

# Investigation of the solution of least squares problems using the QR factorization

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## 1 Introduction

Least squares is a statistical method used to determine a line of best fit by minimizing the sum of squares created by a mathematical function.

QR factorization of a matrix is the decomposition of a matrix  $D$  into a product  $D = QR$  of an orthogonal matrix  $Q$  and an upper triangular matrix  $R$ . Orthogonal basis is the relation of two lines at right angles to one another and the generalization of this relation into  $n$  dimensions. Orthonormal basis is a square matrix with real entries whose columns and rows are orthogonal unit vectors.

## 2 OBJECTIVES

### 2.1 Main objective

- To solve the least squares using QR factorization.

### 2.2 Specific Objectives

- To turn the columns of the matrix into the orthogonal set via Gram-Schmidt.

- To turn the orthogonal set into an orthonormal set by dividing the columns in the orthogonal set by their lengths which is  $Q$ .
- To find the upper triangle matrix by finding the product of the transpose of the orthonormal set and the matrix which is  $R$ .
- To find the QR factorization by finding the product of the orthonormal set and the upper triangle matrix.