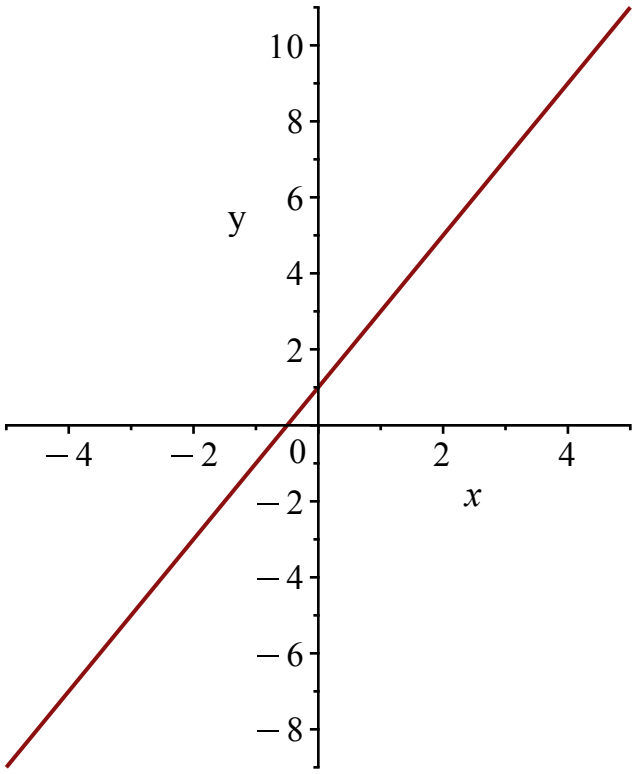
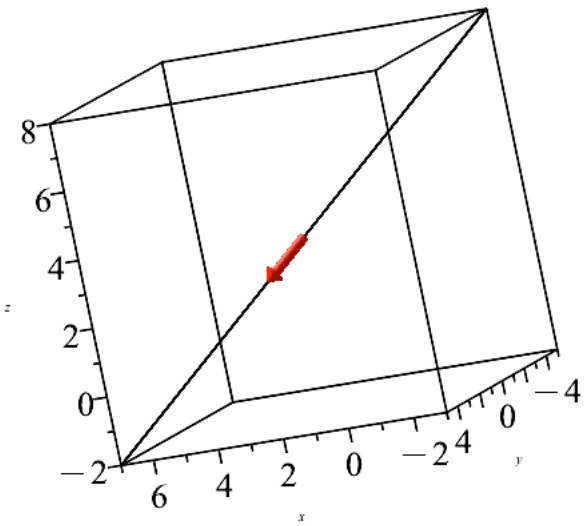
Vector - valued functions

Load the following packages
with(*LinearAlgebra*) *with*(*VectorCalculus*) *with*(*Student*[*Calculus1*])*with*(*plots*) :
We consider vector - valued functions of a single real variable of the form r: $\mathbb{R} \to \mathbb{R}^n$ with n=2 or n=3. They can be used to represent curves in $\mathbb{R}^2$ and $\mathbb{R}^3$, respectively (we can interpret r(t) as the position of a particle at time t).

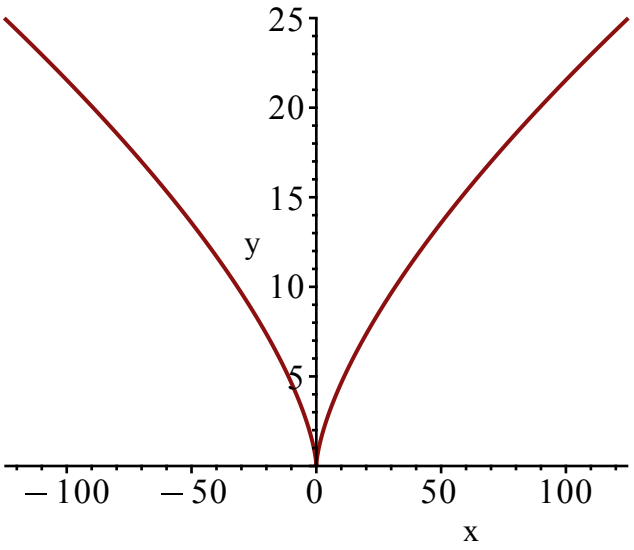
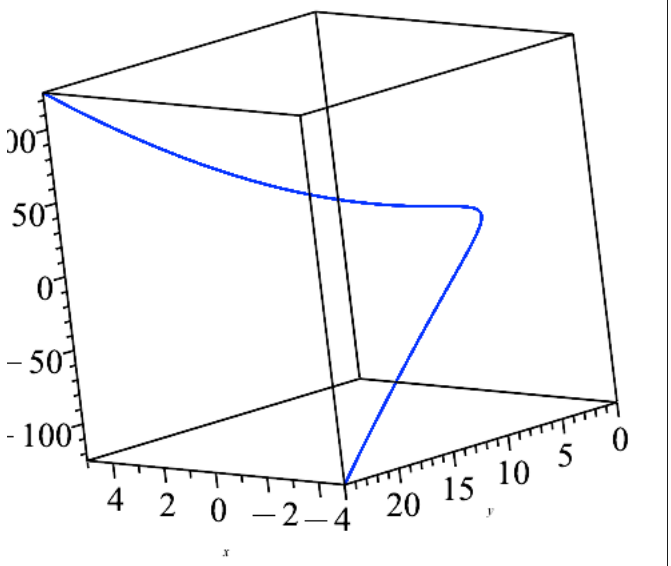
Example 1: Lines

2D	3D
$r(t) = (t, 2t + 1)$ *plot*([*t*, 2 *t* + 1, *t* = −5 ..5])	$r(t) = (2, 0, 3) + t(1, 1, -1)$ *s* := *plot3d*([2 + *t*, *t*, 3 − *t*], *t* = −5 ..5) : *v* := *arrow*(⟨2, 0, 3⟩, ⟨1, 1, −1⟩, *color* = *red*, *width* = 0.3) : *display*(*v*, *s*, *labels* = [*x*, *y*, *z*])





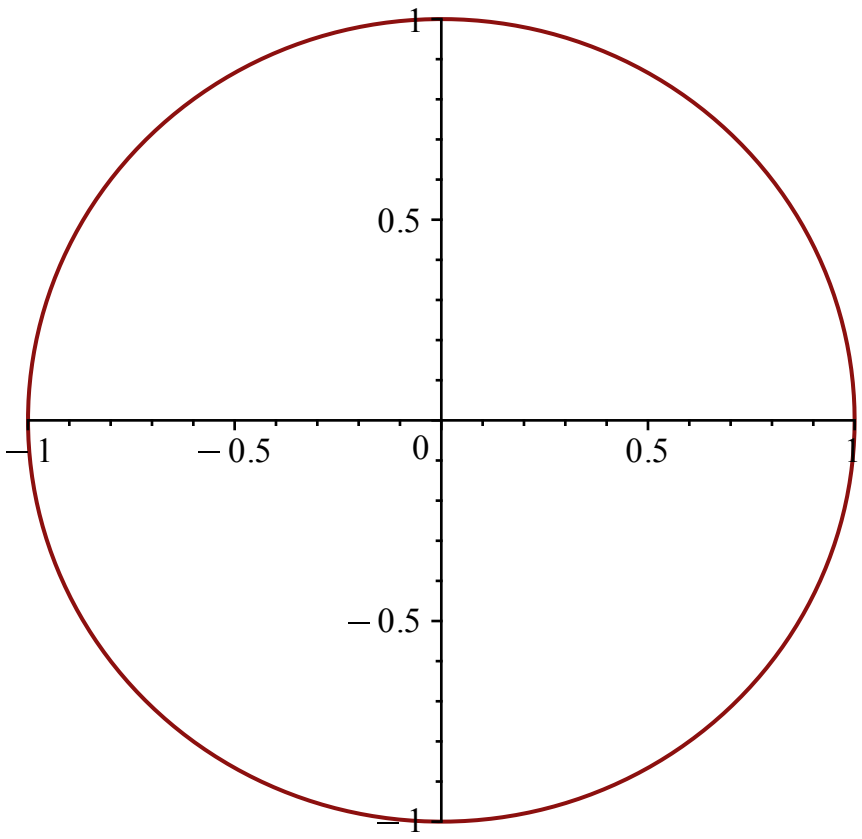
Example 2: Curves

2D	3D
$r(t) = (t^3, t^2)$ $plot([t^3, t^2, t = -5..5])$  **Remark:** the curve is not smooth at (0,0).	$r(t) = (t, t^2, t^3)$ $plot3d([t, t^2, t^3], t = -5..5)$ 

Example 3: Circle

As a parametric equation $r(t) = (\cos(t), \sin(t))$ for $0 \le t < 2\pi$

$plot([\cos(t), \sin(t), t = 0..2\pi])$



$$x^2 + y^2 = 1 \qquad \textbf{(1)}$$

```
> ArcLength([cos(t), sin(t)], t = 0..2*Pi)
```

$$2\,\pi \qquad \textbf{(2)}$$