

APRIL 2021
EBS 301
CALCULUS
2 HOURS

Candidate's Index Number:
Signature:

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, APRIL, 2021

APRIL 8, 2021

CALCULUS

9:00 AM – 9:30 AM

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

SECTION A

Answer ALL the questions in this Section.

For items 1 to 20, each stem is followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

- Find the gradient of the normal to the curve $x^2 - 2xy + 3y^2 - x = 4$ at the point $(2, -1)$.
 - $-2\frac{1}{2}$
 - $\frac{1}{2}$
 - 1
 - 2
- Which of the following is the derivative of $y = (5x + 47)^2$.
 - $2(5x + 47)$
 - $5(5x + 47)$
 - $10(5x + 47)$
 - $47(5x + 47)$
- If $\int_0^a (2x + 2)dx = 8$, $a > 0$, determine the value of a .
 - 2
 - 3
 - 6
 - 16

4. The distance, S meters travelled by a particle in a straight line is given by $S = 10t^2 + 58t$. What is the velocity after 1 second?
- 78 m/s
 - 84 m/s
 - 88 m/s
 - 98 m/s
5. Determine the maximum value of the curve $y = x^3 - 3x^2$.
- 0
 - 2
 - 4
 - 6
6. If f is a polynomial or a rational function and a is in the domain of f , then $\lim_{x \rightarrow a} f(x)$ is
- $f'(a)$
 - $f(a)$
 - $af'(x)$
 - $af(x)$
7. Which of the following is not a condition for a function f to be continuous at a ?
- $f(a)$ is defined
 - $\lim_{x \rightarrow a} f(x)$ exists
 - $\lim_{x \rightarrow a} f(x) = f(a)$
 - $\lim_{x \rightarrow a} f(a) = f(x)$
8. Calculate the slope of the tangent line to the curve $y = \frac{1}{x}$ at the point $(3, 1)$.
- 3
 - $-\frac{1}{9}$
 - $\frac{1}{3}$
 - 3
9. If $f(x) = \sqrt{x}$, find $f'(x)$.
- $\frac{1}{2\sqrt{x}}$
 - $\frac{1}{\sqrt{x}}$
 - $\frac{\sqrt{x}}{2}$
 - $2\sqrt{x}$
10. Find $\lim_{x \rightarrow 1} \frac{\ln x}{x-1}$.
- 0
 - 1
 - 2
 - Does not exist.

11. Which of the following **cannot** occur as indeterminate form?
- Indeterminate difference.
 - Indeterminate powers.
 - Indeterminate product.
 - Indeterminate sum.
12. If c is a constant and f is a differentiable function, then
 $\frac{d[cf(x)]}{dx} = c \frac{df(x)}{dx}$ is a
- chain rule.
 - constant multiple rule.
 - product rule.
 - quotient rule.
13. If $h(x) = \sqrt{4 + 3f(x)}$, where $f(1) = 7$ and $f'(1) = 4$, find $h'(1)$.
- 1.0
 - 1.2
 - 1.4
 - 1.6
14. The mathematical statement $f(x) \approx f(a) + f'(a)(x - a)$ is known as
- linear approximation of f at a
 - linear combination of f at a .
 - linear differentiation of f at a .
 - linear interpolation of f at a
15. Find the gradient of the normal to the curve $y = 2 - x - x^2$ at the point where $x = 2$.
- 5
 - $-\frac{1}{5}$
 - $\frac{1}{5}$
 - 5
16. The radius of a spherical balloon is increasing at 0.5cm/s. At the instant when the radius is 4cm, find the rate at which the surface area is increasing.
- $4\pi \text{ cm}^2/\text{s}$
 - $8\pi \text{ cm}^2/\text{s}$
 - $16\pi \text{ cm}^2/\text{s}$
 - $32\pi \text{ cm}^2/\text{s}$
17. Which of the following expression represents $\int x^n dx + k$?
- $nx^{n-1} + k$
 - $nx^{n+1} + k$
 - $\frac{x^{n-1}}{n+1} + k$
 - $\frac{x^{n+1}}{n+1} + k$

18. If $f'(x) = \sqrt{x}$, what is $f(x)$?

- A. $\frac{2}{3}x^{\frac{3}{2}} + k$
- B. $\frac{3}{2}x^{\frac{2}{3}} + k$
- C. $\frac{2}{3}x^{\frac{2}{3}} + k$
- D. $\frac{3}{2}x^{\frac{3}{2}} + k$

19. Evaluate $\int_1^2 \left(\frac{x^3-1}{x^2} \right) dx$.

- A. 1
- B. 2
- C. 3
- D. 4

20. A particle which moves along a straight line, has its displacement equation given as

$$s = \frac{1}{3}t^3 - \frac{5}{2}t^2 + 6t + 3.$$

What is the time at which the particle is instantaneously at rest?

- A. $t = 1s$ and $t = 2s$
- B. $t = 2s$ and $t = 3s$
- C. $t = 3s$ and $t = 4s$
- D. $t = 4s$ and $t = 5s$.

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SECTION B

Answer only THREE questions from this Section.

1.

a. Let $f(x) = \frac{|x|}{x} + x$.

i. Find $\lim_{x \rightarrow 0^-} f(x)$

ii. Find $\lim_{x \rightarrow 0^+} f(x)$

iii. Does the limit exist?

(10 Marks)

b. Find the linearization of the function $f(x) = \sqrt{x+3}$ at $a = 1$ and use it to approximate the numbers $\sqrt{3.98}$ and $\sqrt{4.05}$.

(10 Marks)

2.

a. A curve has equation $y = \frac{16}{x} - 4\sqrt{x}$. The normal to the curve at the point $(4, -4)$ meets the y -axis at P . Find the coordinates of P .

(12 Marks)

b. Find the value of k , if $\int_{-1}^2 (6x^5 + k)dx = 81$.

(8 Marks)

3.

a. Calculate $\lim_{x \rightarrow \infty} \frac{e^x}{x^2}$.

(8 Marks)

b. Find the turning values of y on the graph $y = f(x)$, where $f(x) = 5 + 24x - 9x^2 - 2x^3$ and distinguish between them.

(12 Marks)

4.

a. Find the equation of the tangent line to the curve $y = xe^{-x^2}$ of the point $(0, 0)$. (12 Marks)

b. Evaluate $\int_1^2 (4x^3 + 3x^2 - 6x + 1)dx$. (8 Marks)