**МОСКОВСКИЙ ФИЗИКО-ТЕХНИЧЕСКИЙ ИНСТИТУТ (НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ)**

Физтех-школа Радиотехники и компьютерных технологий

# Лабораторная работа 3.9.7
# Исследование функции

**Рогов Анатолий Б01-406**

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# Пункт 1

## Исходная функция

$$f(ded) = (\frac{((\sin ded)+(\cos ded))}{((\ln ded)+9)})$$

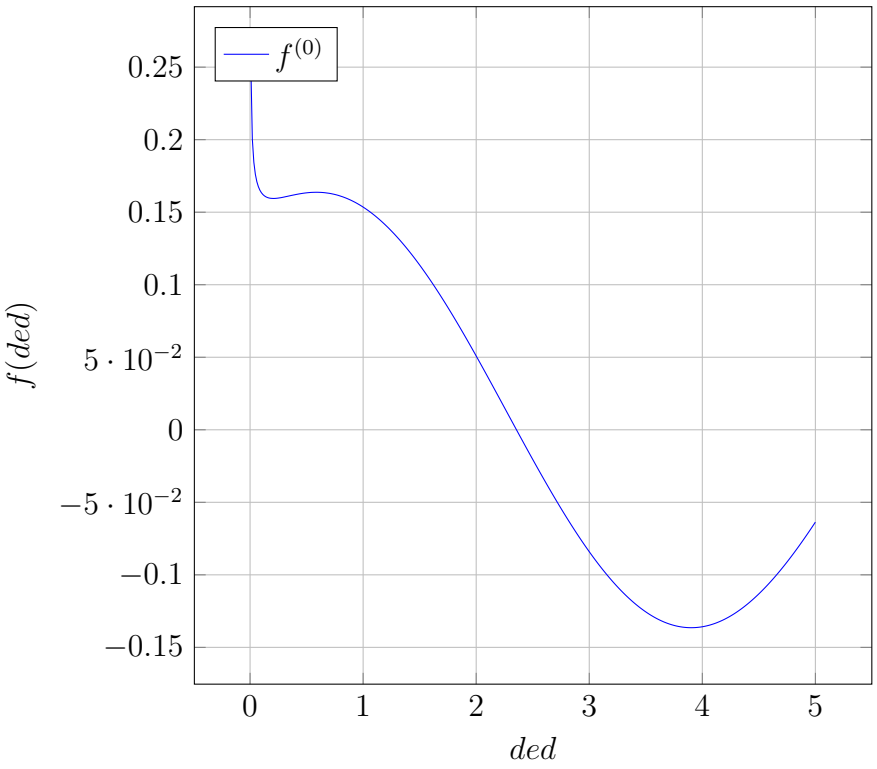


Рис. 1.1: График функции

# Пункт 2

## Разложение по формуле Тейлора до $o((ded - ded_0)^2)$ в точке $ded_0 = 1$

$$f^0(ded) = (\frac{((\sin ded)+(\cos ded))}{((\ln ded)+9)})$$

$$f^0(1) = 0.15353$$

## 2.1 Производная $f^{(1)}$ по переменной "$ded$"

**Шаг 1**

$$(\sin ded)' = (\cos ded)$$

**Шаг 2**

$$(\cos ded)' = (-1 \cdot (\sin ded))$$

**Шаг 3**

$$((\sin ded) + (\cos ded))' = ((\cos ded) + (-1 \cdot (\sin ded)))$$

**Шаг 4**

$$(\ln ded)' = (\frac{1}{ded})$$

**Шаг 5**

$$((\ln ded) + 9)' = (\frac{1}{ded})$$

**Шаг 6**

$$(\frac{((\sin ded)+(\cos ded))}{((\ln ded)+9)})' = (\frac{((((\cos ded)+(-1\cdot(\sin ded)))\cdot((\ln ded)+9))-(((\sin ded)+(\cos ded))\cdot(\frac{1}{ded})))}{(((\ln ded)+9)^2)})$$

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$$f^{(1)}(ded) = (\frac{((((\cos ded)+(-1\cdot(\sin ded)))\cdot((\ln ded)+9))-(((\sin ded)+(\cos ded))\cdot(\frac{1}{ded})))}{(((\ln ded)+9)^2)})$$

$$f^1(1) = -0.0505221$$

## 2.2 Производная $f^{(2)}$ по переменной "$ded$"

**Шаг 1**

$$(\cos ded)' = (-1 \cdot (\sin ded))$$

**Шаг 2**

$$(\sin ded)' = (\cos ded)$$

**Шаг 3**

$$(-1 \cdot (\sin ded))' = (-1 \cdot (\cos ded))$$

**Шаг 4**

$$((\cos ded) + (-1 \cdot (\sin ded)))' = ((-1 \cdot (\sin ded)) + (-1 \cdot (\cos ded)))$$

**Шаг 5**

$$(\ln ded)' = (\frac{1}{ded})$$

**Шаг 6**

$$((\ln ded) + 9)' = (\frac{1}{ded})$$

**IIar 7**

$$(((\cos ded) + (-1 \cdot (\sin ded))) \cdot ((\ln ded) + 9))' = \\ ((((-1 \cdot (\sin ded)) + (-1 \cdot (\cos ded))) \cdot ((\ln ded) + 9)) + \\ (((\cos ded) + (-1 \cdot (\sin ded))) \cdot (\tfrac{1}{ded})))$$

**IIar 8**

$$(\sin ded)' = (\cos ded)$$

**IIar 9**

$$(\cos ded)' = (-1 \cdot (\sin ded))$$

**IIar 10**

$$((\sin ded) + (\cos ded))' = ((\cos ded) + (-1 \cdot (\sin ded)))$$

**IIar 11**

$$(\tfrac{1}{ded})' = (\tfrac{-1}{(ded^2)})$$

**IIar 12**

$$(((\sin ded) + (\cos ded)) \cdot (\tfrac{1}{ded}))' = \\ ((((\cos ded) + (-1 \cdot (\sin ded))) \cdot (\tfrac{1}{ded})) + (((\sin ded) + (\cos ded)) \cdot (\tfrac{-1}{(ded^2)})))$$

**IIar 13**

$$((((\cos ded) + (-1 \cdot (\sin ded))) \cdot ((\ln ded) + 9)) - \\ (((\sin ded) + (\cos ded)) \cdot (\tfrac{1}{ded})))' = \\ (((((-1 \cdot (\sin ded)) + (-1 \cdot (\cos ded))) \cdot ((\ln ded) + 9)) + (((\cos ded) + (-1 \cdot (\sin ded))) \cdot (\tfrac{1}{ded})))- \\ ((((\cos ded) + (-1 \cdot (\sin ded))) \cdot (\tfrac{1}{ded})) + (((\sin ded) + (\cos ded)) \cdot (\tfrac{-1}{(ded^2)}))))$$

**IIar 14**

$$(\ln ded)' = (\tfrac{1}{ded})$$

**Шаг 15**

$$((\ln ded) + 9)' = (\frac{1}{ded})$$

**Шаг 16**

$$(((\ln ded) + 9)^2)' = ((2 \cdot ((\ln ded) + 9)) \cdot (\frac{1}{ded}))$$

**Шаг 17**

$$(\frac{((((\cos ded)+(-1\cdot(\sin ded)))\cdot((\ln ded)+9))-(((\sin ded)+(\cos ded))\cdot(\frac{1}{ded})))}{(((\ln ded)+9)^2)})' =$$
$$(\frac{(((((((-1\cdot(\sin ded))+(-1\cdot(\cos ded)))\cdot((\ln ded)+9))+(((\cos ded)+(-1\cdot(\sin ded)))\cdot(\frac{1}{ded})))-((((\cos ded)+(-1\cdot(\sin ded)))\cdot(\frac{1}{ded}))+(((\sin ded)$$
$$((((\ln$$

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$$f^{(2)}(ded) =$$
$$(\frac{(((((((-1\cdot(\sin ded))+(-1\cdot(\cos ded)))\cdot((\ln ded)+9))+(((\cos ded)+(-1\cdot(\sin ded)))\cdot(\frac{1}{ded})))-((((\cos ded)+(-1\cdot(\sin ded)))\cdot(\frac{1}{ded}))+(((\sin ded)$$
$$((((\ln$$

$$f^2(1) = -0.125244$$

## 2.3 Ответ

$$f(ded) = 0.15353 + \frac{-0.0505221}{1!} \cdot (ded-1)^1 + \frac{-0.125244}{2!} \cdot (ded-1)^2 + o((ded-1)^2)$$

## 2.4 График членов Тейлора

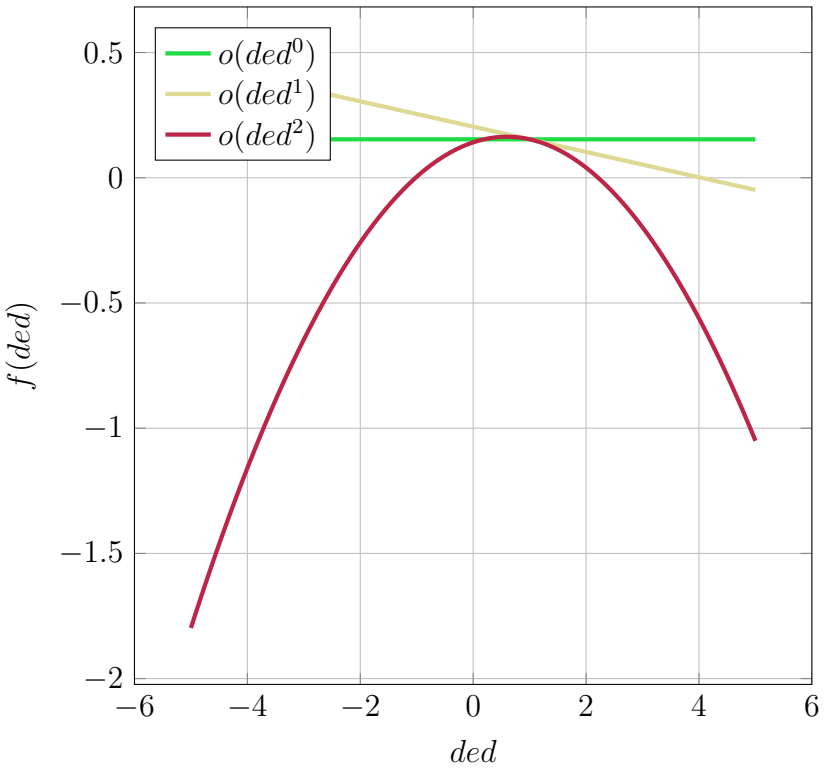


Рис. 2.1: График членов разложения