Color Transformations
Colors on the computer are defined by three components: red, green, and blue. Each of these colors is a real number between 0 and 1 inclusive. A value of 1 indicates complete saturation of that color; zero indicates none of that color.

```
> restart; with(linalg):
```
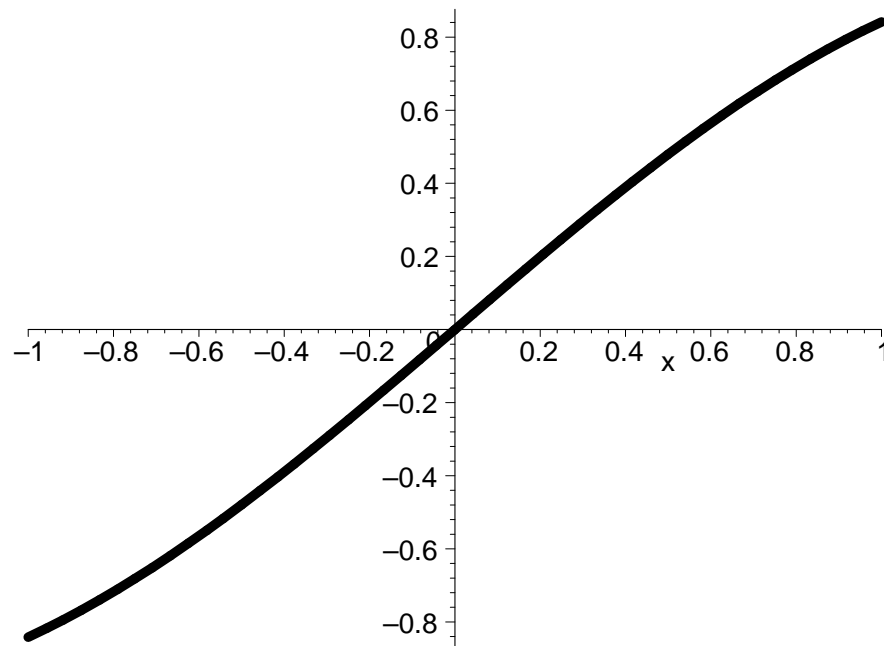Warning, the protected names norm and trace have been redefined and unprotected

Black is defined as (0,0,0) - there is no color at all. White is defined as (1,1,1) - remember that light is made up of all colors.

```
> red := 0; green := 0; blue := 0;
  plot(sin(x), x=-1..1, thickness=10, color=COLOR(RGB, red,
  green, blue));
```

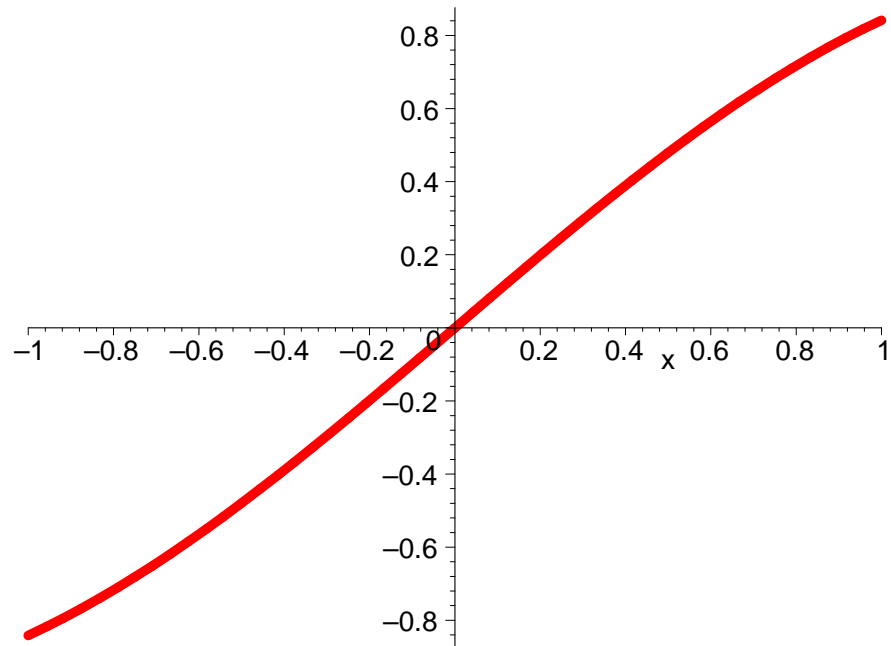$$red := 0$$
$$green := 0$$
$$blue := 0$$

Red is defined as (1,0,0) (similarly green is (0,1,0) and blue is (0,0,1))

```
> red := 1; green := 0; blue := 0;
  plot(sin(x), x=-1..1, thickness=10, color=COLOR(RGB, red,
  green, blue));
```
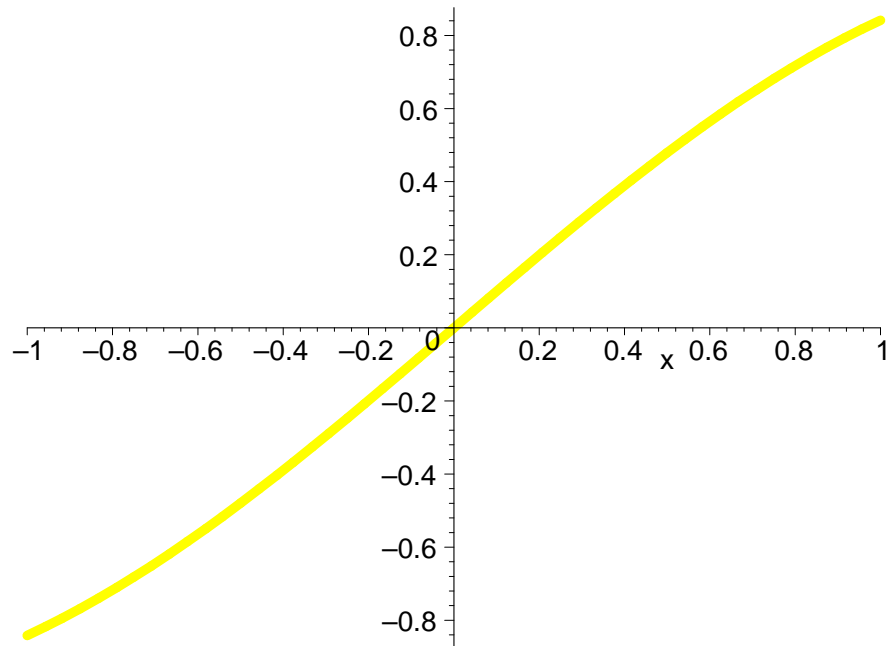
$$red := 1$$
$$green := 0$$
$$blue := 0$$

Combinations can be defined as well; yellow is red and green combined (1,1,0)

```
> red := 1; green := 1; blue := 0;
  plot(sin(x), x=-1..1, thickness=10, color=COLOR(RGB, red,
  green, blue));
```

$$red := 1$$

$$green := 1$$

$$blue := 0$$

We can put the colors into a matrix and transform them appropriately.

```
> C := vector([red, green, blue, 1]);
```

$$C := [1, 1, 0, 1]$$

L is the Luminence vector - if we convert the color to black and white, this will tell us how bright the color is. The values 0.3086, 0.6094, and 0.0820 are mostly made up.

```
> L := matrix([[0.3086, 0.3086, 0.3086, 0], [0.6094,
  0.6094,0.6094, 0], [0.0820, 0.0820, 0.0820, 0], [0, 0, 0,
  1]]);
```

$$L := \begin{bmatrix} .3086 & .3086 & .3086 & 0 \\ .6094 & .6094 & .6094 & 0 \\ .0820 & .0820 & .0820 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

We can see that since the luminence is 0.9180, the color (yellow from the previous example) is very bright

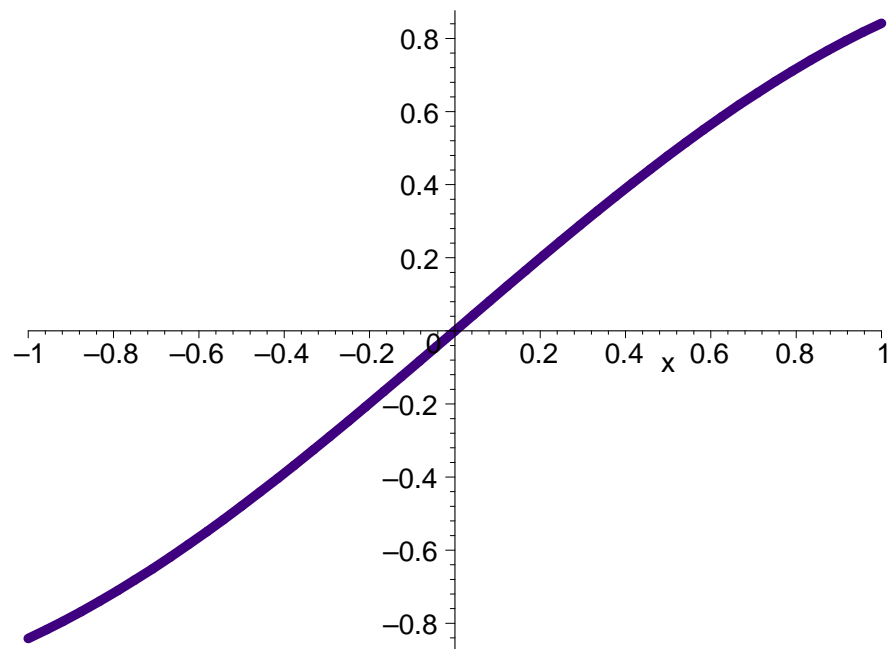```
> evalm(C&*L);
```

$$[.9180, .9180, .9180, 1]$$

Let's try purple

```
> red := 1/4; green := 0; blue := 1/2;
  plot(sin(x), x=-1..1, thickness=10, color=COLOR(RGB, red,
  green, blue));
```

$$red := \frac{1}{4}$$

As expected, purple is rather dark (low luminence)

```
> C :=  vector([red, green, blue, 1]);
  evalm(C&*L);
```

$$C := \left[\frac{1}{4}, 0, \frac{1}{2}, 1\right]$$

$$[.1181500000, .1181500000, .1181500000, 1]$$

This will be an ongoing session...