Using TikZ To Draw A Picture

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Oct 2022

1   Introduction

Package TikZ written by Till Tantau, which is useful tool in LaTeX drawing a figures.

2   Setting up and drawing a line

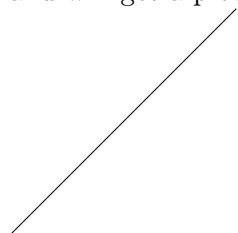`\usepackage{tikz}` in the preamble.

then when you want to do a picture just write

```
1  \begin{tikzpicture}
2      code
3  \end{tikzpicture}
```

the most simpliest straight lines:

```
1      \begin{tikzpicture}[scale=3]
2          \draw (0,0) --- (3,3);
3      \end{tikzpicture}
```

and will get a plot like this:

we use `\draw` to get the starting point and ending point, Between them is the form of "line", telling the compiler to draw a line between the points. the option `[scale=3]` use to control the output scale. we can set the option by `xscale` and `yscale` respectively.

```
1        \begin{tikzpicture}[xscale=3,yscale=1]
2            \draw (0,0)−−(1,1);
3        \end{tikzpicture}
```

And we will get the picture like this and significantly differs from former.
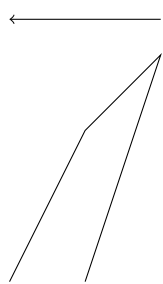
2.1 Adding to a line

Further if we want to get some arrow , we can use the `\draw` to add some options after it. `[->]` and `[<-]` are frequency to draw a line with arrow

```
1        \begin{tikzpicture}
2        \draw [−>] (0,0) −− (2,0);
3        \draw [<−] (0,−0.5) −− (2,−0.5);
4    \end{tikzpicture}
```

This gives:

drawing a axis means use `[<->]` among three points, and the direction is vertical.

```
1        \begin{tikzpicture}
2        \draw [<−>] (0,2)−−(0,0)−−(3,0);
3        \end{tikzpicture}
```
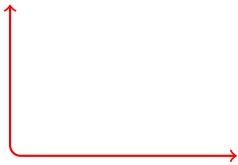
and will get

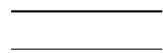smoothing the corner you can make paths take smoother turns:

```
1  \begin{tikzpicture}
2      \draw [<->,rounded corners,thick,red] (0,2)−−(0,0)−−(3,0);
3  \end{tikzpicture}
```

Note 2.1. the options appending use the ','

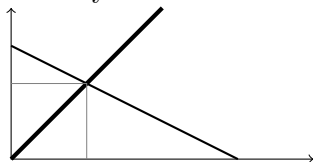change the thickness of lines:

Note 2.2. help lines is the substitute lines; ultra thick is more thick than thick.

```
1      \begin{tikzpicture}
2      \draw[<->] (0,2)−−(0,0)−−(4,0);
3      \draw[thick] (0,1.5)−−(3,0);
4      \draw [ultra thick] (0,0)−−(2,2);
5      \draw [help lines] (1,0)−−(1,1)−−(0,1);
6  \end{tikzpicture}
```
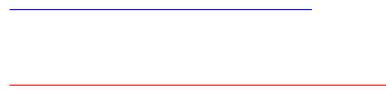
which yields

the way to adjust width of line above all is use the qualitative command. we also can use quantitative command`[line width=xx]`:

2.2 colors

```
1       \begin{tikzpicture}
2       \draw [green] (0,3)--(3,3);
3       \draw [blue] (0,2)--(4,2);
4       \draw [red] (0,1)--(5,1);
5   \end{tikzpicture}
```

This gives:

Note 2.3. the `tikzpicture` is on one picture to draw if the figure has some overlap it will display overlay.

```
1  \begin{tikzpicture}[yscale=4]
2       \draw[-][draw=red,very thick](0,0)--(0,0.45);
3       \draw[-][draw=green,very thick](0,0.45)--(0,1);
4       \draw [-][thick] (-0.1,0.2) -- (0.1,.2)
5       node[align=left, right]
6       {$q_1$ vendue\\au prix $p_1$};
7       \node[right] at (0.1,.45) { $p_1$ at $p_2$};
8       \draw [-][thick] ((-0.1,0.85) -- (0.1,.85) node[align=left,
9       right]{$q_2$ vendue\\ au prix $p_2$};
10      \draw (-0.1,0) -- (0.1,0);
11      \draw (-0.1,1) -- (0.1,1);
12  \end{tikzpicture}
```

the [-] used to add the node to generate a segment.

Adding some text in we use \node and appended with some option like [direction,color] , location and text etc.

q_2 vendue

au prix p_2

p_1 at p_2

q_1 vendue

au prix p_1
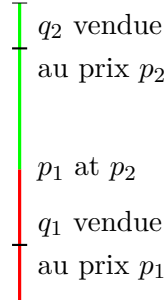
3 Curves

straight line is useful but curve is more frequency use in daily work.

```
1  \begin{tikzpicture}
2      \draw [blue](0,0) rectangle (1.5,1);
3      \draw [red,ultra thick](3,0.5) circle [radius=0.5];
4      \draw [yellow](0,0)
5      arc[radius=1, start angle=45, end angle= 120];
6  \end{tikzpicture}
```

the `arc circle` and `rectangle` set the shape of figure, First of all curve is set the "initial point". Different figure has different "initial point". And the parameter are different based on different figure. in the circle we just need to set the radius.

They gives like that:
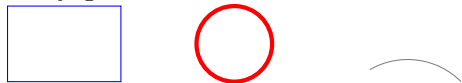
To drawing a precise curve, I suggest that visit the website mathcha to draw the curve, the drawing process is a easy. And it can generate the tikz code based on the curve you draw.
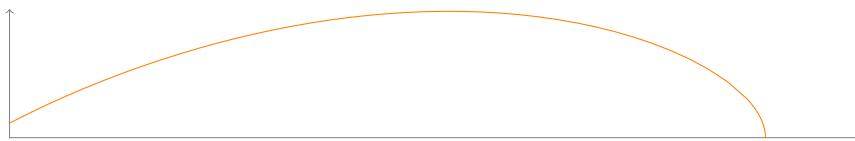
There are number of ways by which you can do curves without plotting all the points. Here is a easy one based on TiKZ.

```
1  \begin{tikzpicture}
2      \draw[very thick](0,0) to [out=90,in=195] (2,1.5);
3  \end{tikzpicture}
```

This curve from (0,0) to (2,2) which leaves at an angle of 90o and arrive at an angle of 195o
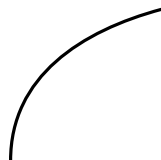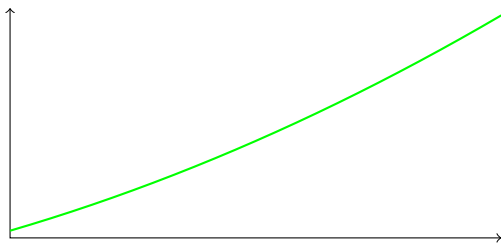
3.1 Plotting functions

TikZ also has math engine that make some plot based on plot function is easy.

```
1  \begin{tikzpicture}
2      \draw[<->] (0,0.8) --(0,0)--(0.5,0);
3      \draw[green,very thick,domain=0:0.4] plot(\x,{0.025+\x+\x*\x};
4  \end{tikzpicture}
```

the yield:

the option of domain set up the domain of the function. in the function we set the independent variable and function form.The independent variable need to use to distinguish with letter.

the expression `sin(\x r)` it assume that x is in degrees;

```
1  \begin{tikzpicture}
2      \draw [help lines,<->] (0,0)--(6.5,0);
3      \draw [help lines, ->] (0,-1.1) -- (0,1.1);
4      \draw [green,domain=0:2*pi]
5      plot (\x, {(sin(\x r)* ln(\x+1))/2});
6      \draw [red,domain=0:pi] plot (\x, {sin(\x r)});
7      \draw [blue, domain=pi:2*pi]
8      plot (\x, {cos(\x r)*exp(\x/exp(2*pi))});
9  \end{tikzpicture}
```
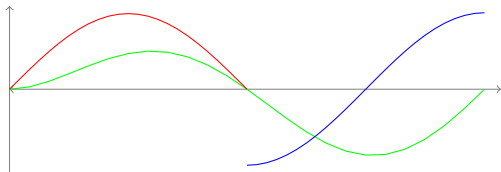
4   Filling up areas

```
1  \begin{tikzpicture}
2  \draw [fill=red,ultra thick] (0,0) rectangle (1,1);
3  \draw [fill=red,ultra thick,red] (2,0) rectangle (3,1);
4  \draw [blue, fill=blue] (4,0) -- (5,1) -- (4.75,0.15) -- (4,0);
5  \draw [fill] (7,0.5) circle [radius=0.1];
6  \draw [fill=orange] (9,0) rectangle (11,1);
7  \draw [fill=white] (9.25,0.25) rectangle (10,1.5);
8  \end{tikzpicture}
```
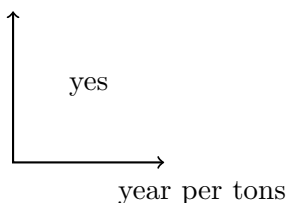
the yield:

5   Putting labels in pictures

some time we need some label in the axis to illustrate the meanings of label

```
1      \begin{tikzpicture}
2          \draw [thick,<->](0,2)--(0,0)--(2,0);
3          \node at (1,1){yes};
4          \node at (2.5,-.4){year per tons};
5      \end{tikzpicture}
```

yes

year per tons

some time the label to be situated relative to a point. TikZ has neat commands for this
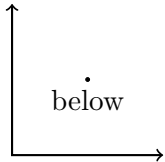
```
1      \begin{tikzpicture}
2          \draw[thick,<->](0,2)--(0,0)--(2,0);
```

```
3          \draw[ fill ](1,1) circle [radius=0.025];
4          \node[below] at (1,1){below};
5       \end{tikzpicture}\newline
```

the yield:

below

Note 5.1. note that 'below' is an option else could use 'above''left''right' besides,they can complex with.
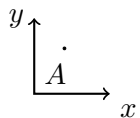
this makes it possible to label axes and points:

```
1          \begin{tikzpicture}
2             \draw[thick,<−>](0,1)−−(0,0)−−(1,0);
3             \node [below right] at (1,0) {$x$};
4             \node [left] at (0,1) {$y$};
5             \draw[fill](0.4,0.6) circle [radius=0.5pt];
6             \node[above right](0.4,0.6) {$A$};
7             \end{tikzpicture}
```

the yield:

y

A

x

```
1  \begin{tikzpicture}[xscale=1.3]
2  \draw [thick] (0,0) —— (9,0);
3  \draw (0,−.2) —— (0, .2);
4  \draw (3,−.2) —— (3, .2);
5  \draw (6,−.2) —— (6, .2);
6  \draw (9,−.2) —— (9, .2);
7  \node[align=left , below] at (1.5,−.5)%
8  {This happens\\in period 1\\and is aligned\\ left};
9  \node[align=center , below] at (4.5,−.5)%
10 {This happens\\in period 2\\and is centered};
11 \node[align=right , below] at (7.5,−.5)%
```
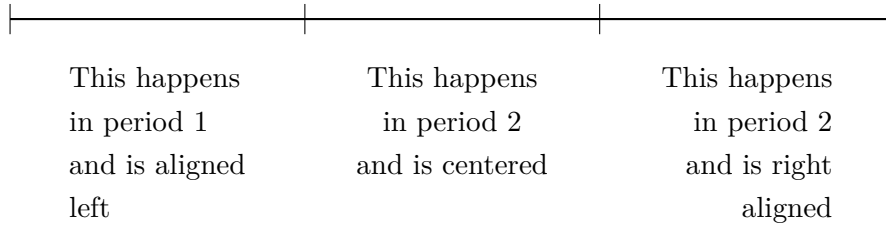
```
12    {This happens\\in period 2\\and is right\\aligned};
13    \end{tikzpicture}
```

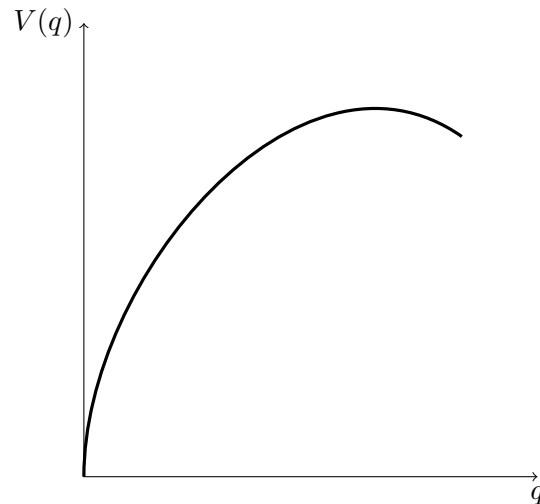| This happens | This happens | This happens |
in period 1	in period 2	in period 2
and is aligned	and is centered	and is right
left		aligned

5.1   The whole picture

Note 5.2. we can set the location of figure in the layout by

```
1    \begin{center}
2        code
3    \end{center}
```


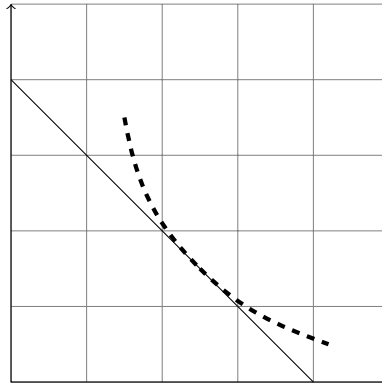the degree to measure is from the point where we starting and ending.

```
1          \begin{center}
2              \begin{tikzpicture}
3              \draw [help lines] (0,0) grid (5,5);
4              \draw [<->] (5,0) —— (0,0) —— (0,5);
5              \draw (4,0) —— (0,4);
```

```
6            \draw[dashed,ultra thick]
7              (1.5,3.5) to [out=-80,in=135] (2.5,1.5);
8            \draw [dashed,ultra thick]
9              (2.5,1.5) to [out=-45,in=160] (4.2,0.5);
10           \end{tikzpicture}
11         \end{center}
```

the degrees is from a horizontal level which above is positive degree and the below is negative degree.

6   Conclusion

TikZ is a excellent Package can do something useful. You can use it to draw some beautiful plots in LaTeX. And remember one word someone said:"a picture is more than a thousand words."