

# Indian Institute of Technology Palakkad

## Convex Optimizations Programming Assignment - 2

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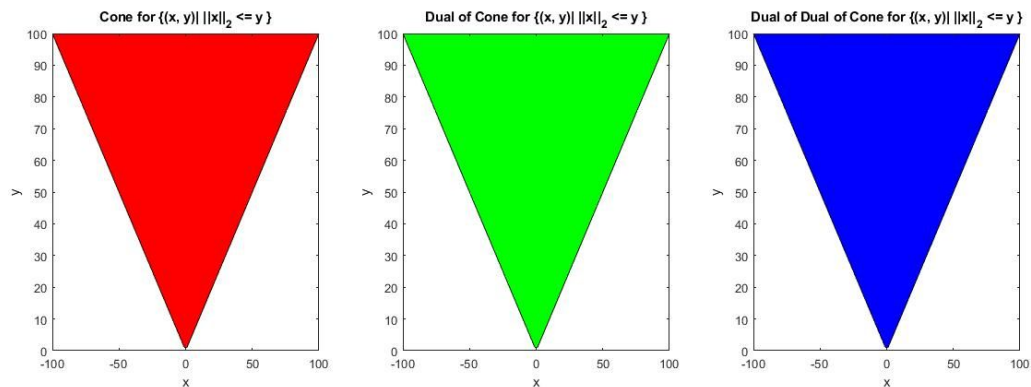
### Question 1

Write a program to draw following cones, dual cone, dual of dual cone

(i)  $\{(x, y) \mid \|x\|_2 \leq y\}$

The cone that encloses the set is given as the area shaded red.

The dual of the cone and the dual of the dual of the cone are the cone itself.

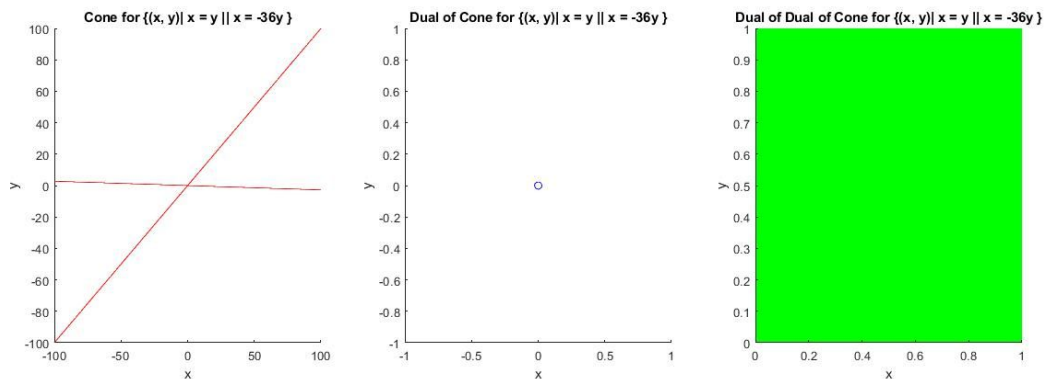


(ii)  $\{(x, y) \mid x=y \parallel x=-36y\}$

The cone is the union of the two lines themselves.

The dual of the cone consists of a single point  $(0,0)$ .

The dual of the dual consists of the entire  $R^2$  plane.

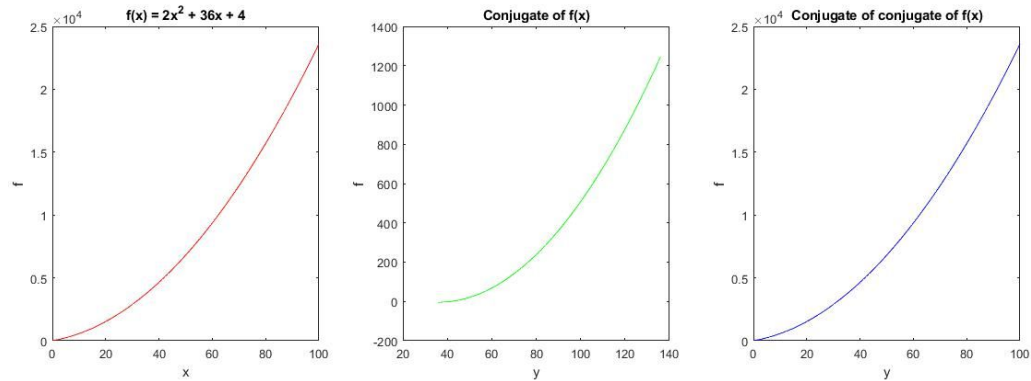


## Question 2

(i)  $f(x) = 2x^2 + 36x + 4$ , for  $x \geq 0$

Conjugate function:  $f(y) = y^2 - 9y + 158$ ,  $y > 36$

Conjugate of conjugate function:  $f(y) = 2y^2 + 36y + 4$ , for  $y \geq 0$



(ii)  $f(x) = -\log(x)$ , for  $x \geq 0$

Conjugate function:  $f(y) = -1 + \log\left(\frac{-1}{y}\right)$ ,  $y < 0$

Conjugate of conjugate function:  $f(y) = -\log(y)$ , for  $y \geq 0$

