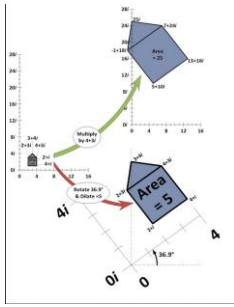


Rotation of a figure in xy plane



Vector for the rotation in an angle "α"

$\alpha = 30^\circ$

$\alpha = 0.523599 \text{ rad}$
 $\tan(\alpha) = 0.57735$
 $\tan(\alpha) = 4/7$ Only an approximated fraction value is shown

Absize component (1)
 $v_x = \text{NumDen}(J11, "D")$
 $v_x = 9.97E+06$

Ordinate component (1)
 $v_y = \text{NumDen}(J11, "N")$
 $v_y = 5.76E+06$

Vector
 $v = (v_x, v_y)$
 $v = 9973081+5757961i$

Noe 1. Function NumDen has been used

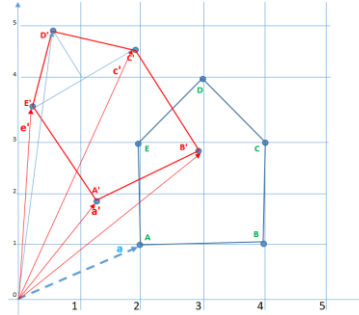
Versor $eV = v / \text{Mod}(v)$

$\text{Mod}(v) = (v_x^2 + v_y^2)^{0.5}$
 $v_x = 9.97E+06$
 $v_y = 5.76E+06$
 $\text{Mod}(v) = 1.15E+07$

Components of versor v
 $eV_x = v_x / \text{Mod}(v)$
 $eV_x = 0.86603$

$eV_y = v_y / \text{Mod}(v)$
 $eV_y = 0.5$

Versor
 $eV = 0.866+0.5000i$



When the rotation is defined by a versor, the original area of the figure and the area of the rotated figure are equal.

Multiplication by the versor eV

The vectors: a, b, c, d, e defining the corners of the original figure are multiplied by the versor

$$eV = 0.866+0.5000i$$

Original vectors

a	2+i
b	4+i
c	4+3i
d	3+4i
e	2+3i

Versor

$$0.866+0.5000i$$

The resulting vectors a', b', c', d', e' define the corners of the new figure, which has been rotated by an angle "α" using the associated versor

New vectors:
 $a' = eV * a$
 $b' = eV * b$

...

New vectors

a'	1.232+1.866i
b'	2.964+2.866i
c'	1.964+4.598i
d'	0.598+4.964i
e'	0.232+3.598i

$$\text{Area CDE} = (1/2) * (c_x * (d_y - e_y) - c_y * (d_x - e_x) + (d_x * e_y - d_y * e_x))$$

Surface area of the original figure

Area of square

$b - a = 2.000+0.000i$
 $\text{abs}(b-a) = 2.000$
 $c - b = 0.000+2.000i$
 $\text{abs}(c-b) = 2.000$
 $\text{abs}(b-a) * \text{abs}(c-b) = 4.00$
 $\text{Asq} = \text{abs}((b-a) * (c-b))$
 $\text{Asq} = 4.000$

Area of triangle CDE = Atr

$\text{CDE} = (1/2) * (c_x * (d_y - e_y) - c_y * (d_x - e_x) + (d_x * e_y - d_y * e_x))$
 $c_x = 4$
 $c_y = 3$
 $d_x = 3$
 $d_y = 4$
 $e_x = 2$
 $e_y = 3$
 $\text{CDE} = 1.00 = \text{Atr}$

Total area

$A = \text{Asq} - \text{Atr}$
 $A = 5.000$

Surface area of the rotated figure

Area of square

$b' - a' = 1.732+i$
 $\text{abs}(b'-a') = 2.0000$
 $c' - b' = -1+1.732i$
 $\text{abs}(c'-b') = 2.0000$
 $\text{abs}(b'-a') * \text{abs}(c'-b') = 4.00$
 $\text{Asq}' = \text{abs}((b'-a') * (c'-b'))$
 $\text{Asq}' = 4.000$

Area of triangle C'D'E' = Atr'

$\text{C'D'E}' = (1/2) * (c'_x * (d'_y - e'_y) - c'_y * (d'_x - e'_x) + (d'_x * e'_y - d'_y * e'_x))$
 $c'_x = 1.964$
 $c'_y = 4.598$
 $d'_x = 0.598$
 $d'_y = 4.964$
 $e'_x = 0.232$
 $e'_y = 3.598$
 $\text{C'D'E}' = 1.00 = \text{Atr}'$

Total area

$A' = \text{Asq}' - \text{Atr}'$
 $A' = 5.000$