-\frac{(1-2x^2)^{-1/2}}{2} + C$ (d) $x(1 + 2x^2)^{1/2} + C$ (e) none of the above

34. Let $z = cos\theta + isin\theta$ and $z^{-1} = cos\theta - isin\theta$. What is the expression for $z + \frac{1}{z}$
(a) $2isin\theta$ (c) $2cos\theta$ (b) $2\sin n\theta$ (d) $2icos\theta$ (e) none of the above

35. Expand $f(x) = e^{ax}$ about the point $x = 0$
(a) $1 + (ax) + \frac{(ax)^2}{2!} + \frac{(ax)^3}{3!} + \cdots ... + \frac{(ax)^n}{n!} + E_{\text{n}}(\text{x})$
(b) $1 - (ax) + \frac{(ax)^2}{2!} - \frac{(ax)^3}{3!} + \cdots ... + \frac{(ax)^n}{n!} + E_{\text{n}}(\text{x})$
(c) $1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots ... + \frac{x^n}{n!} + E_{\text{n}}(\text{x})$
(d) $1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \cdots ... + \frac{x^n}{n!} + E_{\text{n}}(\text{x})$ (e) none of the above