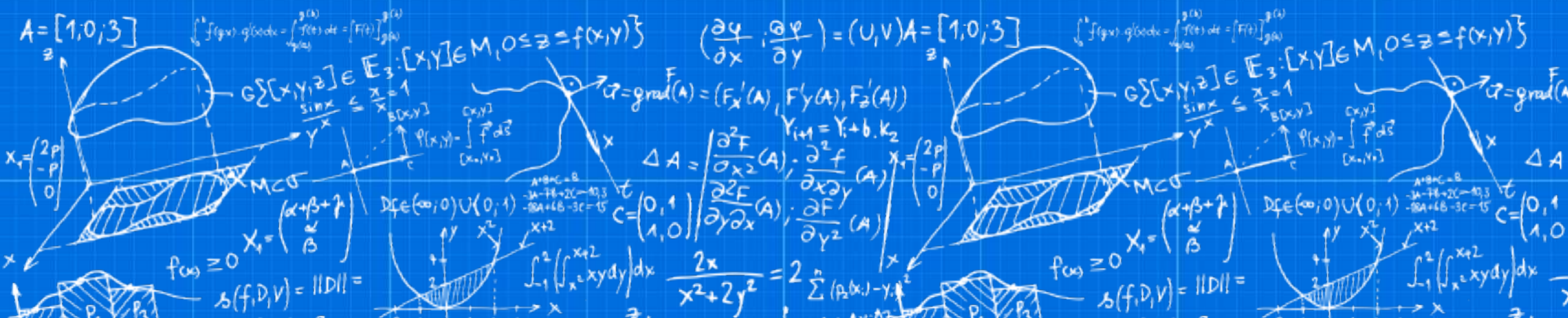


DISCONTINUITIES

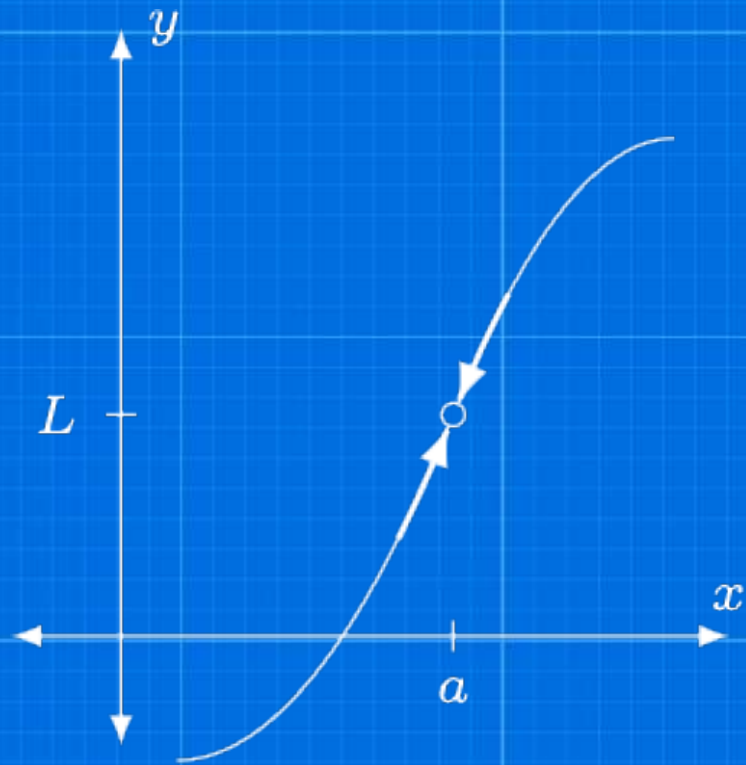
DANTE MACÍAS | MIGUEL FERRIZ



What is a discontinuity

A discontinuity is a point where a function is sort of interrupted. It is like a branch cut. Many people refer to it as a "Jump".

Imagine a normal function with a small gap or hole; that is called a discontinuity.



Types of Discontinuities

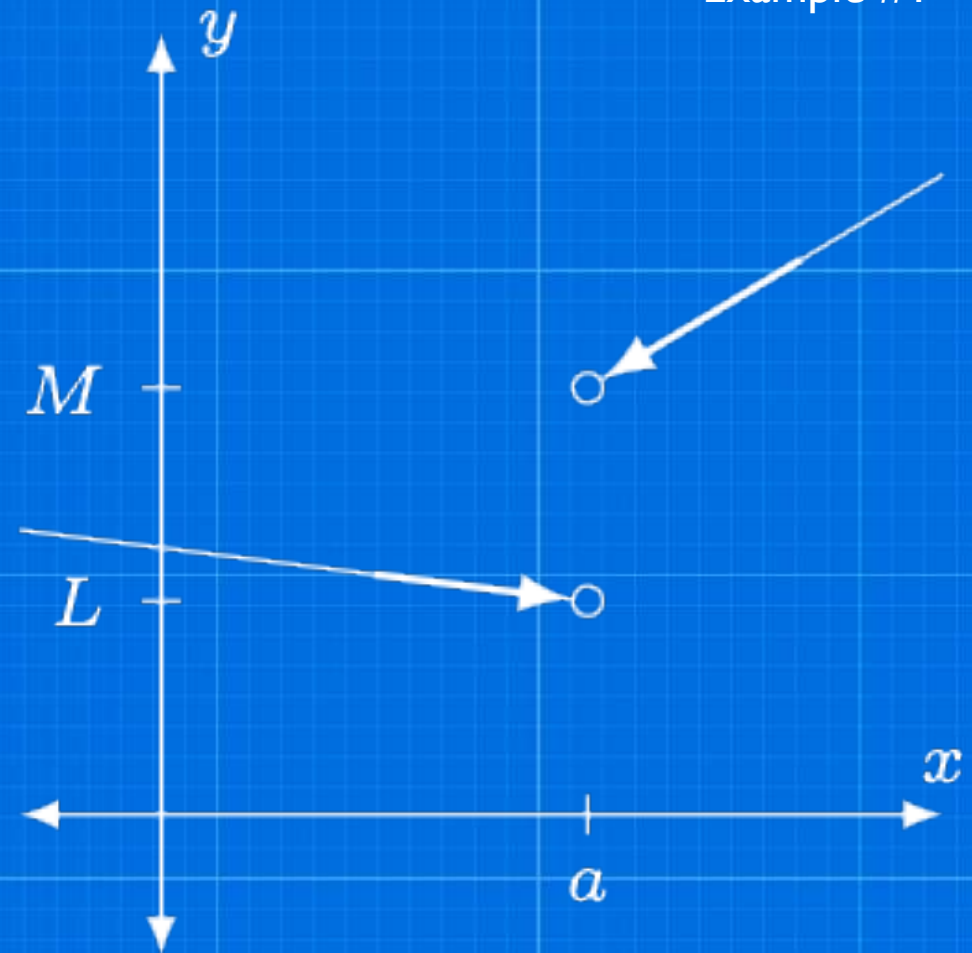
Type 1: Jump Discontinuity

In the following graph you can notice that:

$$\lim_{x \rightarrow a^-} f(x) = L \text{ and } \lim_{x \rightarrow a^+} f(x) = M.$$

The function comes to different points depending on the direction it's coming from. You express the discontinuity as $x=a$

Example #1

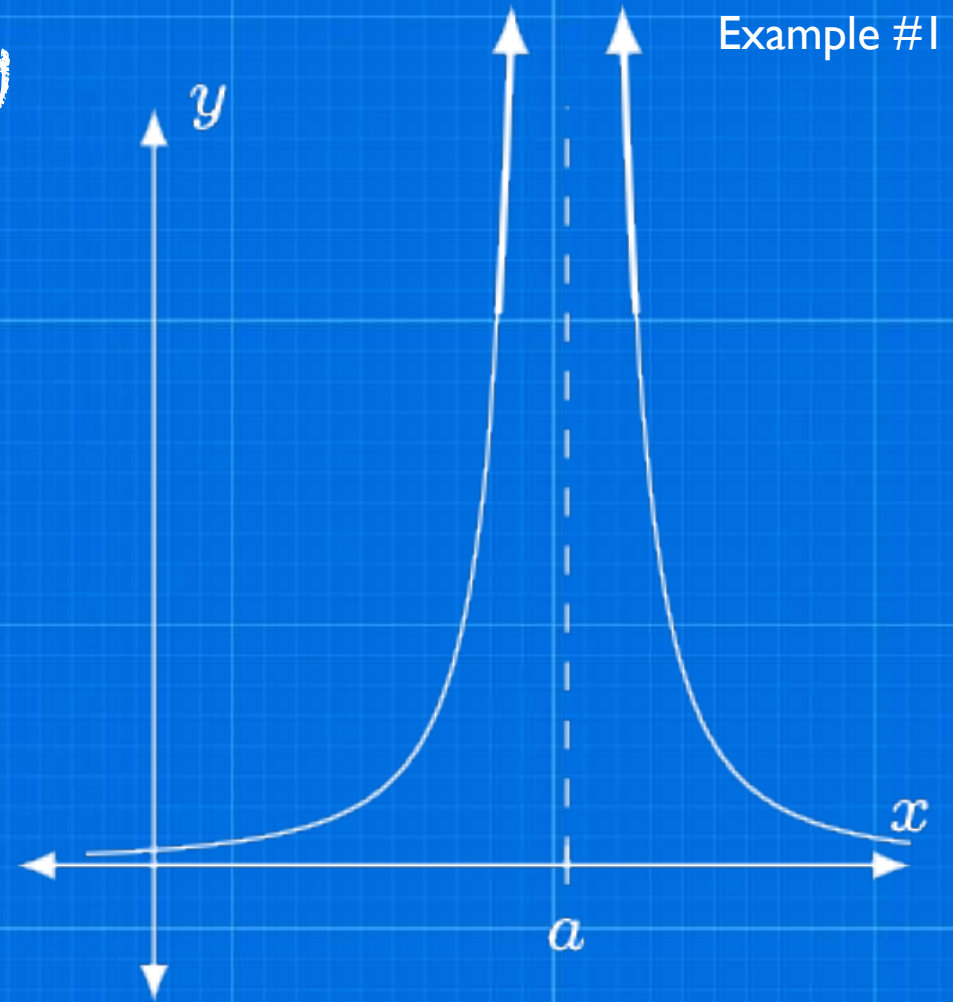


Types of Discontinuities

Type 2: Infinite Discontinuity

When the graph grows continuously and doesn't show any finite value (usually indicated by the arrows) it is considered an infinite discontinuity

This graph shows an infinite discontinuity at $x=a$



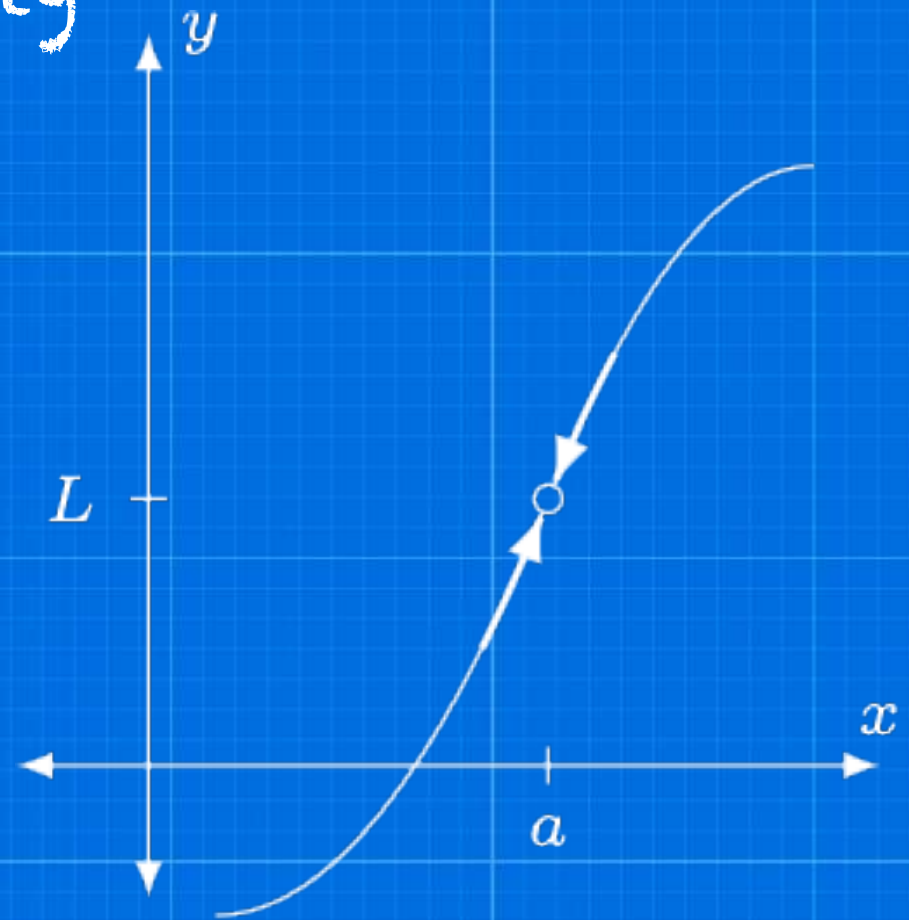
Types of Discontinuities

Type 3: Removable Discontinuity

A removable discontinuity is basically a hole; an interruption on a function that if removed, the graph would be complete.

Eventhough there is a hole at $x=a$, there is an existent limit value.

Example #1



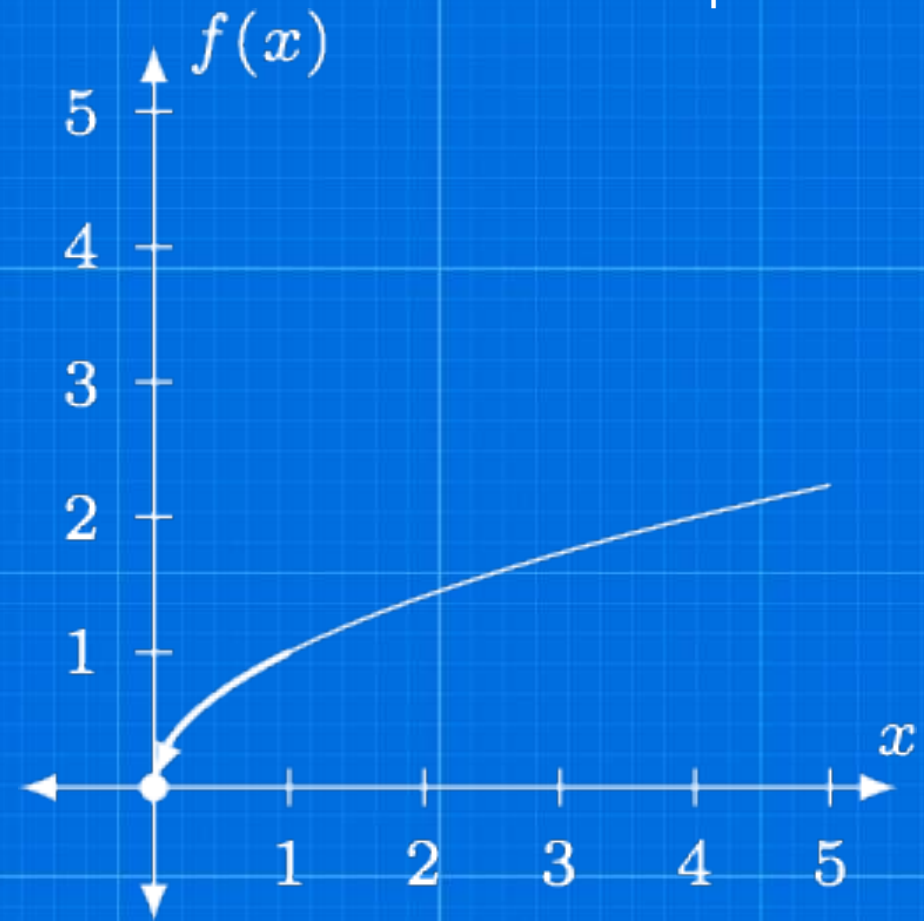
Types of Discontinuities

Type 4: Endpoint Discontinuity

A function is considered to be endpoint, when the limit can't be at that endpoint. This is because the limit has to examine the function values as x approaches from both sides.

The discontinuity can't exist at 0 therefore is an endpoint.

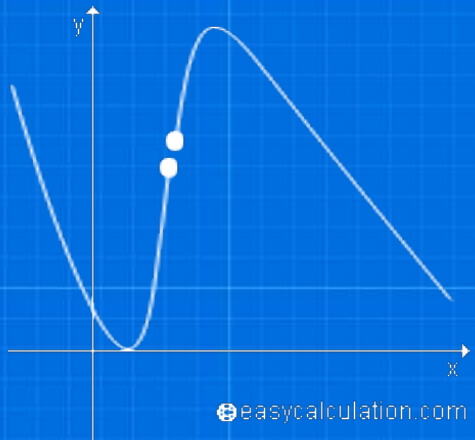
Example #1



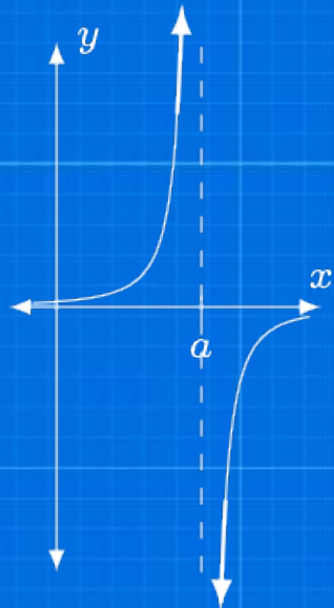
Examples

*Example #1 is found at each slide of each type of discontinuity

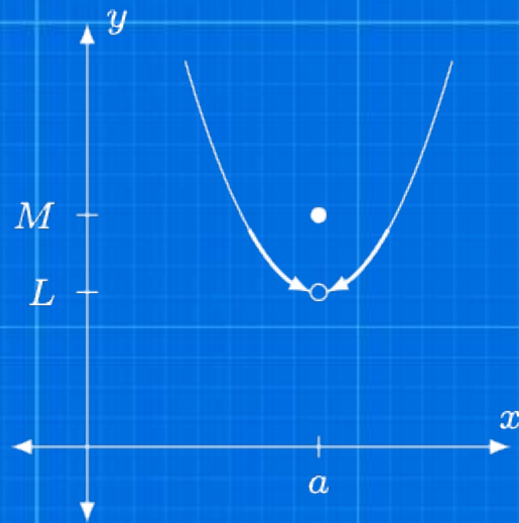
Jump Discontinuity Example #2



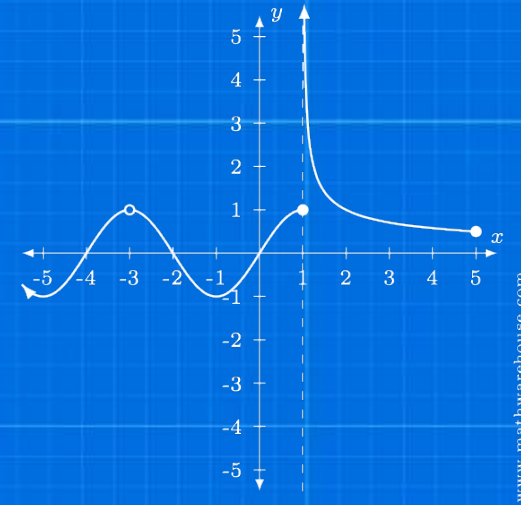
Infinite Discontinuity Example #2



Removable Discontinuity Example #2



EndPoint Discontinuity Example #2



Graph for Questions 4-6

Handwritten mathematical notes and diagrams illustrating optimization and Lagrange multipliers.

$A = [1, 0, 3]$
 z
 $G\{[x, y, z] \in E_3 : [x, y] \in M, 0 \leq z = f(x, y)\}$
 $\frac{\partial \varphi}{\partial x}, \frac{\partial \varphi}{\partial y} = (U, V)A = [1, 0, 3]$
 $\sigma = \text{grad}(A) = (F'_x(A), F'_y(A), F'_z(A))$
 $\frac{\partial^2 F}{\partial x^2}(A) = \frac{\partial^2 f}{\partial x^2}$
 $Y_{i+1} = Y_i + b \cdot k_2$
 $x = \sqrt{2p}$
 $G\{[x, y, z] \in E_3 : [x, y] \in M, 0 \leq z = f(x, y)\}$
 $\frac{\partial \varphi}{\partial x}, \frac{\partial \varphi}{\partial y} = (U, V)A = [1, 0, 3]$
 $\sigma = \text{grad}(A) = (F'_x(A), F'_y(A), F'_z(A))$
 $\frac{\partial^2 F}{\partial x^2}(A) = \frac{\partial^2 f}{\partial x^2}$
 $Y_{i+1} = Y_i + b \cdot k_2$
 $x = \sqrt{2p}$

REFERENCES

All the information and graphs were retrieved from:



What are the types of Discontinuities? (n.d.). Retrieved August 28, 2017, from <http://www.mathwarehouse.com/calculus/continuity/what-are-types-of-discontinuities.php>

Hand-drawn mathematical notes on graph paper, including:

- 3D plots of surfaces and volumes, with labels like $A = [1; 0; 3]$, $G\{[x, y, z] \in E_3 : [x, y] \in M, 0 \leq z \leq f(x, y)\}$, and $\sigma = \text{grad}(A) = (F_x'(A), F_y'(A), F_z'(A))$.
- 2D graphs of functions like $\sin x \leq \frac{x}{2}$ and $\frac{2x}{x^2+2y^2} = 2 \sum_{n=1}^{\infty} (2n-1) \cdot y^{2n-1}$.
- Equations for gradients and partial derivatives: $\left(\frac{\partial \varphi}{\partial x}, \frac{\partial \varphi}{\partial y}\right) = (U, V)A = [1; 0; 3]$.
- Equations for double integrals: $\int_1^2 \int_x^{x+2} xy \, dy \, dx$.
- Equations for surface area: $\Delta A = \left| \frac{\partial^2 F}{\partial x^2}(A) \cdot \frac{\partial^2 f}{\partial x \partial y}(A) \right|$.
- Equations for vector norms: $\delta(f, D, V) = \|Df\|$.
- Equations for surface area: $\int_1^2 \int_x^{x+2} xy \, dy \, dx$.
- Equations for surface area: $\int_1^2 \int_x^{x+2} xy \, dy \, dx$.