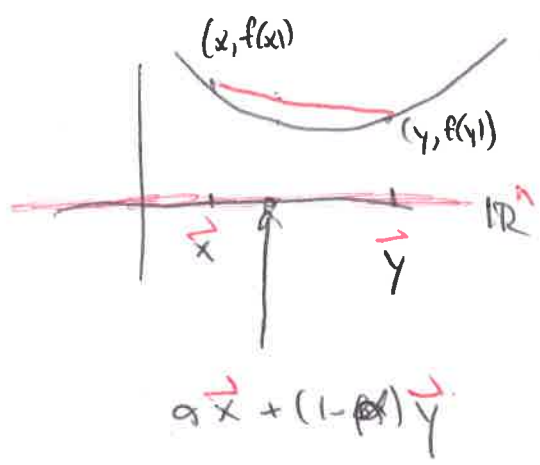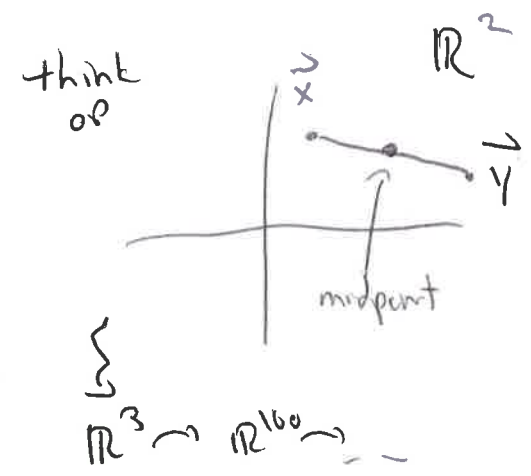- More on KKT
- Comments on Progress Reports
- Talks start next Friday

Convexity & convex functions:

think of

$\mathbb{R}^n$

$\mathbb{R}^2$

midpoint
$\frac{1}{2}\vec{x} + \frac{1}{2}\vec{y}$

midpoint

$\mathbb{R}^3 \frown \mathbb{R}^{100} \frown \ldots$

$(x, f(x))$
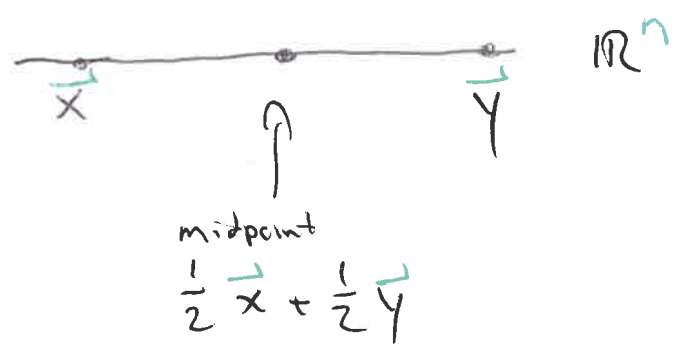
convex functions

f is convex if

$(y, f(y))$

$\mathbb{R}^n$

$\alpha\vec{x} + (1-\alpha)\vec{y}$

$$f\left(\alpha\vec{x} + (1-\alpha)\vec{y}\right)$$
$$\leq \alpha\, f(\vec{x}) + (1-\alpha)\, f(\vec{y})$$

KKT: If $\min f(\vec{x})$ ← objective

s.t. $g_1(\vec{x}) \leq 0,\ g_2(\vec{x}) \leq 0 \ldots,\ g_m(\vec{x}) \leq 0$ ← feasible region

and $\vec{x}^*$ is a minimum of f in the feasible region,

f

$\vec{x}^* + \varepsilon \vec{y}$

ε small, (tending to zero)

$\mathbb{R}$

$\vec{x}^*$

$\vec{x}^* + \varepsilon \vec{y}$

$\vec{x}^*$

$\mathbb{R}^2$
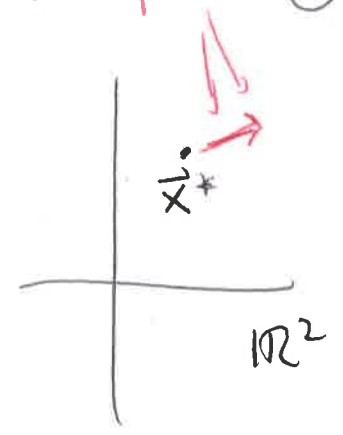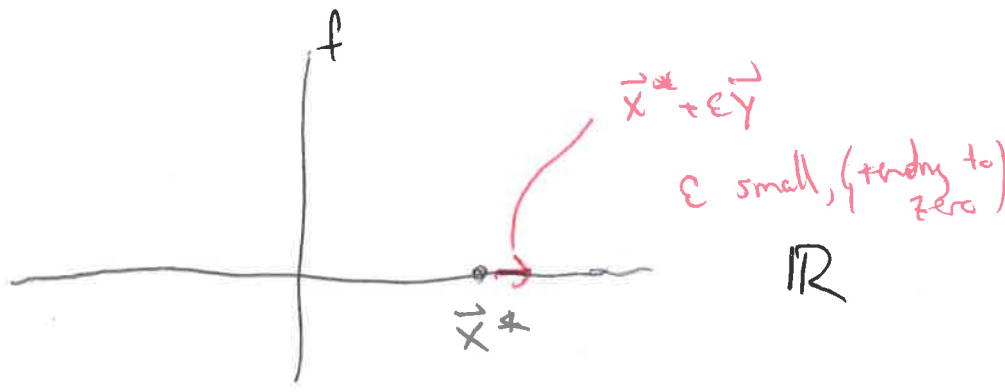
Idea: For small ε, can't have

① $\vec{x}^* + \varepsilon \vec{y}$ remains feasible for $\varepsilon > 0$ small

② and $f(\vec{x}^* + \varepsilon \vec{y}) < f(\vec{x}^*)$ for " "

Otherwise $\vec{x}^*$ is not a minimum solution to our problem.

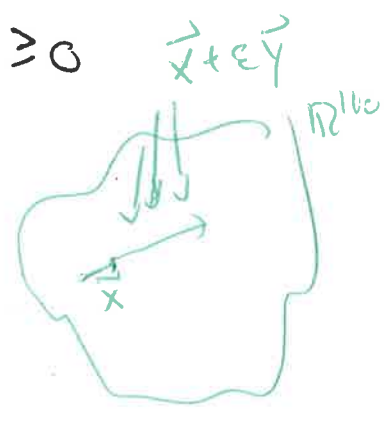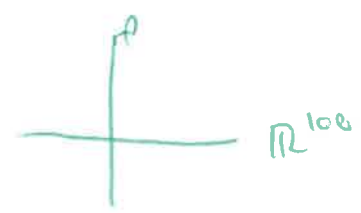So: For any $\vec{y} \in \mathbb{R}^n$, $\vec{x}^*$ optimal, either   or $\mathbb{R}$

①' $\vec{x}^* + \varepsilon \vec{y}$ is not feasible for any small ε, or

②' $\dfrac{d}{d\varepsilon} f(\vec{x}^* + \varepsilon \vec{y}) \geq 0$ $(\varepsilon \geq 0)$

So in core

①' If $g_i(\vec{x}^* + \varepsilon \vec{y})$ is not ≤ 0 for small $\varepsilon > 0$

then $g_i(\vec{x}^*) = 0$ and $\dfrac{d}{d\varepsilon} g_i(\vec{x}^* + \varepsilon \vec{y}) \geq 0$ $\vec{x}^* + \varepsilon \vec{y}$

$\mathbb{R}^{100}$

f

$\mathbb{R}$ or $\mathbb{R}^{100}$

$\vec{x}^* + \varepsilon \vec{y}$

$\vec{x}$

FINAL REPORT WILL HAVE DIFFERENT WEIGHTS

	Excellent = 4	Good = 3	Satisfactory = 2	Poor = 1
Abstract and Introduction (Weight = 1) • Score: 2 • Comments:	• Excellent overview of the background is given • Motivation for studying the problem is credible and convincing • Purpose of the paper is clearly explained and justified	• Some overview of the background is given • Motivation is valid, but incomplete and possibly not effective • Purpose of the paper is stated	• Background is incomplete • Motivation is vague and not supported • Purpose of the paper is vague or not explicitly stated	• No background given • Motivation is unclear • Purpose of the paper is obscure
Overall organization (Weight = 1) • Score: 1 • Comments:	• Logically organized • Sections and results are clearly marked • Plenty of appropriate links and transitions	• Paper is mostly well organized • Most transitions are present	• Some sections are too long/short or are not logically placed • Incorrect or missing transitions	• Section and result names and/or numbers are missing • No transitions and no overall flow
Writing style (Weight = 1) • Score: 2 • Comments:	• Tone is professional • Audience is addressed appropriately with uniform amount of detail	• Tone is appropriate • Most details are appropriate for the intended audience	• Tone is mostly respectful • Some details are skipped or redundant	• Tone is patronizing, disrespectful • Details are lacking or redundant
Modeling terminology and content (Weight = 1) • Score: 1 • Comments:	• All necessary variables, constraints, and objectives are given and explained • All optimization problems correspond to the goals of the project • Sources of data and any synthetic generation of data are explained and realistic • Optimization algorithms and methods of analyzing the results are explained. • Explanations are correct, precise and easy to follow	• Some notation and explanations are not given • Most of the optimization problems are correctly formulated and consistent with the goals of the project • The stated results in the article are mostly justified by the optimization problems solved. • Most explanations are precise and can be followed	• A number of explanations are not given • Some terminology is not correctly used • The optimization problems studied and the data correspond only weakly to the results claimed in the article • Reasoning and explanation are lacking	• Notation is not defined • Terminology is misused • Modeling is incorrect • Results claimed aren't justified by the data and optimization problems solved
Sentence Mechanics (Spelling, grammar, etc.) (Weight = 1) • Score: 2 • Comments:	• Excellent grammar, perfect spelling • Strong sentences • Math is well incorporated into the text	• Mostly good grammar, perfect spelling • Math is mostly well integrated into the text	• Few awkward sentences • Some spelling mistakes • Math is separated from the text • Some sentences need tightening	• Awkward phrases • Many spelling mistakes • Math is not integrated or punctuated • Many sentences need tightening
Bibliography and citations (Weight = 0) • Score: Not Applicable for Progress Report • Comments:	• Excellent use of citations • Bibliography is complete with uniformly formatted entries	• Most citations are present • Some bibliography items are incorrectly formatted	• Citations are missing • Bibliography has errors, and some necessary sources are not listed	• Few or no citations • Bibliography entries are not clear or missing
Additional Comments:				

(Handwritten notes: "Section 1 (Intro", "Section 2 - could have more info...", "Section 2: related matter")

"Bloat" : — Reader suspects you have nothing to say

       — " has difficultly understanding (for no good reason)

- Exposition lacks focus, strays from main topic

- Bloat in one section, one paragraph, or one sentence has "ripple effect" in reader's mind

Common Problems:

Section 1 (Intro): Too vague; no specific questions

Section 2: { Modeling incorrect/errors

{ Modeling too simple to correspond to Intro

Writing/Mechanics: Need of tightening