SPECIFY TYPE OF EXAMINATION

FIRST ATTEMPT ☐
FIRST RESIT ☐
SECOND RESIT ☐
RE-TAKE ☐

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF IT

2nd YEAR Diploma 1ST SEMESTER 2022/2023 ACADEMIC YEAR

KISUMU CAMPUS

COURSE CODE: SMA 2111

COURSE TITLE: DIFFERENTIAL AND INTEGRAL CALCULUS

DATE: **TIME:**

TIME: 2 HOURS

Instructions:

Answer ALL questions in Section A and B and ANY other TWO questions in Section C

Tick the most correct alternative in Section A

Answers to Questions in Section B and C must be written in the spaces provided on the question paper.

Candidates must ensure they submit their work by clicking “finish and submit attempt” button at the end.

SECTION A: 30 Marks (Each question carries 1 mark)

1. **Which of the following notation is used to represent the set of all real numbers x which satisfy** $a < x \leq b$?

A. (a, b)
B. [a, b)
C. (a, b]
D. [a, b]

2. The set B = $\{ x \mid x^2 - 1 > 0 \}$ **is represented by the notation**

A. $(-\infty, -1)$ and $(1, \infty)$.
B. $(-\infty, 1)$ and $(1, \infty)$.
C. $(\infty, -1)$ and $(1, \infty)$.
D. $(-\infty, \infty)$.

3. What is the integral of $(3t - 1)^3$ dt?

A. $(1/12)(3t - 1)^4 + C$
B. $(1/12)(3t - 4)^4 + C$
C. $(1/4)(3t - 1)^4 + C$
D. $(1/4)(3t - 1)^3 + C$

4. **What is the limit of sin(θ)/θ when θ approaches zero?**

A. 1
B. sin(θ)
C. 0
D. None of these

5. **What is meant of the differential?**

A. A word used a lot on a popular medical television series.
B. A method of directly relating how changes in a dependent variable affect changes in an independent variable.
C. A gearbox on the back end of your car.
D. None of these

6. Evaluate the integral of ln x dx, the limit are 1 and e.

A. 0

B. 1

C. 2

D. 3

7. Which of the following statements is always true for a function f(x)?

i. If f(x) and g(x) are continuous at x=a, then f(x)g(x) is continuous at x=a.

ii. If f(x)+g(x) is continuous at x=a and f′(a)=0, then g(x) is continuous at x=a.

iii. If f(x)+g(x) is differentiable at x=a, then f(x) and g(x) are both differentiable at x=a.

A. only i.

B. only ii.

C. only iii.

D. i. and ii.

E. ii. and iii.

8. What is the area bounded by the curve y = x^3, the x-axis, and the line x = -2 and x = 1?

A. 4.25 sq. units

B. 2.45 sq. units

C. 5.24 sq. units

D. 5.42 sq. units

9. Integrate: ($7x^3$ + $4x^2$) dx
A. ($7x^3/3$) + ($4x^2/2$) + C
B. ($7x^4/4$) + ($4x^2/5$) + C
C. ($7x^4/4$) + ($4x^3/3$) + C
D. $7x^4$ + ($4x^2/2$) + C

10. What will be the condition for L'Hôpital's Rule to work?
A. The function must possess at least three non-zero derivatives
B. The function must be determinate.
C. The function must be indeterminate.
D. The function must be inconsistent

11. What will be the second step when we performing anti-differentiation?
A. Multiply the coefficient by the new exponential value.
B. Divide the coefficient by the new exponential value.
C. Divide the coefficient by the old exponential value.
D. Subtract the new exponential value from the coefficient.

12. Evaluate the integral of cos x dx limits from π/4 to π/2.

A. 0.423

B. 0.293

C. 0.923

D. 0.329

13. If G(d) determined to 3d + C; then C is called:

A. the constant of integration.
B. the constant of death and taxes.
C. the constant of differentiation.
D. the constant of anti-differentiation.

14. What is the answer to ∫1/x dx?

A. loge(x)
B. Undefined because you cannot divide by zero
C. ln(x) + C
D. ln(x)

15. Compute the partial derivative of the function f(x, y, z) = e 1−x cos(y) + z e −1/(1+y 2) with respect to x at the point (1, 0, π).

A. -1
B. −1/e
C. 0
D. π/e

16. Evaluate the limit $\lim\limits_{(x,y)\to(0,0)} \frac{xy}{x^2+y^2}$.

A. −1
B. 0
C. $\frac{1}{2}$
D. 1
E. the limit does not exist

17. Evaluate: $\lim_{x \to 4} \frac{x^2 - 16}{x - 4}$

A. 0

B. 1

C. 8

D. 16

18. What is the derivative with respect to x of $(x + 1)^3 – x^3$?

A. 3x + 6

B. 3x – 3

C. 6x – 3

D. 6x + 3

19. Find the slope of the line tangent to the curve $y = x^3 – 2x + 1$ at x = 1.

A. 1

B. 1/2

C. 1/3

D. ¼

20. Find the coordinates of the vertex of the parabola $y = x^2 – 4x + 1$ by making use of the fact that at the vertex, the slope of the tangent is zero.

A. (2, -3)

B. (3, -2)

C. (-1, -3)

D. (-2, -3)

21. In the curve $2 + 12x – x^3$, find the critical points.

A. (2, 18) and (-2, -14)

B. (2, 18) and (2, -14)

C. (-2, 18) and (2, -14)

D. (-2, 18) and (-2, 14)

22. The sum of two positive numbers is 50. What are the numbers if their product is to be the largest possible.

A. 24 and 26

B. 28 and 22

C. 25 and 25

D. 20 and 30

23. A farmer has enough money to build only 100 meters of fence. What are the dimensions of the field he can enclose the maximum area?

A. 25 m x 25 m

B. 15 m x 35 m

C. 20 m x 30 m

D. 22.5 m x 27.5 m

24. The cost of C of a product is a function of the quantity x of the product: $C(x) = x^2 – 400x + 50$. Find the quantity for which the cost is minimum.

A. 1000

B. 1500

C. 2000

D. 3000

25. The product rule is used to

A. Integrate a function
B. Differentiate a function
C. Divide the functions
D. None of these

26. Which of the following is the wrong notation for derivative?

A. dy/dx
B. f'(x)
C. y'
D. dy

27. The derivative of the function is the

A. Slope of secant
B. Instantaneous rate of change
C. Maxima
D. Minima

28. The product rule formula is

A. $dy/dx = uv + vu$
B. $dy/dx = uv' + vu'$
C. $dy/dx = u'v' + vu$
D. $dy/dx = uv - vu'$

29. The derivative of f(x)=x^2tanx is

A. 2xsec2
B. 2xtanx+x2cotx,
C. 2xtan x+(xsecx)
D. None of these.

30. Let f(x) be a continuous function on [a,b] and differentiable on (a,b) such that f(b)=10, f(a)=2. On which of the following intervals [a,b] would the Mean Value Theorem guarantee a c∈(a,b) such that f′(c)=4.

A. [0,4] B. [0,3] C. [2,4] D. [1,10] E. (0,∞)

SECTION B (Answer all questions in this section) (20 marks)

1. Define the following terms;
   i. Function
   ii. Derivative
   iii. Integral. (3 marks)
2. State the properties of: Limits of sums, products and quotients. (3 marks)
3. Find the integral of cos x with respect to x (3 marks)
4. Differentiate y = x^2cos 3x (3 marks)
5. Define the quotient rule. (2mks)
6. Find the critical point of y = $x^2 + 7x - 17$ and state whether it is a local maximum or minimum point. (3 marks)
7. *I*f $f(x) = 3x + 2$, find its inverse i.e. $f^{-1}(x)$ (3mks)

SECTION C (20 marks). Answer any two questions in this section.

1. If $f(x) = 3x + 1$ and $g(x) = x^2 - 1$, find the composite of $(f\text{o}g)(x)$ (5mks)
   Using the product rule differentiate $y = x^2 (x^2 + 2x - 3)$. (5mks)

2. Define Limits (2 marks)
   Find by substituting numbers the limits of:
   a. $\lim\limits_{x \to 2} \dfrac{x^2 - 2x}{x^2 - 4}$. (4 marks)

b) $\lim\limits_{x \to \infty} \dfrac{1}{x}$ (4 marks)

3. a. Find the domain and range of $f(x) = \dfrac{1}{x^2}$. (3 marks)

   b. Define the term 'Function of a function' as used in calculus (2 marks)
   c. State the chain rule in differentiation. (2 marks)
   d. Differentiate $y = e^{x^3}$ (3 marks)