CALCULUS 1: MID-TERM EXAM - 20201
Course ID: MI1016. Time: 60 minutes.

Note: Documents are not allowed.

Question 1. Determine the domain of

$$y = \arccos(e^x).$$

Question 2. For what value of a is $f(x) = \begin{cases} \dfrac{2^x - 1}{x} & \text{if } x \neq 0, \\ a & \text{if } x = 0 \end{cases}$ continuous on $\mathbb{R}$.

Question 3. Evaluate the following limits

a) $\lim\limits_{x\to 0} \dfrac{3x - \arctan(3x)}{x^3}$ b) $\lim\limits_{x\to\infty} \left(\sin\frac{1}{x} + \cos\frac{2}{x}\right)^x$.

Question 4. Determine the local extreme values of

$$f(x) = \sqrt[3]{x(x-2)^2}.$$

Question 5. Find the nth derivative of the function

$$f(x) = \frac{x}{(x-1)(x+2)}.$$

Question 6. Evaluate the following integrals

a) $\int \dfrac{e^x}{e^{2x}+1}dx$ b) $\int \ln(x^2+4)dx$.

Question 7. Determine the asymptotes of the curve

$$y = x \operatorname{arccot}\frac{1}{x}.$$

Question 8. Prove that

$$\tan x < \frac{x}{\sqrt{1-x^2}} \quad \text{for all } x \in (0;1).$$

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