

JIMMA UNIVERSITY COLLEGE OF NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

Applied Mathematics I Final exam for pre engineering students

Time allowed: 3:00 hrs

May 17, 2021

Name _____

ID.NO. _____ Section _____

Part I. short answer problems (15 points)

Write the most simplified solution on the answer sheet provided

1. Let $f(x) = x^2 \cosh x$, then
 - a) $f'(x) =$ _____
 - b) $\int f(x)dx =$ _____
2. $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot x} =$ _____
3. If $f(x) = \tan^{-1} x$, then $\int f(x)dx =$ _____
4. If $\int_0^1 f(x)dx = 2$, $\int_0^4 f(x)dx = -4$ and $\int_3^4 f(x)dx = 1$, then $\int_3^1 f(x)dx =$ _____
5. Let $f(x) = 2x^3 + 3x^2 - 12x + 4$ on $[0, 2]$ find
 - a) absolute maximum value = _____
 - b) absolute minimum value = _____

Part II. Work out problems (35 points)

Show all the necessary and logically connected steps on the answer sheet provided

1. Find $\frac{dy}{dx}$, if $\sin^{-1}(x+y) + y = x^2$ (3pts)
2.
 - a) State mean value theorem (2pts)
 - b) if $0 < a < b$, prove that $\frac{b-a}{b} < \ln\left(\frac{b}{a}\right) < \frac{b-a}{a}$ (4pts)

3. A water tank has a shape inverted circular cone with base radius $2m$ and height $4m$. If water is being pumped in to the tank at the rate $2 \text{ m}^3/\text{s}$, then find the rate at which water level is rising when the water is $3m$ deep. (5pts)
(4pts each)

4. Evaluate

a) $\int \frac{2^{\sin \sqrt{x}} \cos \sqrt{x}}{\sqrt{x}} dx$

b) $\int e^{2x} \sin 3x dx$

c) $\int \frac{1}{e^{2x} - 4e^x + 4} dx$

5. Let $f(x) = \frac{x}{x^2 - 4}$

Find

- a) Critical numbers (if any) (1pt).
- b) Symmetry, x and y intercepts and Asymptotes (2pts).
- c) Interval of monotonicity (1pts).
- d) Local maximum and local minimum value(s) (1pts).
- e) Interval of concavity and Inflection points (if any) (2pts).
- f) Sketch the graph (2pts).

GOOD LUCK!!!