Math Document Template

Bee G S Ashuwin

***Abstract*—This is a document explaining for a question on the concept of area of triangles.**

Download all python codes from

```
svn co https://github.com/Ashuwin/summer_20/
    trunk/linalg_triangle/codes
```

and latex-tikz codes from

```
svn co https://github.com/Ashuwin/summer_20/
    trunk/linalg_triangle/figs
```

1 Problem

Find the area of triangle whose vertices are

a) $\begin{pmatrix}2\\3\end{pmatrix}, \begin{pmatrix}-1\\0\end{pmatrix}, \begin{pmatrix}2\\-4\end{pmatrix}$

b) $\begin{pmatrix}-5\\-1\end{pmatrix}, \begin{pmatrix}3\\-5\end{pmatrix}, \begin{pmatrix}5\\2\end{pmatrix}$

2 Construction

2.1. The design parameters used for construction solution See Table. 2.1.

Design Parameters	
Parameters	Value
A	$\begin{pmatrix}2\\3\end{pmatrix}$
B	$\begin{pmatrix}-1\\0\end{pmatrix}$
C	$\begin{pmatrix}2\\-4\end{pmatrix}$
P	$\begin{pmatrix}-5\\-1\end{pmatrix}$
Q	$\begin{pmatrix}3\\-5\end{pmatrix}$
R	$\begin{pmatrix}5\\2\end{pmatrix}$

TABLE 2.1: Triangle *ABC* and Triangle *PQR*

2.2. Draw fig. 2.2.
Solution: The following Python code generates Fig. 2.2

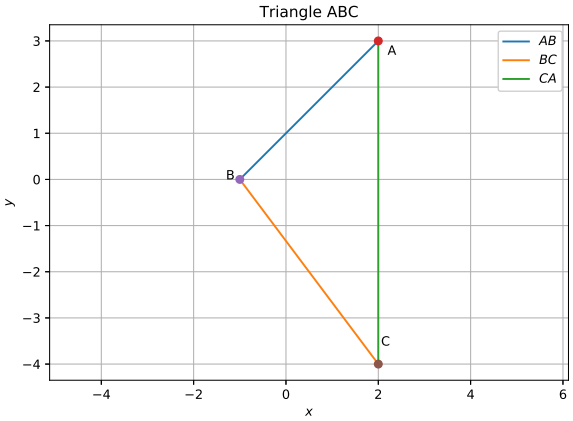

Fig. 2.2: Triangle *ABC* using python

```
codes/triangle1.py
```

2.3. Draw fig. 2.3.

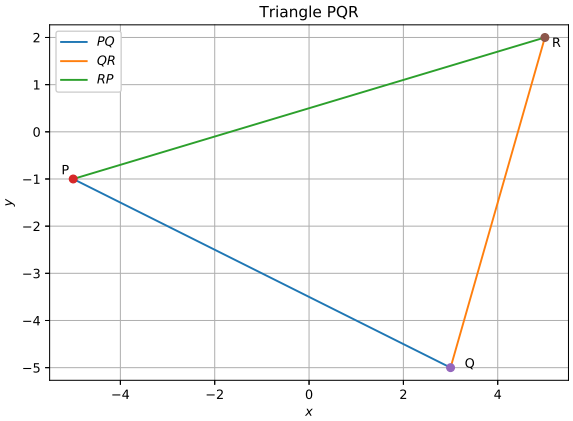

Fig. 2.3: Triangle *PQR* using python

Solution: The following Python code generates Fig. 2.3

```
codes/triangle2.py
```

3 Solution

3.1. The area of triangle *ABC*:
Solution: The area of triangle *ABC* using cross

product is obtained as:

$$\frac{1}{2}\left\|(\mathbf{B}-\mathbf{A})\times(\mathbf{C}-\mathbf{A})\right\|$$

and it is found in the following python code:

codes/tri_area_ABC.py

Area of $\triangle ABC = 10.5 units^2$

3.2. The area of triangle PQR:

Solution: The area of triangle PQR using Heron's formula is obtained as:

$$\frac{1}{2}\left\|(\mathbf{Q}-\mathbf{P})\times(\mathbf{R}-\mathbf{P})\right\|$$

and it is found in the following python code:

codes/tri_area_PQR.py

Area of $\triangle PQR = 32 units^2$