Homework 1 - Stat4ML Course

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*Notice: Deadline: 2 days after receiving the email!

1   Set theory

Verify the following identities:

- $A \setminus B = A \setminus (A \cap B) = A \cap B^c$

- $B = (B \cap A) \cup (B \cap A^c)$

- $B \setminus A = B \cap A^c$

- $A \cup B = A \cup (B \cap A^c)$

2   function

Consider
$$f(x) = \ln \sqrt{x^2 + 10x + 9}.$$
Determine the domain and range of this function in R.

3   Integrals

Calculate the following integrals:

- $\int e^{2x} dx$

- $\int 4x e^{x^2} dx$

- $\int \ln x\, dx$

4 Derivatives

Calculate the following derivatives:

- $(\sin x^3)^2$

- $\frac{6x+2}{x^2+1}$

- $\frac{(\sin x^4)(x^4+3)^3}{(\cos x^3)(x^2+3x)}$

5 Limits

Calculate the following limits:

- $\lim_{x \to 5} x^2 + 3x + 5$

- $\lim_{x \to 0} \frac{\cos x - 1}{x^3 + 2x^2}$

6 Matrix

Let A and B be:
$$A = \begin{bmatrix} 2 & 8 & 9 \\ 5 & 6 & 2 \\ 4 & 9 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 5 & 9 \\ 4 & 3 \end{bmatrix}$$

Calculate:

- $det(A)$

- $B^2 + 2B + 3B^{-1}$

7 Series

Solve the following series in order to find a_i

$$\sum_{n=2}^{\infty} n(n-1)a_n x^{n-2} - \sum_{n=0}^{\infty} a_n x^{n+1} = 0$$