# Math Document Template

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***Abstract*—This is a simple document explaining how to calculate the distance between two points.**

Download all and latex-tikz codes from

```
svn co https://github.com/gadepall/school/trunk/
    ncert/geometry/figs
```

## 1 Problem

Find the distance between the points $\mathbf{P}$ = (1 -3 4)$^T$ and $\mathbf{Q}$ = (-4 1 2)$^T$

## 2 Construction

2.1. List the design parameters for construction
**Solution:** See Table. 2.1.

| Parameters | Values |
|---|---|
| $\mathbf{P}$ | $\begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix}$ |
| $\mathbf{Q}$ | $\begin{pmatrix} -4 \\ 1 \\ 2 \end{pmatrix}$ |

TABLE 2.1: Values of the points

2.2. Generating the points and distance between them using python.
**Solution:** The following Python code generates Fig. 2.2

codes/point_distance.py

2.3. Verification of the solution by using python code
**Solution:** The following Python code verifies the solution.

codes/verify_distance.py

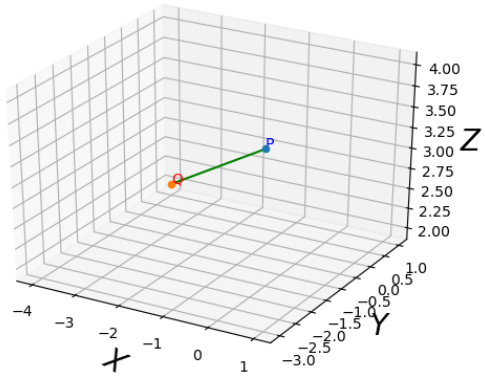


Fig. 2.2: Two points and distance between them.

## 3 Solution

From the problem statement, we got the two points:

$$\mathbf{P} = \begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix} \tag{3.1}$$

$$\mathbf{Q} = \begin{pmatrix} -4 \\ 1 \\ 2 \end{pmatrix} \tag{3.2}$$

The distance between the two points is given by:
$d = \|\mathbf{P} - \mathbf{Q}\|$
or,

$$d = \left\| \begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix} - \begin{pmatrix} -4 \\ 1 \\ 2 \end{pmatrix} \right\| = \left\| \begin{pmatrix} 5 \\ -4 \\ 2 \end{pmatrix} \right\| \tag{3.3}$$

$$\implies d = \sqrt{5^2 + (-4)^2 + 2^2}$$
$$\implies d = 3\sqrt{5}$$