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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS MAIN EXAM

FOR THE DEGREE OF BACHELOR SCIENCE IN MEDICAL LABORATORY

COURSE CODE: **BML 114**

COURSE TITLE: **MATHEMATICS FOR BIOMEDICAL SCIENCES**

DATE: 29TH APRIL 2022 **TIME: 8.00-11.00 AM**

INSTRUCTIONS TO CANDIDATES

Answer all the questions in Section A and any other TWO in section B

This Paper Consists of 6 Printed Pages. Please Turn Over.

SECTION A. ANSWER ALL THE QUESTIONS (20 MARKS)

1. Find an equation of the tangent line to the curve $y = 2x\sin x$ at the point $(0.5\pi, \pi)$
   A. $y = 2x + 2\pi$
   B. $y = 2x$
   C. $y = -2x + 2\pi$
   D. $y = -2x$
2. Integrate (1 / (3x + 4)) with respect to x and evaluate the result from x = 0 and x = 2.

   A. 0.278
   B. 0.336
   C. 0.252
   D. 0.305
3. Integrate the square root of (1 – cos x) dx.

   A. -2√2 cos (x/2) + C
   B. -2√2 cos x + C
   C. 2√2 cos (x/2) + C
   D. 2√2 cos x + C
4. Given the function $f(x) = x^3 - 4x^2 + 5x$, find the open interval(s) where f is concave down, i.e where the second derivative $f''(x) < 0$
   A. $\left(\frac{4}{3}, +\infty\right)$
   B. $\left(-\infty, \frac{4}{3}\right)$
   C. $\left(-\infty, \frac{4}{3}\right)$
   D. $\left[\frac{4}{3}, +\infty\right)$
5. What is the integral of $(3t-1)^3\,dt$?
   A. $(1/12)(3t-1)^4 + c$
   B. $(1/12)(3t-1)^3 + c$
   C. $(1/4)(3t-1)^4 + c$
   D. $(1/4)(3t-1)^3 + c$
6. What is the area(in square units) bounded by the curve $y^2 = x$ and the line $x - 4 = 0$?
   A. 30/3 sq. units
   B. 31/3 sq. units
   C. 32/3 sq. units

D. 29/3 sq. units

7. Use implicit differentiation to find an equation of the tangent line to the curve $\sin x + \cos y = 1$ at the point $(\pi/2, \pi/2)$
   A. $y - \pi/2 = 4(x - \pi/2)$
   B. $y = \pi$
   C. $y - \pi/2 = (x - \pi/2)$
   D. $y = \pi/2$
8. Which of the following methods is a form of graphical presentation of data?
   A. Line Diagram
   B. Pie diagram
   C. Bar diagram
   D. Histogram
9. All the following are measures of central tendency, except:
   A. Mode
   B. Variance
   C. Mean
   D. Median
10. The value of the integral $\int_0^{100\pi} \sin x dx$ is equal to

    A. 100 B. 1 C. 200 D. 100π
11. Which statement about normal distribution is FALSE:
    A. 50 percent of the observations fall within one standard deviation sigma of the mean.
    B. 68 percent of the observations fall within one standard deviation sigma of the mean.
    C. 95 percent of observation falls within 2 standard deviations.
    D. 99.7 percent of observations fall within 3 standard deviations of the mean.
12. Large standard deviations suggest that:
    A. scores are probably widely scattered.
    B. there is very little deference among scores.
    C. mean, median and mode are the same
    D. the scores not normally distributed.
13. A statistic which describes the interval of scores bounded by the 25th and 75th percentile ranks is:
    A. Inter quartile range
    B. Confidence Interval
    C. Standard deviation
    D. Variance
14. The correlation coefficient is used to determine:

A. A specific value of the y-variable given a specific value of the x-variable
B. A specific value of the x-variable given a specific value of the y-variable
C. The strength of the relationship between the x and y variables
D. None of these

15. The area bounded by the curves $y^2 = x-1$, $2y = x$ x-axis and y-axis will be equal to
A. 4.5 square units
B. 0.8 square units
C. 0.333 square units
D. 2 square units

16. Find the exact value of $\lim_{x\to 0}\dfrac{\sqrt{3+x}-\sqrt{3}}{x}$
A. $\sqrt{3}$
B. 0
C. $\dfrac{1}{2\sqrt{3}}$
D. The limit does not exist

17. Find the derivative of the following function $f(x) = 5x^2(x+47)$
A. $f'(x) = 15x^2 + 470x$
B. $f'(x) = 15x^2 + 47x$
C. $f'(x) = 10x$
D. $f'(x) = 15x^2 - 470x$

18. If $\sin(xy) = x^2$, then $\dfrac{dy}{dx}$
A) $2x\sec(xy)$ *B)* $\dfrac{\sec(xy)}{2}$ *C)* $2x\sec(xy) - y$ *D)* $\dfrac{2x\sec(xy)}{y}$

19. If $y = 5^{x^3-2}$, then $\dfrac{dy}{dx} =$
A) $(x^3-2)5^{x^3-3}$ *B)* $3x^2(\ln 5)5^{x^3-2}$ *C)* $3x^2 5^{x^3-2}$ *D)* $x^3(\ln 5)5^{x^3-2}$

20. Find the length of the arc of the parabola $x^2 = 4y$ from $x = -2$ to $x = 2$.
A. 4.2 units
B. 4.6 units
C. 4.9 units
D. 5.2 units

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION ONE (20 MARKS)

a) Define the following terms (2 Marks)
   (i) A function
   (ii) Derivative of a function

b) Given that $f(x)=x^3+2$ and $g(x)=2x+1$ find $g\circ f^{-1}(x)$ (4 Marks)

c) Using the first principle, find the derivative of $f(x)=\sqrt{x-1}$ (5 Marks)

d) Find an equation of the tangent to the circle $x^2+y^2=25$ at the point $(3,4)$ (4 Marks)

e) Find where the function $f(x)=3x^4-4x^3-12x^2+5$ is increasing and where it is decreasing (5 Marks)

QUESTION TWO (20 MARKS)

a) Find $\frac{d}{dx}\int_x^{\pi}\sqrt{1+\sec t}\,dt$ (3 marks)

b) Evaluate $\int_0^2 x^2e^{2x}dx$ (4 Marks)

c) Find the average value of the function $f(x)=x^2+3x-1$ on the interval $[-1,2]$ (3 Marks)

d) Find the area bounded above by $y=x^2+1$, bounded below by $y=x$ and bounded on the sides by $x=0$ and $x=1$. Sketch the region. (5 marks)

e) The region enclosed by the curves $y=x$ and $y=x^2$ is rotated about the x axis. Find the volume of the resulting solid (5 Marks)

QUESTION THREE (20 MARKS)

a) Two brands of drugs are tested with the following results

	NUMBER OF BRANDS	
Mean shell life	**X**	**Y**
20-25	1	0
25-30	22	24
30-35	64	76
35-40	10	0
40-45	3	0

(i) Which brand of drugs has greater average life? (3 marks)

(ii) Compare the variability and state which brands of drug is suitable for use

(3Marks)

b) The mean monthly salary paid to 1000 employees of a company was Kshs. 5000. The mean monthly salary paid to male and female employees were Kshs. 5200 and Kshs. 4200 respectively. Determine the % of males and females employed by the company.

(4 marks)

c) The following are marks obtained by 100 students in statistics class

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No.of students	5	10	25	30	20	10

Compute

(i) The arithmetic mean (2 marks)

(ii) Mode (2 marks)

(iii) Quartile deviation (2 marks)

(iv) The coefficient of mean deviation (2 marks)

(v) Variance (2 marks)

QUESTION FOUR (20 MARKS)

a) Differentiate between odd and even function (2 Marks)

a) Differentiate between definite and indefinite integrals (2 Marks)

b) Find the domain and the range of the function $f(x)=\sqrt{x^2-x-6}$ (4 Marks)

c) Find $\frac{dy}{dx}$ given that $y^3+y^2-5y-x^2=-4$ (4 Marks)

d) Find the open intervals on which $f(x)=x^2-\frac{3}{2}x^2$ is increasing or decreasing (4 Marks)

e) Evaluate $\int x(x^2+1)^2\,dx$ (4 Marks)