

### Convex Optimisation Exercise

Consider the problem of minimising the function  $f(x_1, x_2, x_3) = 3x_1 + 2x_2 + x_3$  whereby  $x_1 \geq 3$ ,  $3x_2 + x_1 \geq 9$  and  $x_3 \geq 12$ .

1. Is this problem convex? Why?
2. Write out this problem in the form of a linear program, as given on slide 29, i.e. in terms of vectors and matrices.
3. Write out the Lagrange function for the problem.
4. Write out the dual function and the dual problem.
5. Solve the Lagrange function to give a candidate solution to the primal problem as well as the Lagrange multipliers.  
(Note: Like we saw in the lecture, this might not be the optimum for a problem with inequality constraints.)
6. Check if the candidate solution from question 5 satisfies the KKT conditions.