MATH 484

Iterative Methods Visualization Using Mathematica

Reference

- Wolfram Documentation – Unconstrained Optimization
  - https://reference.wolfram.com/language/tutorial/UnconstrainedOptimizationOverview.html

- Wolfram Mathematica Tutorial – Unconstrained Optimization
  - http://library.wolfram.com/infocenter/books/8505/unconstrainedoptimizationpart1.pdf
  - http://library.wolfram.com/infocenter/books/8505/unconstrainedoptimizationpart2.pdf

Syntax

- Get Mathematica Online For FREE
  - https://webstore.illinois.edu/shop/search.aspx?keyword=mathematica

- Plot the Search Path
  - FindMinimumPlot[*function*, {{*var*, *guess*}, …}, Method -> "…"]

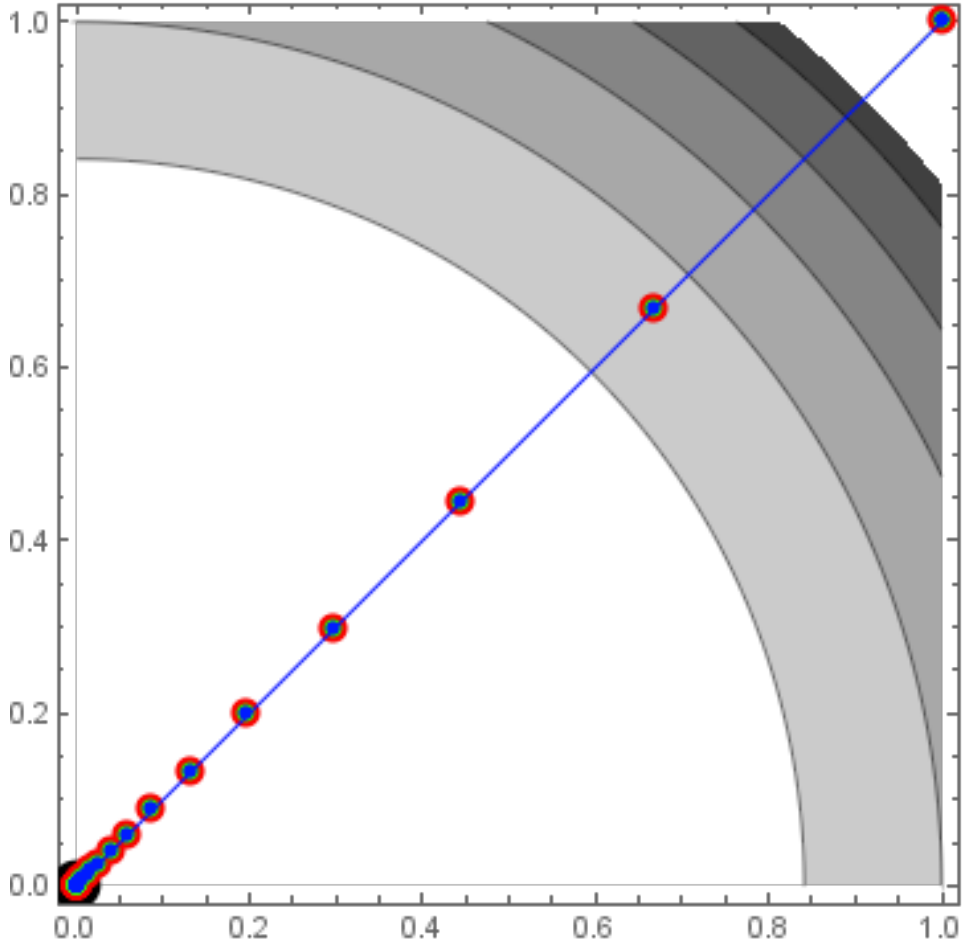
- Plot the Function
  - Plot[*function*, {*x*, *xmin*, *xmax*}]
  - Plot3D[*funciton*, {*x*, *xmin*, *xmax*}, {*y*, *ymin*, *ymax*}]

Plot Legend

- Steps are indicated with blue lines
- Function evaluations are shown with green points
- Gradient evaluations are shown with red points
- **The minimum found** is shown with a **large black point**

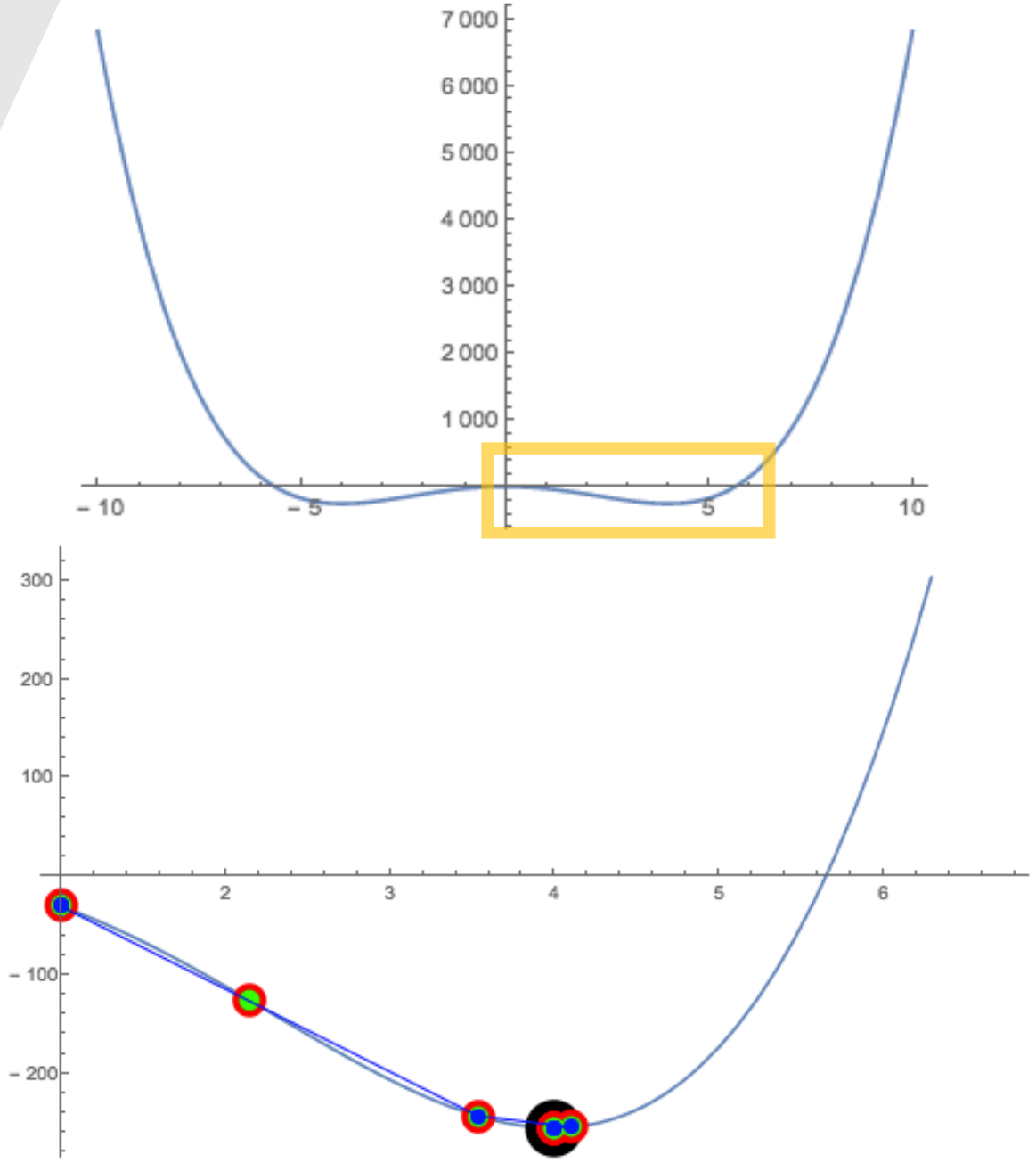
Example 3.1.6

- $f(x,y)=x^4+2x^2y^2+y^4$
- Initial starting point (x,y)=(1,1)
- Method = Newton
- Minimizer: (x,y)=(0,0)



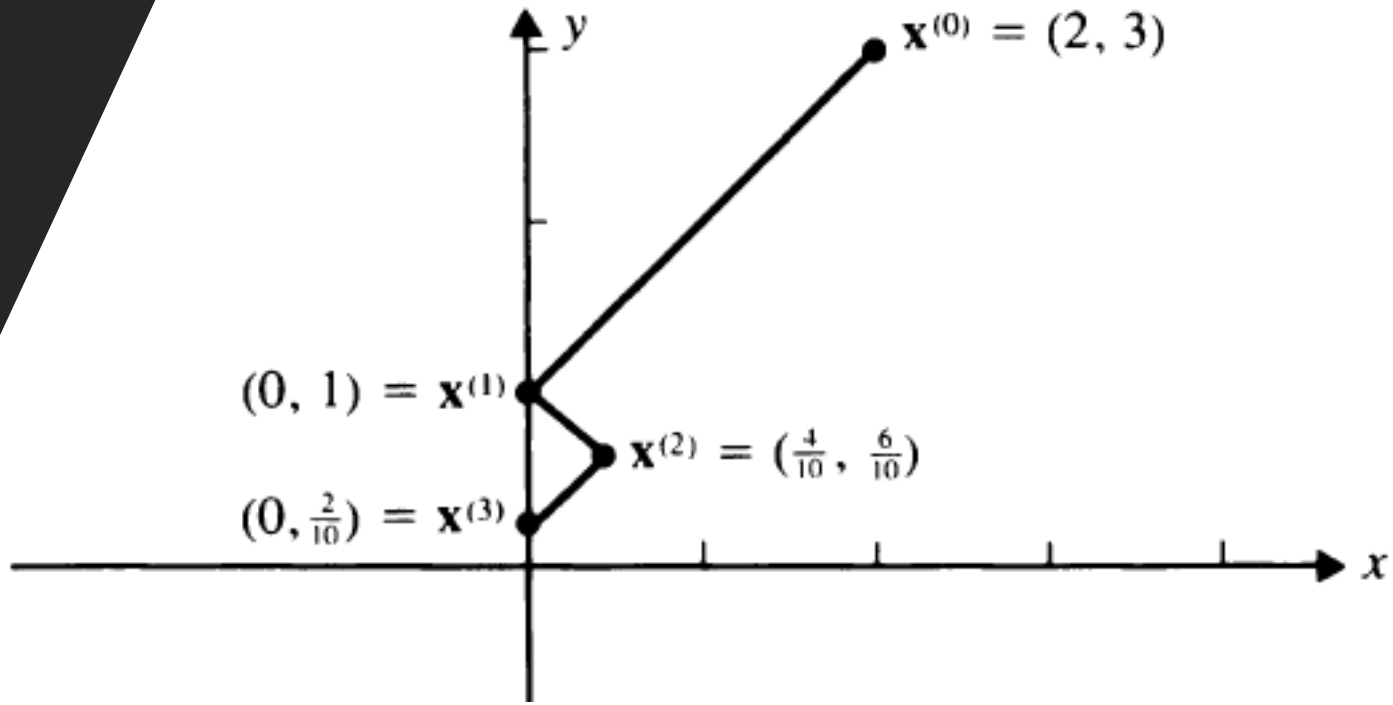
Example 3.1.7

- $f(x,y)=x^4-32x^2$
- Initial starting point x=1
- Method = Newton
- Minimizer: x = 4



Example 3.2.2

- $f(x,y)=4x^2-4xy+2y^2$
- Initial starting point (x,y)=(2,3)
- Method = Steepest Descent
  - Unfortunately, steepest descent is not supported by FindMinimumPlot function
  - The graph to the right is a screenshot from the textbook
- Minimizer: (x,y) = (0,0)



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- $f(x,y)=4x^2-4xy+2y^2$
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- Method = Newton
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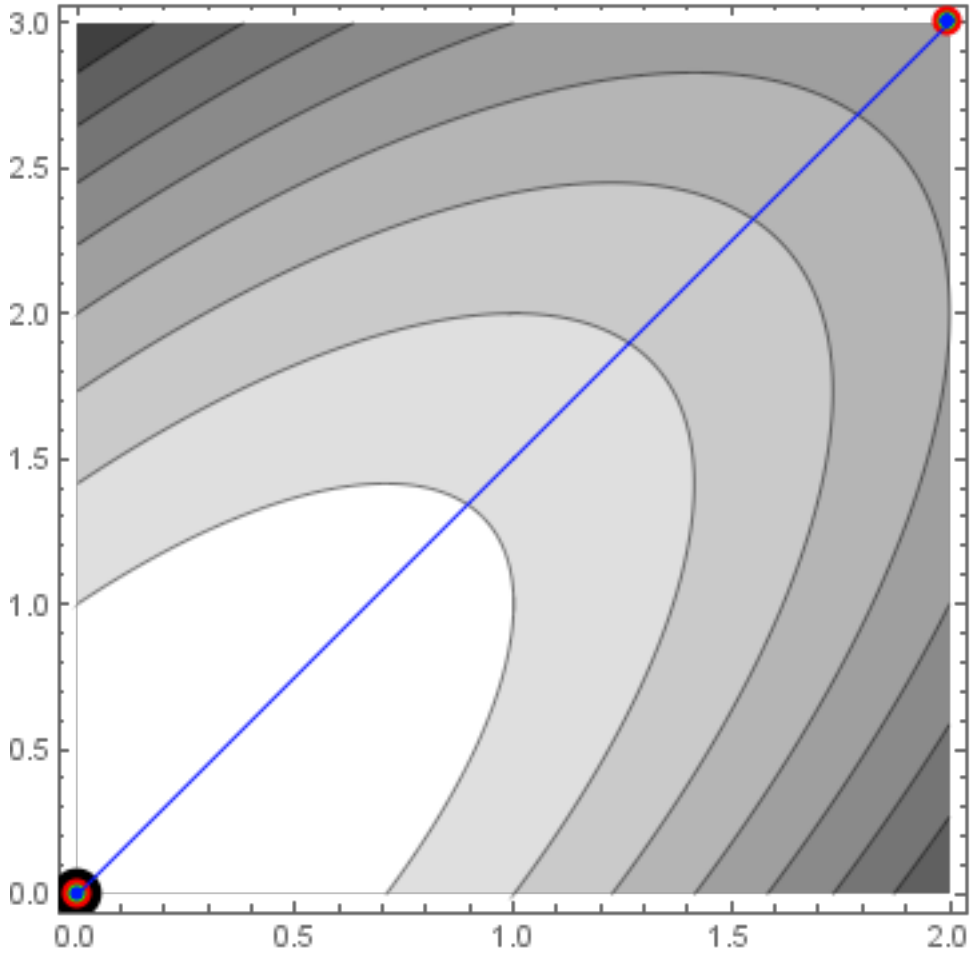

Bonus Example: Trust Region

- $f(x,y)=(x-1)^2+100\sin(x^2-y)$
- Initial starting point (x,y)=(-1,1)
- Method = Newton
- Step Control = Trust Region