MAY 2022
EBS 301
CALCULUS
2 HOURS

Candidate's Index Number: LIBRARY COPY.
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UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B.ED)
THIRD YEAR, END-OF-FIRST SEMESTER EXAMINATION, MAY 2022

MAY 18, 2022 **CALCULUS** **9:00 AM – 9:30 AM**

This paper consists of two sections, A and B. Answer ALL the questions in Section A and THREE questions from Section B. Section A will be collected after the first 30 minutes.

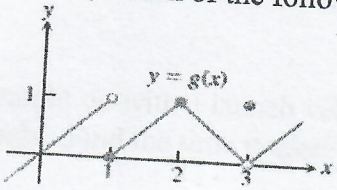
SECTION A
[40 MARKS]

Answer ALL the questions in this Section.

Items 1 to 20 are stems followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

1. Evaluate $\lim_{x\to 1} \frac{x^2+x-2}{x^2-x}$.
   A. 1
   B. 2
   C. 3
   D. 4

2. For the graph of the function $g(x)$ shown, which of the following statements is **not** true?

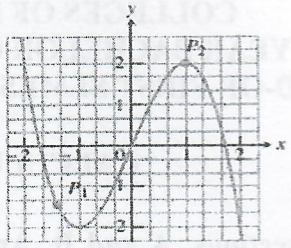


   A. $\lim_{x\to 1} g(x) = 0$
   B. $\lim_{x\to 2} g(x) = 1$
   C. $\lim_{x\to 3} g(x) = 0$
   D. $\lim_{x\to 1} g(x)$ exist

3. Suppose $\lim_{x\to 4} f(x) = 0$ and $\lim_{x\to 4} g(x) = -3$. Find $\lim_{x\to 4} \frac{g(x)}{f(x)-1}$.
   A. -3
   B. -1
   C. 1
   D. 3

4. What is the slope of the curve $y = \frac{1}{x}$ at the point $x = -1$?
   A. -2
   B. -1
   C. 1
   D. 2

5. In the given graph, what is slope the of the curve at the point P_2?



   A. 0
   B. 1
   C. 2
   D. ∞

6. Find the linearization of $f(x) = \sqrt{1+x}$ at $a = 3$.
   A. $\frac{4}{5} - \frac{x}{5}$
   B. $\frac{4}{5} + \frac{x}{5}$
   C. $\frac{5}{4} - \frac{x}{4}$
   D. $\frac{5}{4} + \frac{x}{4}$

7. Use the approximation $(1+x)^k = 1 + kx$ to estimate $\sqrt[3]{1.009}$.
   A. 1.001
   B. 1.002
   C. 1.003
   D. 1.004

8. Evaluate $\lim_{x\to 0} \frac{\sqrt{1+x}-1}{x}$.
   A. 0
   B. $\frac{1}{2}$
   C. 1
   D. ∞

9. Which of the following quantities is **not** indeterminate form?
   A. $0 + 0$
   B. $0/0$
   C. ∞/∞
   D. $\infty - \infty$

10. Suppose u and v are differentiable functions of x and $u(1) = 2, u'(1) = 0, v(1) = 5$ and $v'(1) = -1$. Find the value of $\frac{d(uv)}{dx}$.
    A. -2
    B. 0
    C. 3
    D. 5

11. The composite function $(f \circ g)(x)$ is differentiable at x, then $(f \circ g)'(x)$ is given by .....
    A. $f'(g(x))$
    B. $f'(g'(x))$
    C. $f'(g(x))g(x)$
    D. $f'(g(x))g'(x)$

12. Find $\frac{dy}{dx}$, if $x^2y + xy^2 = 6$.
    A. -1
    B. $\frac{-2xy-y^2}{x^2+2xy}$
    C. $\frac{2xy+y^2}{x^2-2xy}$
    D. 1

13. Let f be a function with domain D. Then f has an absolute minimum value on D at c if ..... for all x in D.
    A. $f(x) \leq f(c)$
    B. $f(x) \geq f(c)$
    C. $f(x) \neq f(c)$
    D. $f(x)f(c) = 1$

14. Find an equation of the straight line having slope $\frac{1}{4}$ and is tangent to the curve $y = \sqrt{x}$.
    A. $x + y = 2$
    B. $x + 2y = 4$
    C. $x - 4y - 4$
    D. $2x + 5y = 6$

15. A dynamite blast a heavy rock straight up with a launch velocity of 160m/s. It reaches a height of $s = 160t - 16t^2$ after t seconds. Find the time it takes to attain maximum height.
    A. 5 seconds
    B. 6 seconds
    C. 7 seconds
    D. 8 seconds

16. Find $\int 2(2x+4)^5\,dx$.

A. $\frac{1}{6}(2x+4)^5+c$

B. $\frac{1}{6}(2x+4)^6+c$

C. $\frac{1}{5}(2x+4)^5+c$

D. $\frac{1}{5}(2x+4)^6+c$

17. If f and g are continuous with $f(x) \geq g(x)$ through out $[a,\ b]$ then, the area of the region between the curves from a to b is given by .....

A. $\int_a^b [f(x)-g(x)]dx$

B. $\int_a^b [f(x)+g(x)]dx$

C. $\int_a^b [f(x)g(x)]dx$

D. $\int_a^b [f(x)/g(x)]dx$

18. Evaluate $\int_0^2 x(x-3)dx$.

A. $-\frac{10}{3}$

B. $-\frac{8}{3}$

C. 3

D. 6

19. A particle moves in a straight line such that t seconds after passing through a point O, its velocity (vm/s) is given by $v = 2t - 3$. Find the time that elapses before its changes it direction of the motion.

A. 1 second

B. $1\frac{1}{2}$ seconds

C. 2 seconds

D. $2\frac{1}{2}$seconds

20. A particle is moving along a straight line with a uniform acceleration of 8m/s^2. Initially, its velocity is 3m/s. Find the distance it travelled in 5 seconds.

A. 35m

B. 75m

C. 115m

D. 135m

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MAY 18, 2022 **CALCULUS** **9:30 AM – 11:00 AM**

SECTION B
[60 MARKS]

Answer only THREE questions from this Section.

1.

a. State the conditions for a function $f(x)$ to be continuous at $x = c$. Hence, determine at $x = 2$, the continuity of the function $g(x) = \begin{cases} \frac{x^2-x-2}{x-2}, & if\ x \neq 2 \\ 1, & if\ x = 2 \end{cases}$ **(10 marks)**

b. Show that the linearization of $f(x) = (1 + x)^k$ at $x = 0$ is $L(x) = 1 + kx$ and use it to estimate the value of $(1.0002)^{50}$. **(10 marks)**

2.

a. Find an equation of the tangent line to the graph of $y = g(x)$ at $x = 5$ if $g(5) = -3$ and $g'(5) = 4$. **(8 marks)**

b. Find the slope of the tangent line to the parabola $y = 4x - x^2$ at the point $(1, 3)$ using differentiation from the first principle. **(12 marks)**

3.

a. Use l'Hospital rule to evaluate $\lim_{x\to\infty} \frac{5x^3-2x}{7x^3}$. **(8 marks)**

b. Evaluate $\int_1^5 \frac{x}{\sqrt{2x-1}} dx$. (Hint let $u = \sqrt{2x-1}$). **(12 marks)**

4.

a. A point moves in the plane according to equations $x = t^2 + 2t$ and $y = 2t^3 - 6t$. Find $\frac{dy}{dx}$ when $t = 0, 2$ and 5.

(10 marks)

b. A particle moves along a straight line and is initially 5 meters from a fixed point O. Its velocity after t seconds is $3t^2 + 2t + 1$. Find:

i. the displacement of the particle from 0 after 2 seconds. **(5 marks)**

ii. the acceleration of the particle after 2 seconds. **(5 marks)**