- Midterm 1:
  - 2 July 9 → 11 } 20
  - 20
- Midterm 2:
  - 16 July 9 → 11
- final → 40
- HOMEWORK → 20
- Quize →

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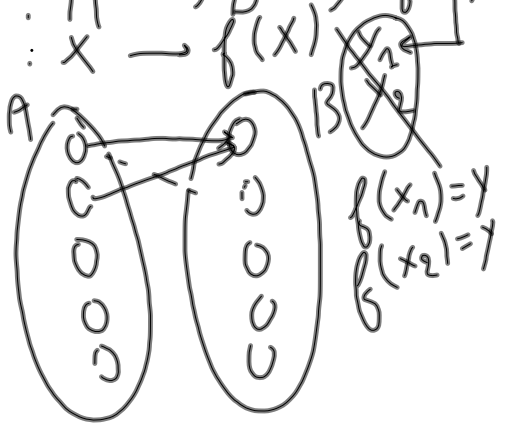
Functions

$f: A \to B$

$x \to f(x) = y$



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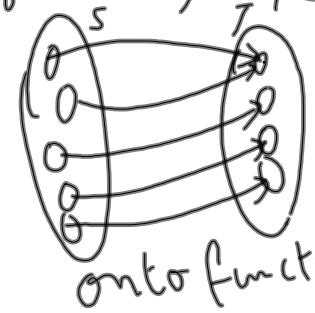
Properties

Given $f: S \to T$

we say f maps onto T

for each $y \in T$, $\exists x \in S$



onto function

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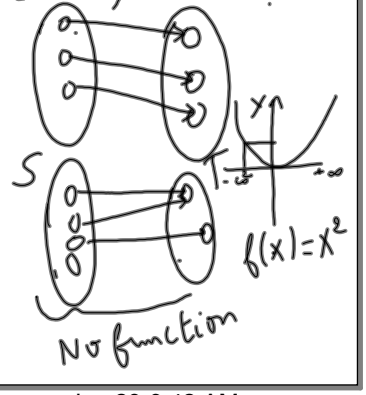
$f: S \to T$ is called one-to-one correspondance between S and T, iff for each $y \in T$, there is exactly one $x \in S$.



No function

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One-to-one

$f: S \to T$

$x \to f(x) = y$

$f(x_1) = f(x_2) \to x_1 = x_2$

Example:

$f: \mathbb{R} \to \mathbb{R}$

$x \to f(x) = 3x + 5$

one-to-one?

$\exists x_1, x_2 \in \mathbb{R}$, $f(x_1) = f(x_2)$

$f(x_1) = f(x_2)$

$3x_1 + 5 = 3x_2 + 5$

$x_1 = x_2$

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f : maps $\mathbb{R}$ onto $\mathbb{R}$

$y = f(x) = 3x + 5$

$y = 3x + 5 \Rightarrow 3x = y - 5$

$\Rightarrow x = \frac{y-5}{3} \in \mathbb{R}$

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Inverse function

$f : S \to T$

$x \to f(x)$

$f^{-1} : T \to S$

$y \to f^{-1}(y)$

$f : \mathbb{R} \to \mathbb{R}$

$x \to f(x) = 3x + 5$

$f^{-1} : \mathbb{R} \to \mathbb{R}$

$y \to f^{-1}(y)$

$f(x) = 3x + 5 = y$

$x = \frac{y-5}{3}$

$f^{-1}(y) = \frac{y-5}{3}$

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Example:

$f : \mathbb{R} \to \mathbb{R}$

$x \to f(x) = x^2$

$y : \mathbb{R}^+ \to \mathbb{R}^+ \; y = x^2$

$y \to \sqrt{y} \quad x = \begin{cases} \sqrt{y} \\ -\sqrt{y} \end{cases}$

$f(x) = e^x$

$y = e^x \Rightarrow x = \ln y$

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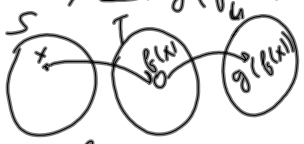
Composition

$f : S \to T$

$g : T \to U$

$gof : S \to U$

$x \to g(f(x))$



Example:

$f(x) = x^3 + 2x$

$g(x) = x^7$

$(gof)(x) = g(f(x))$

$= g(x^3 + 2x)$

$= (x^3 + 2x)^7$

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$f(x) = \sqrt{x}$

$g(x) = \frac{1}{x} \quad x \in]0, \infty[$

gof ?

fog ?

$(gof)(x) = g(f(x))$

$= g(\sqrt{x})$

$= \frac{1}{\sqrt{x}}$

$(fog)(x) = f(g(x))$

$= f(\frac{1}{x}) = \sqrt{\frac{1}{x}} = \frac{1}{\sqrt{x}}$

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$f(x) = x^4$

$g(y) = \sqrt{y^2 + 1}$

$h(z) = z^2 + 2$

$ho(gof)$ $hog(f(x))$

$(hog)of$

$ho(gof) = ho\,g(f(x))$

$ho[g(x^4)]$

$ho[\sqrt{x^8 + 1}] =$

$h(g(f(x)))$

$h(\sqrt{x^8 + 1})$

$= (\sqrt{x^8 + 1})^2 + 2$

$= x^8 + 3 = hog(f(x))$

$(hog)of$

$h(g(x))of = h(\sqrt{x^2 + 1})of$

$= (\sqrt{x^2 + 1})^2 + 2$

$= (x^2 + 3)of$

$= f(x)^2 + 3$

$= x^8 + 3$

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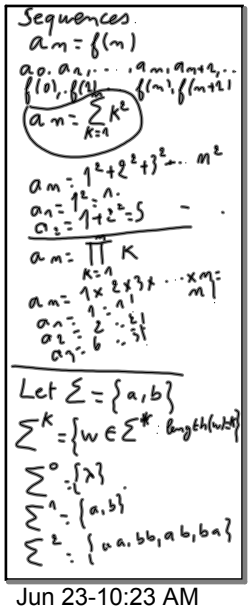

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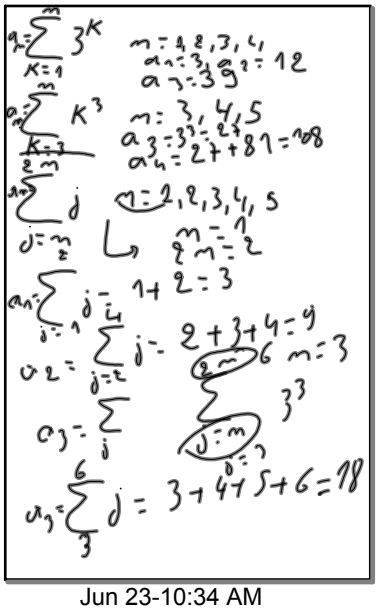

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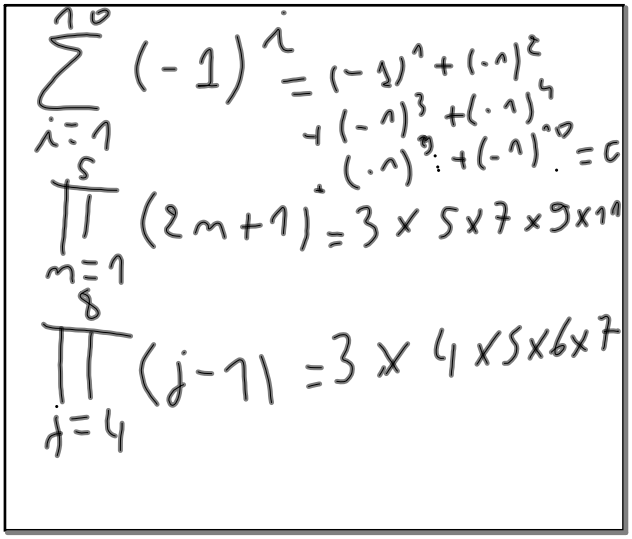

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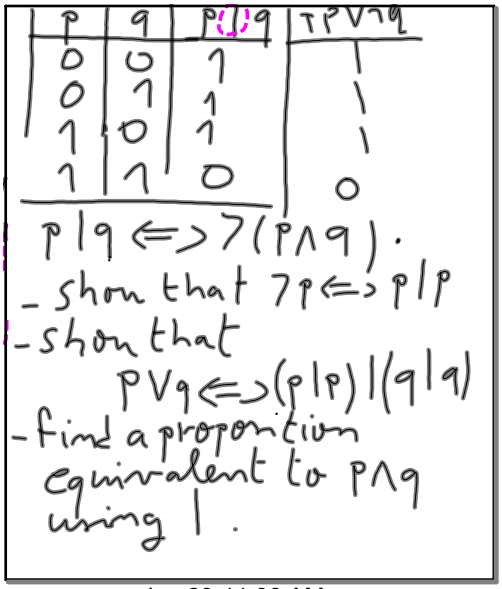

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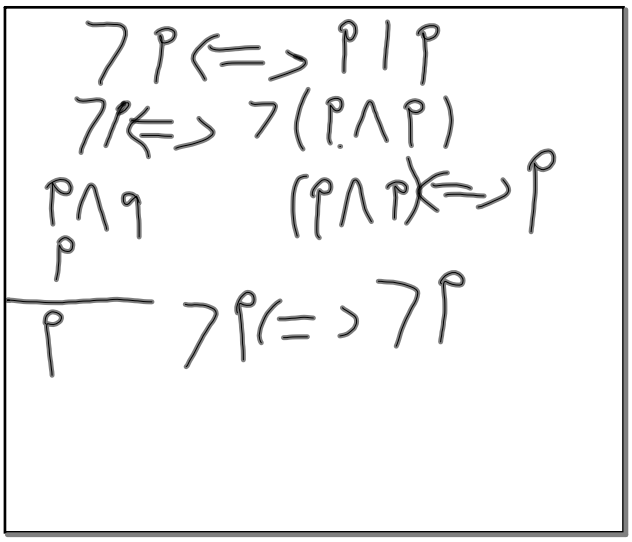

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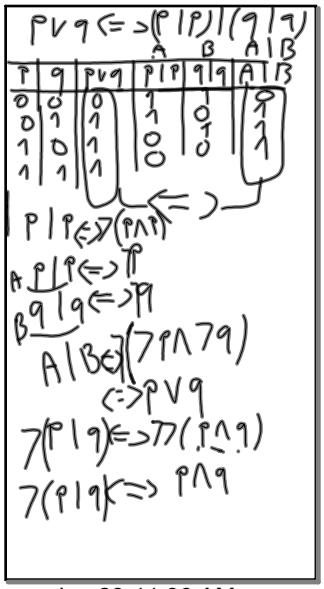

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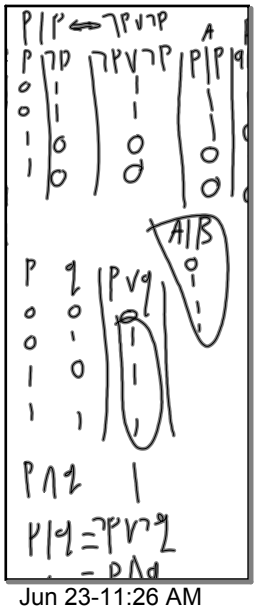

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