Load the packages for graphics and Linear Algebra

> with(Student[LinearAlgebra]): with(plottools): with(plots):
Warning, the previous binding of the name arrow has been removed and it now has an assigned value

Define an object in the plane we are going to play with

> box := rectangle([0, 0], [2, 1], color = green):
face := ellipse([1, 6], 0.7, 1):
lefeye := ellipse([0.7, 6.3], 0.2, 0.15, filled = true, color = red):
righeteye := ellipse([1.3, 6.3], 0.2, 0.15, filled = true, color = red):
nose := line([1, 6.1], [1, 5.5]):
smile := ellipticArc([1, 5.5], 0.4, 0.2, Pi..2*Pi):
body := line([1, 5], [1, 3]):
leftarm := line([1, 5], [0, 3]):
rightarm := line([1, 5], [2, 3]):
leftleg := line([1, 3], [0.5, 2]), line([0.5, 2], [0.5, 1]):
rightleg := line([1, 3], [1.5, 2]), line([1.5, 2], [1.5, 1]):
guy := [face, lefeye, righeteye, nose, smile, body, leftarm, rightarm, leftleg, rightleg]:
picture := display(box, guy, scaling=constrained, view = [-10..10, -10..10] thickness = 2):
display(picture);
Perform a shear transformation

> A := <<1, 0> | <1.5, 1>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1, view = [-5..15, -5..10], title = """);

\[ A := \begin{bmatrix} 1 & 1.5 \\ 0 & 1 \end{bmatrix} \]
Another shear transformation

> A := <<1, -2> | <0, 1>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1,
view = [-5..15, -5..10], title = "");

$$A := \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix}$$
Perform a contraction ...

> A := <<0.5, 0> | <0, 0.5>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1,
view = [-5..15, -5..10], title = ""):

$$A := \begin{bmatrix} 0.5 & 0 \\ 0 & 0.5 \end{bmatrix}$$
... and dilation

> A := <<2, 0> | <0, 2>>;

ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1, view = [-5..15, -5..15], title = "");
Also a reflection...

> A := <<-1, 0> | <0, -1>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1, view = [-10..10, -8..8], title = "");

\[
A := \begin{bmatrix}
-1 & 0 \\
0 & -1
\end{bmatrix}
\]
... and rotation

> A := <<0, 1> | <-1, 0>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1,
view = [-10..10, -5..10], title = "");

\[
A := \begin{bmatrix}
0 & -1 \\
1 & 0
\end{bmatrix}
\]
Another rotation

> A := <<1/sqrt(2), 1/sqrt(2)> | <-1/sqrt(2), 1/sqrt(2)>>;
ApplyLinearTransformPlot(A, picture, output = animation, iterations = 1,
view = [-10..10, -5..10], title = "");

\[
A := \begin{bmatrix}
\frac{1}{2} \sqrt{2} & -\frac{1}{2} \sqrt{2} \\
\frac{1}{2} \sqrt{2} & \frac{1}{2} \sqrt{2}
\end{bmatrix}
\]