

Project 1

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1 Exercise 1

1.1

The objective function:

$$f(x) = \frac{1}{2}x^T Ax - b^T x$$

The gradient of the objective function:

$$\nabla f(x) = \frac{1}{2}A^T x + \frac{1}{2}Ax - b$$

A is symmetric:

$$\nabla f(x) = Ax - b$$

The gradient of objective function at point $x_0 = x_m + v$

$$\nabla f(x_0) = A(x_m + v) - b$$

$Ax_m - b = 0$ because x_m is the minimizer of the objective function.

$$\nabla f(x_0) = Av$$

By the definition of eigenvector:

$$\nabla f(x_0) = \lambda v$$