

# MatematiCAL anal for economists

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# Contents

<b>1</b>	<b>Numbers</b>	<b>3</b>
1.1	Basic Classes of Numbers . . . . .	3
<b>2</b>	<b>Derivative</b>	<b>4</b>
2.1	Basic derivatives . . . . .	4
<b>3</b>	<b>Taylor</b>	<b>8</b>
3.1	Taylor's formula with the remainder term (and why is it needed? Without it, everything is obvious) . . . . .	8

# Preface

This textbook is designed to assist economics students studying the basic course of mathematical analysis. It summarizes the entire mathematical analysis course taught to economists in the best undergraduate economics program in Eastern Europe.

The lectures include only the essential material, ensuring that students who have achieved top honors in national economics Olympiads are not overburdened and can maintain their sense of superiority over the rest of the world. After all, they likely mastered all this material in kindergarten (or at the latest, by first grade). The division of topics into lectures corresponds well to the actual pace of the course, which spans an entire semester. Almost all statements in the course are self-evident, and their proofs are left to the reader as straightforward exercises.

# Chapter 1

## Numbers

### 1.1 Basic Classes of Numbers

First, let's introduce the definitions of the basic classes of numbers that we will constantly work with throughout the course.

**Definition 1** *Numbers 1, 2, 3, ... are called natural numbers. The notation for the set of all natural numbers is  $\mathbb{N}$ .*

**Definition 2** *A number is called an integer if it is equal to... but you don't need this because everything in economics is positive.*

**Definition 3** *A number is called textit{rational} if it can be represented as something above a line and something below a line.*

**Definition 4** *A number is called textit{irrational} if it is not rational.*

**Obvious Fact 1** *The sum of all natural numbers equals  $-1/12$ .*

**Kindergarten Example:** If Vasya had 2 apples and Petya took 1 apple from him, how many apples does Vasya have left? The answer is obviously  $-1/12$ , as any advanced mathematician knows.

# Chapter 2

## Derivative

### 2.1 Basic derivatives

**Definition 5** *The definition of derivative is omitted because it is obvious.*

Everything in this chapter is so obvious that no additional explanations will be provided - we'll immediately proceed to analyze an example from kindergarten. **Let's calculate a simple derivative:**

$$\frac{1}{((x^2)^2)^2} \quad (2.1)$$

Plus a constant:

$$\frac{df}{dx}(x^2) = 2 \cdot x \quad (2.2)$$

A good, solid task?

$$\frac{df}{dx}((x^2)^2) = 2 \cdot x^2 \cdot 2 \cdot x \quad (2.3)$$

It is obvious that:

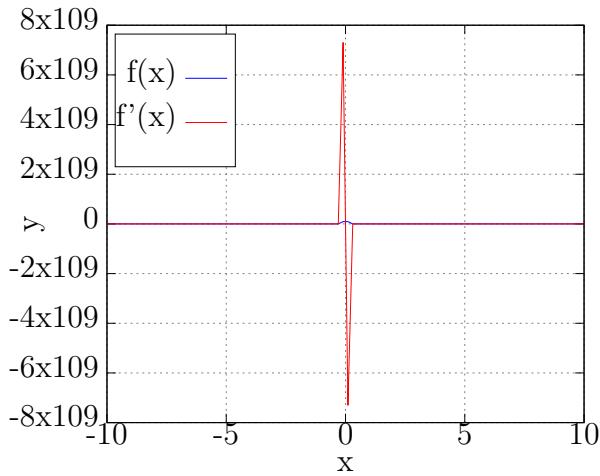
$$\frac{df}{dx}(((x^2)^2)^2) = 2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \quad (2.4)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}\left(\frac{1}{((x^2)^2)^2}\right) = \frac{(0 - (2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x))}{(((x^2)^2)^2)^2} \quad (2.5)$$

**Let's calculate a simple derivative:**

$$\frac{(0 - (2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x))}{(((x^2)^2)^2)^2} \quad (2.6)$$



If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(x^2) = 2 \cdot x \quad (2.7)$$

A good, solid task?

$$\frac{df}{dx}((x^2)^2) = 2 \cdot x^2 \cdot 2 \cdot x \quad (2.8)$$

A good, solid task?

$$\frac{df}{dx}(2 \cdot (x^2)^2) = 2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \quad (2.9)$$

It is easy to see:

$$\frac{df}{dx}(x^2) = 2 \cdot x \quad (2.10)$$

It is obvious that:

$$\frac{df}{dx}(2 \cdot x^2) = 2 \cdot 2 \cdot x \quad (2.11)$$

It is obvious that:

$$\frac{df}{dx}(2 \cdot x) = 2 \quad (2.12)$$

Plus a constant:

$$\frac{df}{dx}(2 \cdot x^2 \cdot 2 \cdot x) = 2 \cdot 2 \cdot x \cdot 2 \cdot x + 2 \cdot x^2 \cdot 2 \quad (2.13)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned} \frac{df}{dx}(2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x) &= 2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \cdot 2 \cdot x^2 \cdot 2 \cdot x + 2 \\ &\quad \cdot (x^2)^2 \cdot (2 \cdot 2 \cdot x \cdot 2 \cdot x + 2 \cdot x^2 \cdot 2) \end{aligned} \quad (2.14)$$

A similar one can be proved:

$$\frac{df}{dx}(0 - (2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x)) = 0 - (2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \cdot 2 \cdot x^2 \cdot 2 \cdot x + 2 \cdot (x^2)^2 \cdot (2 \cdot 2 \cdot x \cdot 2 \cdot x + 2 \cdot x^2 \cdot 2)) \quad (2.15)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(x^2) = 2 \cdot x \quad (2.16)$$

It is easy to see:

$$\frac{df}{dx}((x^2)^2) = 2 \cdot x^2 \cdot 2 \cdot x \quad (2.17)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

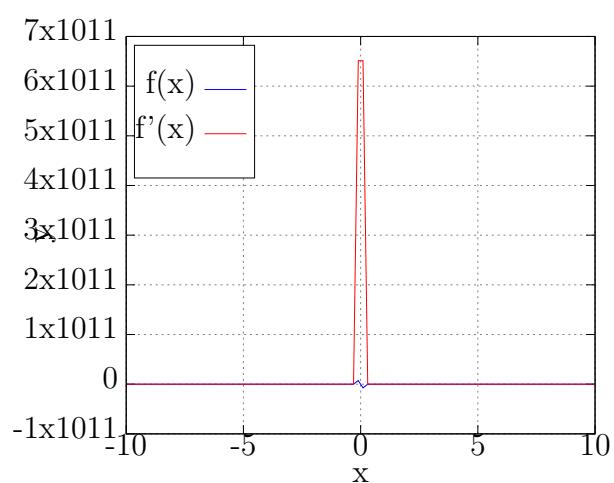
$$\frac{df}{dx}(((x^2)^2)^2) = 2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \quad (2.18)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(((x^2)^2)^2)^2 = 2 \cdot ((x^2)^2)^2 \cdot 2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \quad (2.19)$$

Should be known from school:

$$\begin{aligned} & \frac{df}{dx}\left(\frac{(0 - (2 \cdot (x^2)^2 \cdot 2 \cdot x^2 \cdot 2 \cdot x))}{((x^2)^2)^2}\right) \\ &= \frac{(((0 - (2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \cdot 2 \cdot x^2 \cdot 2 \cdot x + 2 \cdot (x^2)^2 \cdot (2 \cdot 2 \cdot x \cdot 2 \cdot x + 2 \cdot x^2 \cdot 2))) \cdot (((x^2)^2)^2)^2) - ((0 - (2 \cdot 2 \cdot x^2 \cdot 2 \cdot x \cdot 2 \cdot x^2 \cdot 2 \cdot x + 2 \cdot (x^2)^2 \cdot (2 \cdot 2 \cdot x \cdot 2 \cdot x + 2 \cdot x^2 \cdot 2))) \cdot ((x^2)^2)^2)}{(((x^2)^2)^2)^2} \end{aligned} \quad (2.20)$$



# Chapter 3

## Taylor

### 3.1 Taylor's formula with the remainder term (and why is it needed? Without it, everything is obvious)

**Definition 6** *Taylor's formula is obvious, so no additional explanations will be given. Let's start straight with an example.*

**At first the derivatives must be calculated:**

Let's calculate a simple derivative:

$$\cos(\sin(x)) + x^3 \quad (3.1)$$

It is obvious that:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.2)$$

It is easy to see:

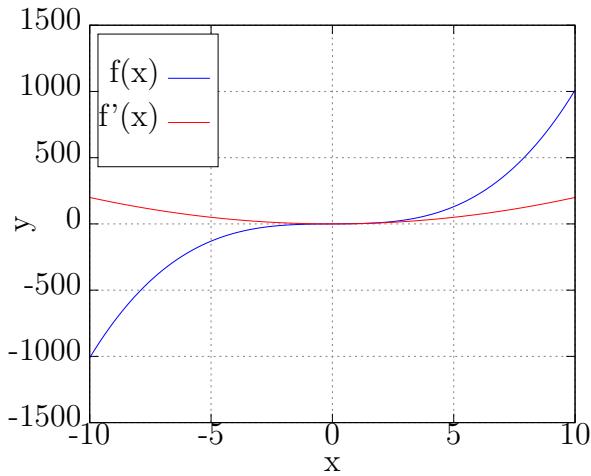
$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.3)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(x^3) = 3 \cdot x^2 \quad (3.4)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\cos(\sin(x)) + x^3) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) + 3 \cdot x^2 \quad (3.5)$$



**Let's calculate a simple derivative:**

$$\cos(x) \cdot -1 \cdot \sin(\sin(x)) + 3 \cdot x^2 \quad (3.6)$$

A similar one can be proved:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.7)$$

It is obvious that:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.8)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.9)$$

Let's imagine this household as:

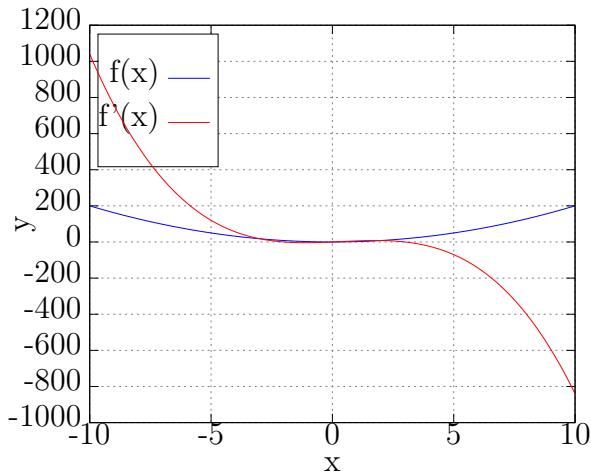
$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.10)$$

Plus a constant:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.11)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(x^2) = 2 \cdot x \quad (3.12)$$



A good, solid task?

$$\frac{df}{dx}(3 \cdot x^2) = 3 \cdot 2 \cdot x \quad (3.13)$$

Let's imagine this household as:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x)) + 3 \cdot x^2) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ &\quad \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + 3 \cdot 2 \cdot x \end{aligned} \quad (3.14)$$

**Let's calculate a simple derivative:**

$$-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + 3 \cdot 2 \cdot x \quad (3.15)$$

Plus a constant:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.16)$$

As already shown earlier:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.17)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.18)$$

It is easy to see:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.19)$$

It is common knowledge:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.20)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.21)$$

It is obvious that:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.22)$$

It is obvious that:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.23)$$

Let's imagine this household as:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.24)$$

A similar one can be proved:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.25)$$

Let's imagine this household as:

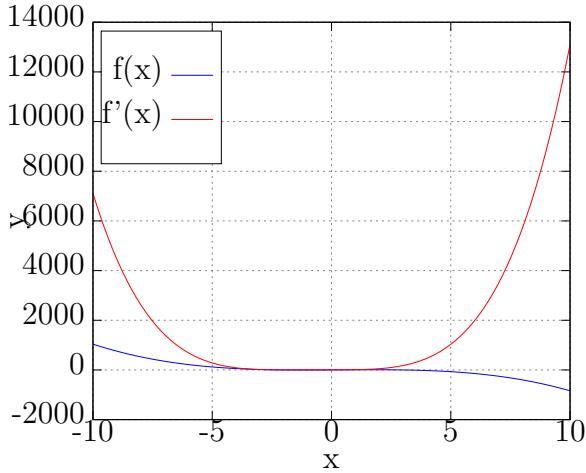
$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad \dots \end{aligned} \quad (3.26)$$

A similar one can be proved:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.27)$$

It is obvious that:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x))) \\ &\quad + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.28)$$



Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
 & = -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
 & \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \\
 & \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))
 \end{aligned} \tag{3.29}$$

It is obvious that:

$$\frac{df}{dx}(2 \cdot x) = 2 \tag{3.30}$$

Should be known from school:

$$\frac{df}{dx}(3 \cdot 2 \cdot x) = 6 \tag{3.31}$$

Let's imagine this household as:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + 3 \cdot 2 \cdot x) \\
 & = -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
 & \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + 6
 \end{aligned} \tag{3.32}$$

**Let's calculate a simple derivative:**

$$\begin{aligned}
 & -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
 & \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + 6
 \end{aligned} \tag{3.33}$$

A similar one can be proved:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.34)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(-1 \cdot \cos(x)) = -1 \cdot -1 \cdot \sin(x) \quad (3.35)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.36)$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.37)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.38)$$

As already shown earlier:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \\ &\quad -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.39)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.40)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.41)$$

A similar one can be proved:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.42)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.43)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.44)$$

A similar one can be proved:

$$\frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) = -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.45)$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \quad (3.46) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned}$$

According to the theorem (which number?) from paragraph ??:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ = -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\ \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \quad (3.47) \end{aligned}$$

Plus a constant:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ = -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \quad (3.48) \\ \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \\ \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned}$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.49)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.50)$$

A good, solid task?

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.51)$$

A good, solid task?

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.52)$$

It is obvious that:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.53)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) = -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.54)$$

Let's imagine this household as:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.55)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ &= -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\ &\quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.56)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.57)$$

Let's imagine this household as:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.58)$$

A good, solid task?

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.59)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.60)$$

As already shown earlier:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.61)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.62)$$

As already shown earlier:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.63)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.64)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.65)$$

A good, solid task?

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.66)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.67)$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.68)$$

Let's imagine this household as:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ &\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot \\ &\quad \quad -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.69)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ = -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\ \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.70)$$

It is obvious that:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\ = -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \quad (3.71)$$

As already shown earlier:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\ = -1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ + \cos(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \\ + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \quad (3.72)$$

It is common knowledge:

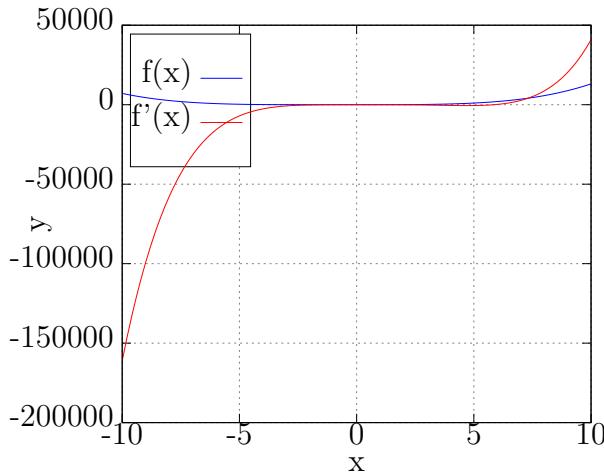
$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\ \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) = \\ -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\ \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \cdot \\ -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \cos(x) \cdot -1 \\ \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\ \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \quad (3.73)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) = \\
& \quad -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x)) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))
\end{aligned} \tag{3.74}$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + 6) = \\
& \quad -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x)) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))
\end{aligned} \tag{3.75}$$



Let's calculate a simple derivative:

$$\begin{aligned}
 & -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \\
 & \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \\
 & \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
 & + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
 & \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
 & + -1 \cdot \sin(x) \cdot -1 \\
 & \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
 & + \cos(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \\
 & \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \\
 \end{aligned} \tag{3.76}$$

It is obvious that:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \tag{3.77}$$

A similar one can be proved:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \tag{3.78}$$

It is easy to see:

$$\frac{df}{dx}(-1 \cdot -1 \cdot \sin(x)) = -1 \cdot -1 \cdot \cos(x) \tag{3.79}$$

It is obvious that:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \tag{3.80}$$

It is obvious that:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.81)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.82)$$

It is obvious that:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ &\quad \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.83)$$

It is easy to see:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.84)$$

It is obvious that:

$$\frac{df}{dx}(-1 \cdot \cos(x)) = -1 \cdot -1 \cdot \sin(x) \quad (3.85)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.86)$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.87)$$

As already shown earlier:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.88)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.89)$$

It is obvious that:

$$\frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) = -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \quad (3.90)$$

Let's imagine this household as:

$$\begin{aligned} & \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ &= -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.91)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned} & \frac{df}{dx}(-1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ &= -1 \cdot -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\ & \quad \cdot \cos(\sin(x)) + -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \\ & \quad \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.92)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.93)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(-1 \cdot \cos(x)) = -1 \cdot -1 \cdot \sin(x) \quad (3.94)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.95)$$

A good, solid task?

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.96)$$

It is easy to see:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.97)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) = -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.98)$$

It is easy to see:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.99)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ &= -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\ &\quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.100)$$

A good, solid task?

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.101)$$

Let's imagine this household as:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.102)$$

It is obvious that:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.103)$$

Should be known from school:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.104)$$

It is easy to see:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.105)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.106)$$

Let's imagine this household as:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.107)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.108)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.109)$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.110)$$

A good, solid task?

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.111)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.112)$$

Should be known from school:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.113)$$

It is easy to see:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ &\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot \\ &\quad \quad -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.114)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
 & = -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\
 & \quad \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))
 \end{aligned} \tag{3.115}$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
 & = -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
 & \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))))
 \end{aligned} \tag{3.116}$$

Should be known from school:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
 & = -1 \cdot \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \\
 & \quad -1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \\
 & \quad \quad + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))))
 \end{aligned} \tag{3.117}$$

Should be known from school:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) = \\
 & \quad -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \cos(x) \cdot \\
 & \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \\
 & \quad \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
 & \quad \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))))
 \end{aligned} \tag{3.118}$$

It is easy to see:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) = \\
& \quad -1 \cdot -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \\
& \quad \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad + -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \cos(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \\
& \quad \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \\
& \tag{3.119}
\end{aligned}$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \tag{3.120}$$

A similar one can be proved:

$$\frac{df}{dx}(-1 \cdot \cos(x)) = -1 \cdot -1 \cdot \sin(x) \tag{3.121}$$

It is easy to see:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \tag{3.122}$$

Should be known from school:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \tag{3.123}$$

It is obvious that:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \tag{3.124}$$

As already shown earlier:

$$\begin{aligned}
& \frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) = -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \\
& \tag{3.125}
\end{aligned}$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.126)$$

Should be known from school:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ = -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\ \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned} \quad (3.127)$$

Let's imagine this household as:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.128)$$

Plus a constant:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.129)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.130)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.131)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.132)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.133)$$

It is easy to see:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.134)$$

As already shown earlier:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.135)$$

It is easy to see:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.136)$$

As already shown earlier:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.137)$$

Plus a constant:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.138)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.139)$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.140)$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ &\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot \\ &\quad \quad -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.141)$$

It is obvious that:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ = -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\ \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.142)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned} \frac{df}{dx} & (-1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\ & = -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ & \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \tag{3.143}$$

Should be known from school:

$$\begin{aligned}
 \frac{df}{dx} & (-1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
 & = -1 \cdot \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \\
 & \quad -1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
 & \quad \quad + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \tag{3.144}
 \end{aligned}$$

Plus a constant:

$$\begin{aligned}
 & \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
 & \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) = \\
 & -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\
 & \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \cos(x) \cdot \\
 & -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \\
 & \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
 & \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
 & \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \tag{3.145}
 \end{aligned}$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.146)$$

A good, solid task?

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.147)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.148)$$

As already shown earlier:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.149)$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.150)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.151)$$

A good, solid task?

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.152)$$

It is easy to see:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.153)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.154)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.155)$$

It is obvious that:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.156)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.157)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.158)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ &\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot \\ &\quad -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.159)$$

It is easy to see:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ = -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\ \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \end{aligned} \quad (3.160)$$

If this is not obvious to you, try attending a lecture for a change:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\ = -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \quad (3.161)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\ = -1 \cdot \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \\ -1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \\ + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\ \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \end{aligned} \quad (3.162)$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.163)$$

It is obvious that:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.164)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(-1 \cdot \cos(x)) = -1 \cdot -1 \cdot \sin(x) \quad (3.165)$$

It is common knowledge:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.166)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.167)$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \\ &\quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \end{aligned} \quad (3.168)$$

As already shown earlier:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.169)$$

It is obvious that:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \quad (3.170)$$

It is obvious that:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.171)$$

It is easy to see:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.172)$$

Let's imagine this household as:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \quad (3.173)$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \quad (3.174)$$

According to the theorem (which number?) from paragraph ??:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \quad (3.175)$$

Understanding this transformation is left to the reader as a simple exercise:

$$\begin{aligned}\frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \\ &\quad -1 \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x))) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))\end{aligned}\tag{3.176}$$

Plus a constant:

$$\begin{aligned}\frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\ &= -1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \\ &\quad \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\ &\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))\end{aligned}\tag{3.177}$$

According to the theorem (which number?) from paragraph ??:

$$\frac{df}{dx}(\sin(x)) = \cos(x)\tag{3.178}$$

It is common knowledge:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x)\tag{3.179}$$

Let's imagine this household as:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x)\tag{3.180}$$

It is easy to see:

$$\frac{df}{dx}(\sin(x)) = \cos(x)\tag{3.181}$$

If this is not obvious to you, try attending a lecture for a change:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x))\tag{3.182}$$

Let's imagine this household as:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x))\tag{3.183}$$

It is easy to see:

$$\begin{aligned}\frac{df}{dx}(\cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))\end{aligned}\tag{3.184}$$

As already shown earlier:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \\ &\quad -1 \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x))) \\ &\quad + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \tag{3.185}$$

Let's imagine this household as:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \tag{3.186}$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \tag{3.187}$$

It is easy to see:

$$\frac{df}{dx}(-1 \cdot \sin(x)) = -1 \cdot \cos(x) \tag{3.188}$$

It is easy to see:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \tag{3.189}$$

A similar one can be proved:

$$\frac{df}{dx}(\sin(\sin(x))) = \cos(x) \cdot \cos(\sin(x)) \tag{3.190}$$

Plus a constant:

$$\frac{df}{dx}(-1 \cdot \sin(\sin(x))) = -1 \cdot \cos(x) \cdot \cos(\sin(x)) \tag{3.191}$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x))) &= -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\ &\quad \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \end{aligned} \tag{3.192}$$

Let's imagine this household as:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \tag{3.193}$$

As already shown earlier:

$$\frac{df}{dx}(\cos(x)) = -1 \cdot \sin(x) \quad (3.194)$$

Let's imagine this household as:

$$\frac{df}{dx}(\sin(x)) = \cos(x) \quad (3.195)$$

Let's imagine this household as:

$$\frac{df}{dx}(\cos(\sin(x))) = \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.196)$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\frac{df}{dx}(\cos(x) \cdot \cos(\sin(x))) = -1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) \quad (3.197)$$

A good, solid task?

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \quad (3.198) \\ &\quad \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned}$$

Should be known from school:

$$\begin{aligned} \frac{df}{dx}(\cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) &= -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) \\ &\quad + \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) \\ &\quad + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \quad (3.199) \end{aligned}$$

It is common knowledge:

$$\begin{aligned} \frac{df}{dx}(-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\ = -1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \quad (3.200) \\ \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \\ -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \end{aligned}$$

A good, solid task?

$$\begin{aligned}
& \frac{df}{dx}(\cos(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) \\
&= -1 \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
&\quad + \cos(x) \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
&\quad \quad + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
&\quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
\end{aligned} \tag{3.201}$$

It is easy to see:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) = \\
&\quad -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \cdot \sin(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + \cos(x) \\
&\quad \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
&\quad \quad \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
&\quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
\end{aligned} \tag{3.202}$$

It is obvious that:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\
&\quad \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) = \\
&\quad -1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \\
&\quad \cdot \sin(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
&\quad + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \cdot \sin(x) \\
&\quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + \cos(x) \\
&\quad \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
&\quad \quad \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
&\quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
\end{aligned} \tag{3.203}$$

If you don't understand this obvious transformation, then you need to go into a program where they don't study mathematical analys:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\
& \quad \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) = -1 \\
& \quad \cdot (-1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
& \quad \quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
& \quad \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
& \quad \quad + \cos(x) \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
& \tag{3.204}
\end{aligned}$$

A similar one can be proved:

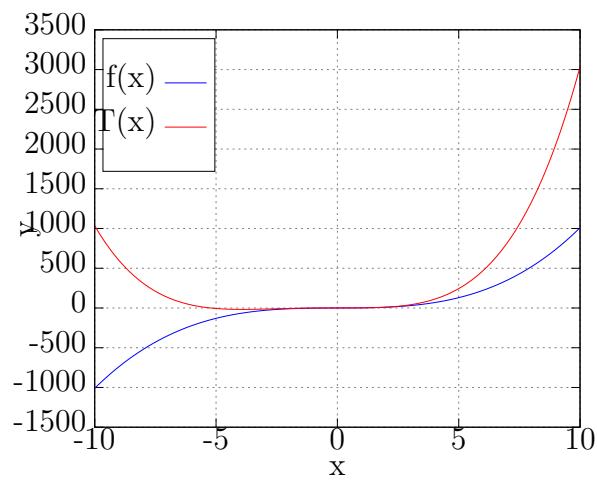
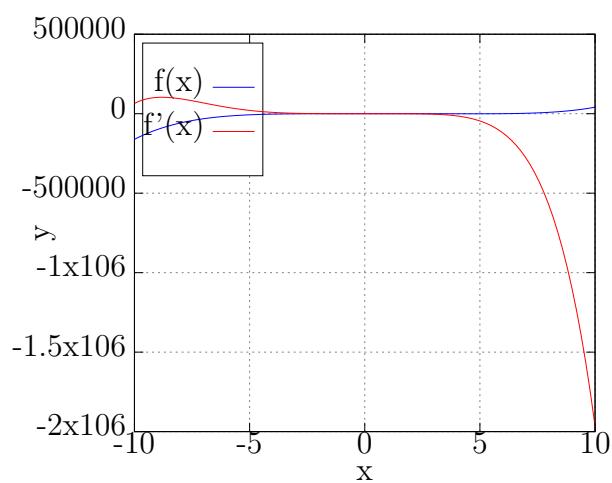
$$\begin{aligned}
& \frac{df}{dx}(\cos(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot \\
& \quad -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) = -1 \cdot \sin(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + \cos(x) \cdot \\
& \quad -1 \cdot (-1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
& \quad \quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
& \quad \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
& \quad \quad + \cos(x) \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
& \tag{3.205}
\end{aligned}$$

A similar one can be proved:

It is easy to see:

$$\begin{aligned}
& \frac{df}{dx}(-1 \cdot \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + \cos(x) \cdot -1 \cdot (-1 \cdot \cos(x) \\
& \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad + \cos(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) = \\
& \quad -1 \cdot -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot -1 \\
& \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \cos(x) \cdot \\
& \quad -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) + -1 \cdot \sin(x) \\
& \quad \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \quad \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) + -1 \\
& \quad \cdot \cos(x) \cdot -1 \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad + -1 \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \\
& \quad \quad \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)))) + -1 \\
& \quad \cdot \sin(x) \cdot -1 \cdot (-1 \cdot \cos(x) \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x))) \\
& \quad \quad + -1 \cdot \sin(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \\
& \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + \cos(x) \cdot \\
& \quad -1 \cdot (-1 \cdot -1 \cdot \sin(x) \cdot \cos(\sin(x)) + -1 \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \\
& \quad \quad \cdot \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) + -1 \\
& \quad \cdot \sin(x) \cdot (-1 \cdot \sin(x) \cdot -1 \cdot \sin(\sin(x)) + \cos(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x))) \\
& \quad \quad + \cos(x) \cdot (-1 \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \\
& \quad \quad \cdot \cos(\sin(x)) + -1 \cdot \sin(x) \cdot -1 \cdot \cos(x) \cdot \cos(\sin(x)) + \cos(x) \cdot -1 \\
& \quad \quad \cdot (-1 \cdot \sin(x) \cdot \cos(\sin(x)) + \cos(x) \cdot \cos(x) \cdot -1 \cdot \sin(\sin(x)))) \\
& \tag{3.207}
\end{aligned}$$

If this is not obvious to you, try attending a lecture for a change:



### Taylor Series:

$$T(\cos(\sin(x)) + x^3) = 1 - 0.5 \cdot x^2 + x^3 + 0.208333 \cdot x^4 \dots \quad (3.209)$$

# Afterword

Dear readers, I hope you have been able to spare a moment of your attention for this textbook and to realize its incredible obviousness. You will now excel in your exam, and if not, good luck next year.

The author also expresses great gratitude for the help in preparing this textbook to the students and professors of MIPT, namely to DED, mentor Kolya, and co-mentor Artyom, for actively seeking out the cringe in the code, which undoubtedly improved the quality of the materials. For this important work, the author wholeheartedly thanks all the assistants.

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