$$R_{ZYZ} = \begin{pmatrix} 0.7071 & 0 & -0{,}7071 \\ 0 & -1 & 0 \\ -0{,}7071 & 0 & -0{,}7071 \end{pmatrix} \quad \mathrm{I}$$

$$R_{ZYX} = \begin{pmatrix} 0{,}7500 & -0{,}6495 & -0{,}1250 \\ 0{,}4330 & 0{,}6250 & -0{,}6495 \\ 0{,}5000 & 0{,}4330 & 0{,}7500 \end{pmatrix} \quad \mathrm{II}$$

I $\theta = -1 \cdot \sin^{-1}(-0{,}7071) = 45^\circ$ (or $0{,}7853$ rad)

$\psi = \tan^{-1}\left(\frac{0}{-7071}\right) = 0$

$\phi = \tan^{-1}\left(\frac{0}{0{,}7071}\right) = 0$

II $\theta = -\sin^{-1}(0.5) = -30^\circ$ ($0{,}52359$ rad)

$\psi = \tan^{-1}\left(\frac{0{,}4330}{0{,}7500}\right) = 30^\circ$ ($0{,}52358$ rad)

$\phi = \tan^{-1}\left(\frac{0{,}4330}{0{,}7500}\right) = 30^\circ$ ($0{,}52358$ rad)

Computer Graphics sheet no. 6

Exercise 6.2

a) Transformation matrix

$$\begin{pmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{pmatrix}$$

$$\begin{pmatrix} \cos(30°) & -\sin(30°) \\ \sin(30°) & \cos(30°) \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0,86602 & -0,5 \\ 0,5 & 0,86602 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0,86602 \\ 0,5 \end{pmatrix}$$

b) B looks like a standard basis $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ while B' looks like rotated 30° if we look at a) the resuld coordinates for $(1, 0)^T$ equals rotated Basis one ~~at~~ at the bottom right

c) $\begin{pmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{pmatrix} \times \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$$= \begin{pmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{pmatrix} = R_{B,B'}(\phi)$$

Testing:

$$b_1' = R_{B,B'}(\phi) \cdot b_1$$

$$= \begin{pmatrix} \cos(\phi) \\ \sin(\phi) \end{pmatrix} = \begin{pmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{pmatrix} \times \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$b_2' = R_{B,B'}(\phi) \cdot b_2 = \begin{pmatrix} -\sin(\phi) \\ \cos(\phi) \end{pmatrix} = \begin{pmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{pmatrix} \times \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

d) $R_{B,B'}(\phi) \cdot P_i$ will do the job for every coordinate.

$R_{B,B'}(30°) \cdot \begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$; $R_{B,B'}(30°) \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0,86602 \\ 0,5 \end{pmatrix}$;

$R_{B,B'}(30°) \cdot \begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} -0,5 \\ 0,86602 \end{pmatrix}$;

$R_{B,B'}(30°) \cdot \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 0,36602 \\ 1,36602 \end{pmatrix}$; $R_{B,B'}(30°) \cdot \begin{pmatrix} 0,5 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} -0,56699 \\ 1,98204 \end{pmatrix}$

e) Both are the same operations in a) and d) and have the same result.