1 Introduction

Let's calculate smth with a given function: f(x, y) = $\sin x \cdot y^{2.000}$

Firstly, let's insert all constants and simplify this expression: f(x, y) = $\sin x \cdot y^{2.000}$

2 Exploration the expression as a function of multiple variables

Calculation value of function in the point   BRITISH SCIENTISTS WERE SHOCKED, WHEN THEY COUNT IT!!!

In the point $M_0(x_0, y_0) = (3.000, 2.000)$ **it's value** = 0.564

Personally, I've always thought about first derivation of something like that function... Haven't you?

But now, by using informatics and math skills I feel that I'm prepared enough to calculate it!

1 step. finding a derivation of:

y

While preparing for exams, I learned a lot of new things, for example:

$(y)' = ... = [\text{top secret}] = ... =$

$= 1.000$

2 step. finding a derivation of:

$y^{2.000}$

It's really easy to find:

$(y^{2.000})' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot y$

3 step. finding a derivation of:

x

My roommate mumbled it in his sleep all night:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

4 step. finding a derivation of:

$\sin x$

Sounds logical that it is the same as:

$(\sin x)' = ... = [\text{top secret}] = ... =$

$= \cos x$

5 step. finding a derivation of:

$\sin x \cdot y^{2.000}$

For centuries, people have hunted for the secret knowledge that:

$(\sin x \cdot y^{2.000})' = ... = [\text{top secret}] = ... =$

$= \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot \sin x$

Congratulations! **The first derivation of the expression** is:

$\cos x \cdot y^{2.000} + 2.000 \cdot y \cdot \sin x$In the point $M_0(x_0, y_0) = (3.000, 2.000)$ it's value = -3.395

Finding the 3 derivation: Let's calculate the 3 derivation of the expression:

Calculating the 1 derivation of the expression:

1 step. finding a derivation of:

y

Sounds logical that it is the same as:

$(y)' = ... = [\text{top secret}] = ... =$

$= 1.000$

2 step. finding a derivation of:

$y^{2.000}$

It's really easy to find:

$(y^{2.000})' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot y$

3 step. finding a derivation of:

x

My roommate mumbled it in his sleep all night:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

4 step. finding a derivation of:

$\sin x$

What if it equals:

$(\sin x)' = ... = [\text{top secret}] = ... =$

$= \cos x$

5 step. finding a derivation of:

$\sin x \cdot y^{2.000}$

It's really easy to find:

$(\sin x \cdot y^{2.000})' = ... = [\text{top secret}] = ... =$

$= \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot \sin x$

Calculating the 2 derivation of the expression:

1 step. finding a derivation of:

x

Even my two-aged sister knows that it equals:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

2 step. finding a derivation of:

$\sin x$

When I was child, my father always told me: "Remember, son:

$(\sin x)' = ... = [\text{top secret}] = ... =$
$= \cos x$

3 step. finding a derivation of:

y

I spend the hole of my life to find the answer and finally it's:

$(y)' = ... = [\text{top secret}] = ... =$
$= 1.000$

4 step. finding a derivation of:

2.000

Man... Just look:

$(2.000)' = ... = [\text{top secret}] = ... =$
$= 0.000$

5 step. finding a derivation of:

$2.000 \cdot y$

For centuries, people have hunted for the secret knowledge that:

$(2.000 \cdot y)' = ... = [\text{top secret}] = ... =$
$= 2.000$

6 step. finding a derivation of:

$2.000 \cdot y \cdot \sin x$

It's really easy to find:

$(2.000 \cdot y \cdot \sin x)' = ... = [\text{top secret}] = ... =$
$= 2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y$

7 step. finding a derivation of:

y

It's simple as fuck:

$(y)' = ... = [\text{top secret}] = ... =$
$= 1.000$

8 step. finding a derivation of:

$y^{2.000}$

thanks to the results of my colleagues' scientific work, I know that it equals:

$(y^{2.000})' = ... = [\text{top secret}] = ... =$
$= 2.000 \cdot y$

9 step. finding a derivation of:

x

When I was child, my father always told me: "Remember, son:

$(x)' = ... = [\text{top secret}] = ... =$
$= 1.000$

10 step. finding a derivation of:

$\cos x$

It's really easy to find:

$(\cos x)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \sin x$

11 step. finding a derivation of:

$\cos x \cdot y^{2.000}$

I was asked not to tell anyone that:

$(\cos x \cdot y^{2.000})' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x$

12 step. finding a derivation of:

$\cos x \cdot y^{2.000} + 2.000 \cdot y \cdot \sin x$

For centuries, people have hunted for the secret knowledge that:

$(\cos x \cdot y^{2.000} + 2.000 \cdot y \cdot \sin x)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x + 2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y$

Calculating the 3 derivation of the expression:

1 step. finding a derivation of:

y

My roommate mumbled it in his sleep all night:

$(y)' = ... = [\text{top secret}] = ... =$
$= 1.000$

2 step. finding a derivation of:

2.000

What if it equals:

$(2.000)' = ... = [\text{top secret}] = ... =$
$= 0.000$

3 step. finding a derivation of:

$2.000 \cdot y$

Even my two-aged sister knows that it equals:

$(2.000 \cdot y)' = ... = [\text{top secret}] = ... =$
$= 2.000$

4 step. finding a derivation of:

x

I spend the hole of my life to find the answer and finally it's:

$(x)' = ... = [\text{top secret}] = ... =$
$= 1.000$

5 step. finding a derivation of:

$\cos x$

Even my two-aged sister knows that it equals:

$(\cos x)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \sin x$

6 step. finding a derivation of:

$\cos x \cdot 2.000 \cdot y$

While preparing for exams, I learned a lot of new things, for example:

$(\cos x \cdot 2.000 \cdot y)' = ... = [\text{top secret}] = ... =$

$= (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x$

7 step. finding a derivation of:

x

When I was child, my father always told me: "Remember, son:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

8 step. finding a derivation of:

$\sin x$

Sounds logical that it is the same as:

$(\sin x)' = ... = [\text{top secret}] = ... =$

$= \cos x$

9 step. finding a derivation of:

2.000

A true prince must know that it equals:

$(2.000)' = ... = [\text{top secret}] = ... =$

$= 0.000$

10 step. finding a derivation of:

$2.000 \cdot \sin x$

My roommate mumbled it in his sleep all night:

$(2.000 \cdot \sin x)' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot \cos x$

11 step. finding a derivation of:

$2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y$

My roommate mumbled it in his sleep all night:

$(2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y)' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x$

12 step. finding a derivation of:

x

If someone asked me that in the middle of the night, I wouldn't hesitate to say:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

13 step. finding a derivation of:

$\cos x$

A true prince must know that it equals:

$(\cos x)' = ... = [\text{top secret}] = ... =$

$= (-1.000) \cdot \sin x$

14 step. finding a derivation of:

y

My roommate mumbled it in his sleep all night:

$(y)' = ... = [\text{top secret}] = ... =$

$= 1.000$

15 step. finding a derivation of:

2.000

While preparing for exams, I learned a lot of new things, for example:

$(2.000)' = ... = [\text{top secret}] = ... =$

$= 0.000$

16 step. finding a derivation of:

$2.000 \cdot y$

It's really easy to find:

$(2.000 \cdot y)' = ... = [\text{top secret}] = ... =$

$= 2.000$

17 step. finding a derivation of:

$2.000 \cdot y \cdot \cos x$

It's really easy to find:

$(2.000 \cdot y \cdot \cos x)' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y$

18 step. finding a derivation of:

y

When I was child, my father always told me: "Remember, son:

$(y)' = ... = [\text{top secret}] = ... =$

$= 1.000$

19 step. finding a derivation of:

$y^{2.000}$

What if it equals:

$(y^{2.000})' = ... = [\text{top secret}] = ... =$

$= 2.000 \cdot y$

20 step. finding a derivation of:

x

If someone asked me that in the middle of the night, I wouldn't hesitate to say:

$(x)' = ... = [\text{top secret}] = ... =$

$= 1.000$

21 step. finding a derivation of:

$\sin x$

thanks to the results of my colleagues' scientific work, I know that it equals:

$(\sin x)' = ... = [\text{top secret}] = ... =$
$= \cos x$

22 step. finding a derivation of:
(-1.000)
A true prince must know that it equals:
$((-1.000))' = ... = [\text{top secret}] = ... =$
$= 0.000$

23 step. finding a derivation of:
$(-1.000) \cdot \sin x$
A true prince must know that it equals:
$((-1.000) \cdot \sin x)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \cos x$

24 step. finding a derivation of:
$(-1.000) \cdot \sin x \cdot y^{2.000}$
When I was child, my father always told me: "Remember, son:
$((-1.000) \cdot \sin x \cdot y^{2.000})' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot (-1.000) \cdot \sin x$

25 step. finding a derivation of:
$(-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x$
For centuries, people have hunted for the secret knowledge that:
$((-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot (-1.000) \cdot \sin x + 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y$

26 step. finding a derivation of:
$(-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x + 2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y$
A true prince must know that it equals:
$((-1.000) \cdot \sin x \cdot y^{2.000} + 2.000 \cdot y \cdot \cos x + 2.000 \cdot \sin x + \cos x \cdot 2.000 \cdot y)' = ... = [\text{top secret}] = ... =$
$= (-1.000) \cdot \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot (-1.000) \cdot \sin x + 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x$

Finally... The 3 derivation of the expression:
$(-1.000) \cdot \cos x \cdot y^{2.000} + 2.000 \cdot y \cdot (-1.000) \cdot \sin x + 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x + (-1.000) \cdot \sin x \cdot 2.000 \cdot y + 2.000 \cdot \cos x$
BRITISH SCIENTISTS WERE SHOCKED AGAIN, WHEN THEY COUNT THE 3 DERIVATION OF THIS EXPRESSION!!!
In the point $M_0(x_0, y_0) = (3.000, 2.000)$ it's value = -3.673

Finding partical derivations: Partial derivation of the expression on the variable x:
$\frac{\partial f}{\partial x} = 4.000 \cdot \cos x$
In the point $M_0(x_0, y_0) = (3.000, 2.000)$ it's value = -3.959970 !!!
Partial derivation of the expression on the variable y:
$\frac{\partial f}{\partial y} = 0.141 \cdot 2.000 \cdot y$
In the point $M_0(x_0, y_0) = (3.000, 2.000)$ it's value = 0.564480 !!!

Finding full derivation: Full derivation:
$$\sqrt{(4.000 \cdot \cos x)^{2.000} + (0.141 \cdot 2.000 \cdot y)^{2.000}}$$
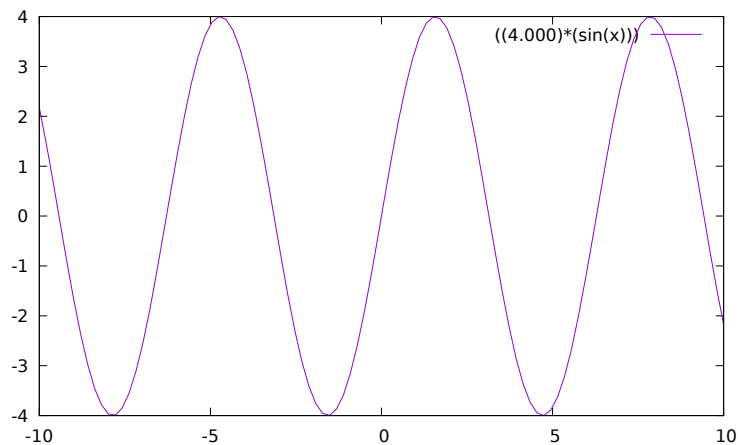In the point $M_0(x_0, y_0) = (3.000, 2.000)$ it's value = 4.000 !!!

3 Exploration the function of the first variable

Now let's consider the expression as a function of x variable: $f(x) = 4.000 \cdot \sin x$

Maklorens formula for $x \to x_0 = 3.000$:
$f(x) = 0.564 + (-3.960) \cdot (x - 3.000) + (-0.282) \cdot (x - 3.000)^{2.000} + 0.660 \cdot (x - 3.000)^{3.000} + 0.024 \cdot (x - 3.000)^{4.000} + o((x - 3.000)^{4.000})$

Graph $f(x) = 4.000 \cdot \sin x$ on the diapasone $x \in [-10 : 10]$:

Tangent equation in the point $x_0 = 0.000$:
f(x) = $4.000 \cdot x$
Normal equation in the point $x_0 = 0.000$:
f(x) = $(-0.250) \cdot x$