Assignment 2

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Download all python codes from

https://github.com/

and latex-tikz codes from

https://github.com/

1 Question No. 2.3 - Quadratic forms

Find the locus of all the unit vectors in the xy-plane

2 Solution

let,the unit vector be $\mathbf{a} = 1$, $OA = \mathbf{a}$
We know that,

$$\mathbf{a} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k} \tag{2.0.1}$$

since the vector in xy plane, there is no z-coordinate.Hence,

$$\mathbf{a} = x\mathbf{i} + y\mathbf{j} \tag{2.0.2}$$

Taking a general vector
Angle AOB with x-axis in between is **a** and **i** is $\angle AOB$ we know that,

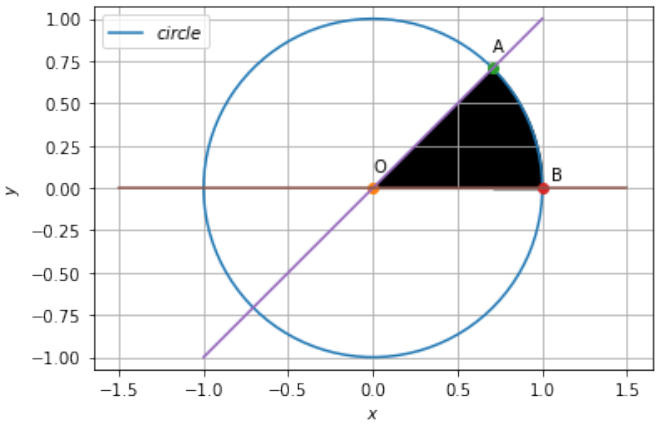

Fig. 0: unit vector

$$\mathbf{a}.\mathbf{b} = |\mathbf{a}||\mathbf{b}| \cos AOB \tag{2.0.3}$$

$$\mathbf{a}.\mathbf{b} = |\mathbf{a}||\mathbf{b}| \cos AOB \tag{2.0.4}$$

putting $a = a$, $b = i$, as we know that a is unit vector

$$\mathbf{a}.\mathbf{i} = \cos AOB \tag{2.0.5}$$

$$(x\mathbf{i} + y\mathbf{j} + z\mathbf{k}).\mathbf{i} = \cos AOB \tag{2.0.6}$$

$$(x\mathbf{i} + y\mathbf{j} + z\mathbf{0})(x\mathbf{1} + y\mathbf{0} + z\mathbf{0}) = \cos AOB \tag{2.0.7}$$

$$x = \cos AOB \tag{2.0.8}$$

Angle with y-axis, in between **a**, and **j** is $(90° - \angle AOB)$
so, angle between

$$\mathbf{a}.\mathbf{j} = |\mathbf{a}||\mathbf{j}|(90° - \cos AOB) \tag{2.0.9}$$

$$\mathbf{a}.\mathbf{j} = (\sin AOB) \tag{2.0.10}$$

$$(x\mathbf{i} + y\mathbf{j} + z\mathbf{k}).\mathbf{j} = \cos AOB \tag{2.0.11}$$

$$(x\mathbf{i} + y\mathbf{j} + z\mathbf{0})(x\mathbf{0} + y\mathbf{1} + z\mathbf{0}) = \cos AOB \tag{2.0.12}$$

$$y = \sin AOB \tag{2.0.13}$$

Thus,

$$\mathbf{a} = x\mathbf{i} + y\mathbf{j} \tag{2.0.14}$$

$$\mathbf{a} = (\cos AOB)\mathbf{i} + (\cos AOB)\mathbf{j} \tag{2.0.15}$$

This value will be in all quadrants(0° to 360°)