Transcomputation

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Agenda

- Equations
- Functions
- Gradient

Equations

Equations

$$a \circ b \circ c \ldots = A \circ B \circ C \ldots$$

- An equation has a left- and right-hand side
- An equation is satisfied by any selection of arguments that makes it true
- An equation is not satisfied by any selection of arguments that makes it false

Functions

Functions

$$f(a,b,c\ldots)=V$$

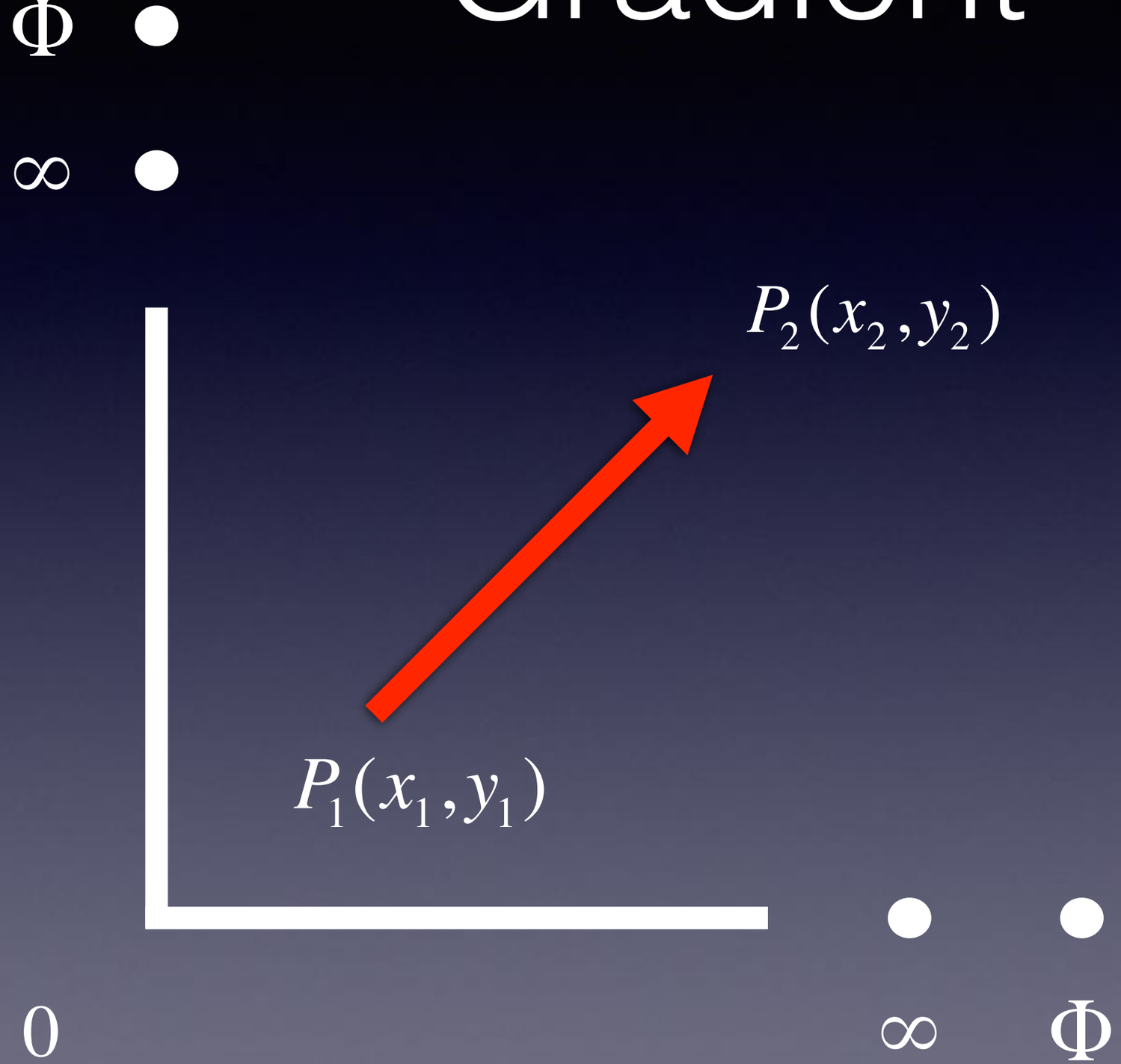
- A function maps each allowable tuple, $\langle a,b,c\ldots\rangle$, of arguments in its domain to a single value, V, in its range
- If all tuples in the domain are allowable, the function is total
- If some tuples in the domain are not allowable, the function is partial

Functions

- We may want to know if the range contains all values of interest
- For example, does a line equation describe all lines?

Gradient

Gradient



Gradient

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

What is the gradient of a line running:

- Vertically upwards?
- Vertically downwards?
- Horizontally right?
- Horizontally left?

General line equation

$$y = mx + c$$

Sketch the functions:

- $y = \infty x$
- $y = -\infty x$
- $y = 0x$

Are these lines?

Puzzle

What is the gradient of a line that passes through the origin and the following point:

- $(\infty,2)$
- $(\infty,3)$
- Can any equation of Cartesian co-ordinates describe all transreal lines?

Puzzle

- What is the space of all transreal lines?
- How can we transform the transreal line onto all transreal lines?

Heuristics

- Start from a finite solution and totalise its domain over the transreals
- Try different total solutions until you find one whose range describes all and only the cases you are interested in
- You may need help from subject specialists to find solutions

Heuristics

- Computer graphics and digital geometry are good sources of total algorithms for solving geometrical problems. Perhaps one of these will generalise in a way that solves your problem?

- Many different solutions have been tried in the history of mathematics. Perhaps one of these will generalise in a way that solves your problem?

Heuristics

- Start from a total, transreal solution and manipulate its range until it does exactly what you want

Conclusion

$$a \circ b \circ c \ldots = A \circ B \circ C \ldots$$

- An equation is satisfied by any selection of arguments that makes it true
- An equation is not satisfied by any selection of arguments that makes it false

Conclusion

$$f(a \circ b \circ c \ldots) = V$$

- A function has exactly one value, V, for each allowable selection of arguments
- If all selections are allowable, the function is total
- If some selection is not allowable, the function is partial

Conclusion

- The line equation, $y = mx + c$, defines a total function, $f(x) = mx + c$, but they do not describe all lines, i.e. the range does not contain all lines

- Totalising the domain of a function is not enough. We also need a range that describes exactly what we want