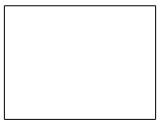
Exercise Computer graphics – (till November 23, 2006)

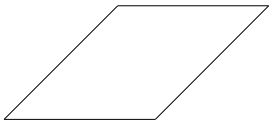
Rotations

Exercise 18: a) It is possible to decompose rotations into a number of succeeding shears. What is the least number of shears a rotation in 2D can be decomposed into? Explicitly state which shears you need.

b) In which way does an image manipulation program benefit from the decomposition you suggested above?

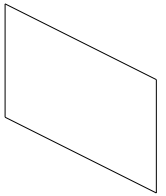


horizontal shear =>



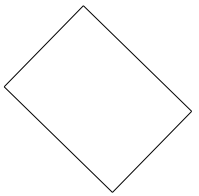
$$\begin{pmatrix} 1 & s \\ 0 & 1 \end{pmatrix}$$

vertical shear =>



$$\begin{pmatrix} 1 & 0 \\ t & 1 \end{pmatrix}$$

rotation =>



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

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Rotations

Exercise 19: The Curves C1, C2 and C3 define a patch T(s,t). The parameters s and t address each point on the surface.

$$T(s,t)=C_2(s)+\Big((1-s)\big(C_1(t)-C_1(0)\big)+s\big(C_3(t)-C_3(0)\big)\Big)$$

a) Determine the parameter space for which

i) form-curve C1
ii) form-curve C2 and
iii) form-curve C1 and C2

have no meaning.

b) How do the curves have to be chosen in order to

i) form a four sided plane patch
ii) form a cylinder
iii) form a cone?