Assignment 1

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Area of Triangle

***Abstract*—This document contains the solution to find the Area of a Triangle, given the coordinates of the vertices.**

Download all python codes from

https://github.com/Abhishektiwari2021/ee5600.git/Assignment_1.ipynb

Download latex-tikz codes from

https://github.com/Abhishektiwari2021/ee5600.git/main.tex

1 Problem

Solve: Problem set: Vector2, Example-2,2

Find the areas of the triangles the coordinates of whose angular points are respectively: (0,4), (3,6) and (-8,-2)

2 Solution

$$\mathbf{Q}-\mathbf{P} = \begin{pmatrix}3\\6\end{pmatrix} - \begin{pmatrix}0\\4\end{pmatrix} = \begin{pmatrix}3\\2\end{pmatrix} \tag{2.0.1}$$

$$\mathbf{R}-\mathbf{P} = \begin{pmatrix}-8\\-2\end{pmatrix} - \begin{pmatrix}0\\4\end{pmatrix} = \begin{pmatrix}-8\\-6\end{pmatrix} \tag{2.0.2}$$

$$\because \text{ Area of the Triangle} = \frac{1}{2}|(\mathbf{Q}-\mathbf{P}) \times (\mathbf{R}-\mathbf{P})| \tag{2.0.3}$$

As the vector cross product of two vectors can also be expressed as the product of a skew-symmetric matrix and a vector.

$$\mathbf{A} \times \mathbf{B} = \begin{pmatrix}0 & -a_3 & a_2\\ a_3 & 0 & -a_1\\ -a_2 & a_1 & 0\end{pmatrix} \times \begin{pmatrix}b_1\\b_2\\b_3\end{pmatrix} \tag{2.0.4}$$

Substituting values from equation 2.0.1 and 2.0.2 in above equation 2.0.4, we'll get:

$$(\mathbf{Q}-\mathbf{P}) \times (\mathbf{R}-\mathbf{P}) = \begin{pmatrix}0 & 0 & 2\\ 0 & 0 & -3\\ -2 & 3 & 0\end{pmatrix} \times \begin{pmatrix}-8\\-6\\0\end{pmatrix} = \begin{pmatrix}0\\0\\-2\end{pmatrix} \tag{2.0.5}$$

$$\therefore |(\mathbf{Q}-\mathbf{P}) \times (\mathbf{R}-\mathbf{P})| = \sqrt{0^2+0^2+-2^2} = 2 \tag{2.0.6}$$

Substituting value from equation 2.0.6 in equation 2.0.3, we'll get area of triangle:

$\implies \frac{1}{2}(2) = 1 units^2$