

Math Document Template

C ANISH

Abstract—This is a document explaining a question about the concept of Circumcenter.

Download all python codes from

```
svn co https://github.com/chakki1234/summer
-2020/trunk/linearalg/codes
```

and latex-tikz codes from

```
svn co https://github.com/chakki1234/summer
-2020/trunk/linearalg/figs
```

1 PROBLEM

Find the center of a circle passing through the points $\begin{pmatrix} 6 \\ -6 \end{pmatrix}$, $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$.

2 CONSTRUCTION

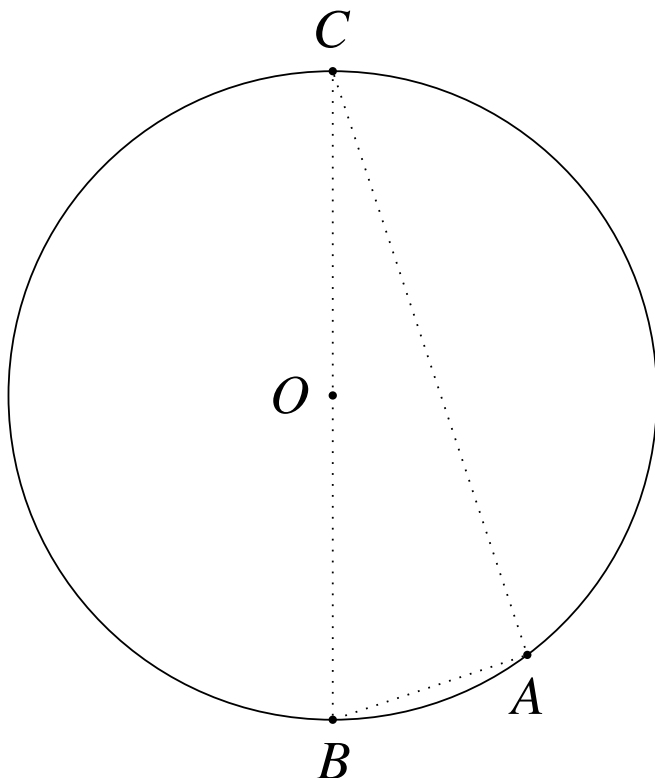


Fig. 2.0: Circumcircle by Latex-Tikz

2.1. The figure obtained looks like Fig. 2.0.

2.2. Coordinates of $\triangle ABC$ Fig2.0.

$$\mathbf{A} = \begin{pmatrix} 6 \\ -6 \end{pmatrix} \quad (2.2.1)$$

$$\mathbf{B} = \begin{pmatrix} 3 \\ -7 \end{pmatrix} \quad (2.2.2)$$

$$\mathbf{C} = \begin{pmatrix} 3 \\ 3 \end{pmatrix} \quad (2.2.3)$$

2.3. To find the coordinates of \mathbf{O} .

Solution: A circle passing through three non-collinear points is the circumcircle and the center is the circumcenter.

$$\mathbf{O} = \frac{A \sin \angle 2A + B \sin \angle 2B + C \sin \angle 2C}{\sin \angle 2A + \sin \angle 2B + \sin \angle 2C} \quad (2.3.1)$$

2.4. From the given information, The values are listed in 2.4

Output values	
Parameter	Value
\mathbf{O}	$\begin{pmatrix} 3 \\ -2 \end{pmatrix}$
radius	5

TABLE 2.4: Values of \mathbf{O}

2.5. Draw Fig. 2.5.

Solution: The following Python code generates Fig. 2.5

```
codes/circumcenter.py
```

and the equivalent latex-tikz code generating Fig. 2.5 is

```
figs/circumcenter_fig.tex
```

The above latex code can be compiled as a standalone document as

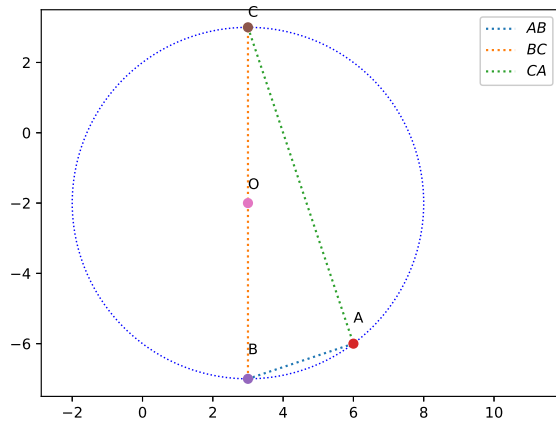


Fig. 2.5: Circumcircle generated using python

figs/circumcenter_fig_final.tex

3 SOLUTION

Solution: A circle passing through three non-collinear points is the circumcircle and the center is the circumcenter.

$$\mathbf{O} = \frac{A \sin \angle 2A + B \sin \angle 2B + C \sin \angle 2C}{\sin \angle 2A + \sin \angle 2B + \sin \angle 2C} \quad (5.1)$$

Substituting values from 2.2.1, 2.2.2 and 2.2.3

$$\therefore \mathbf{O} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} \quad (5.2)$$