

# KETopic as a Tool to Make Teaching Materials and its Recent Developments

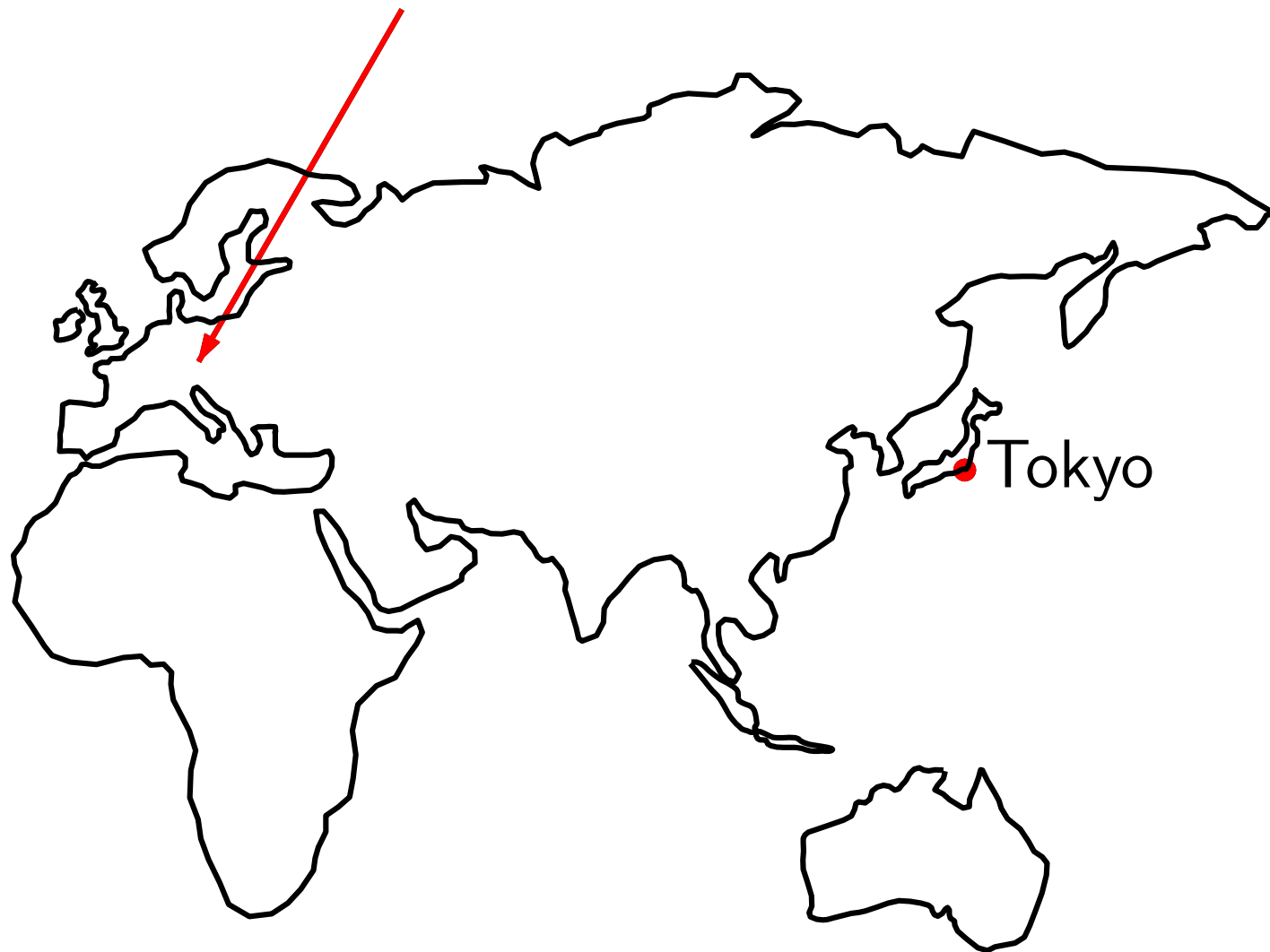
Setsuo Takato (Toho Univ.)

Masataka Kaneko (Kisarazu N.C.T.)

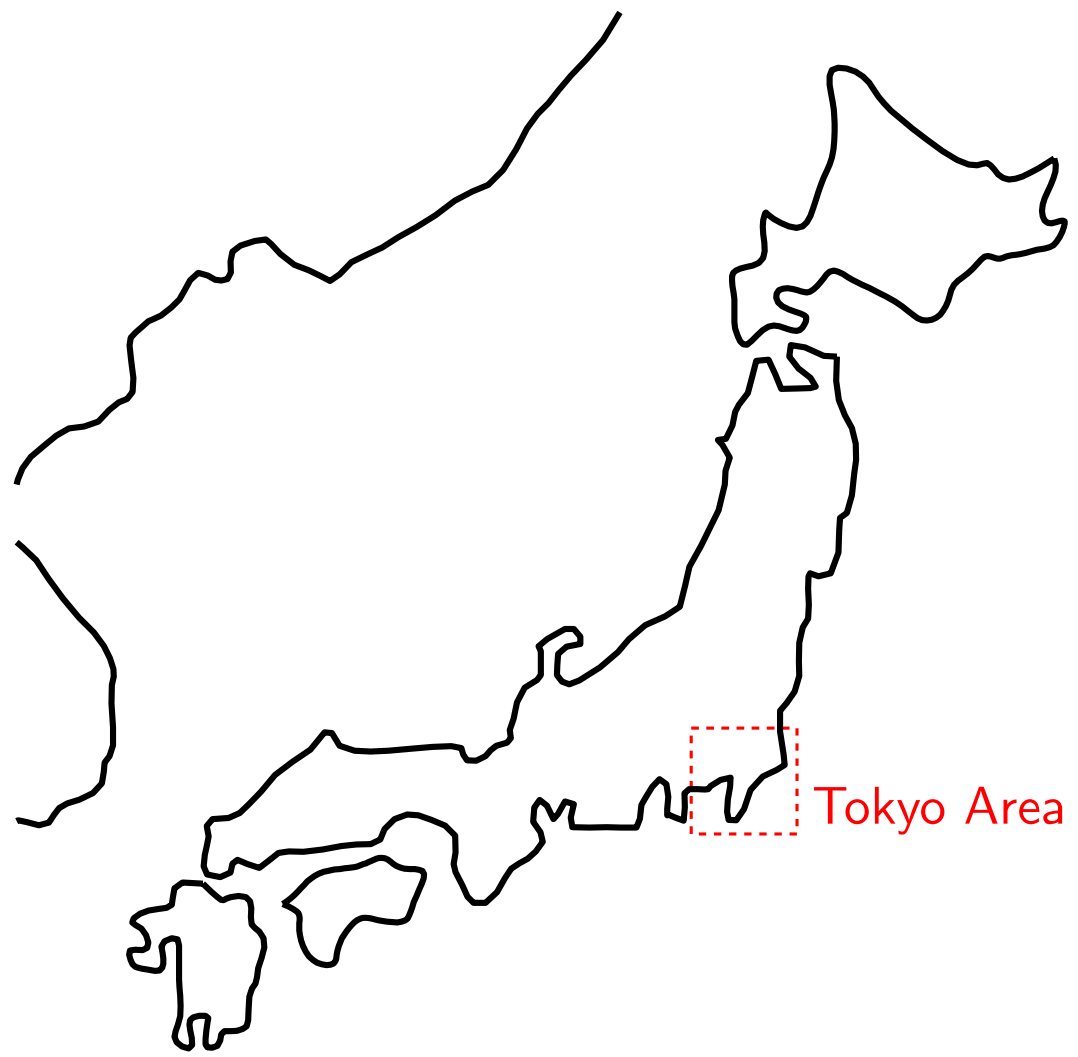
June 29th 2010

CADGME2010

We are here (České Budějovice)







Tokyo Area



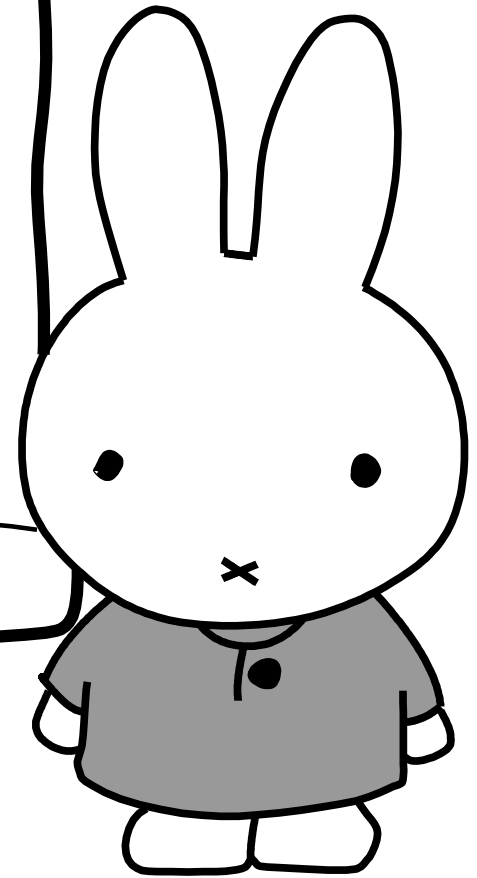
Tokyo

Funabashi

Kisarazu

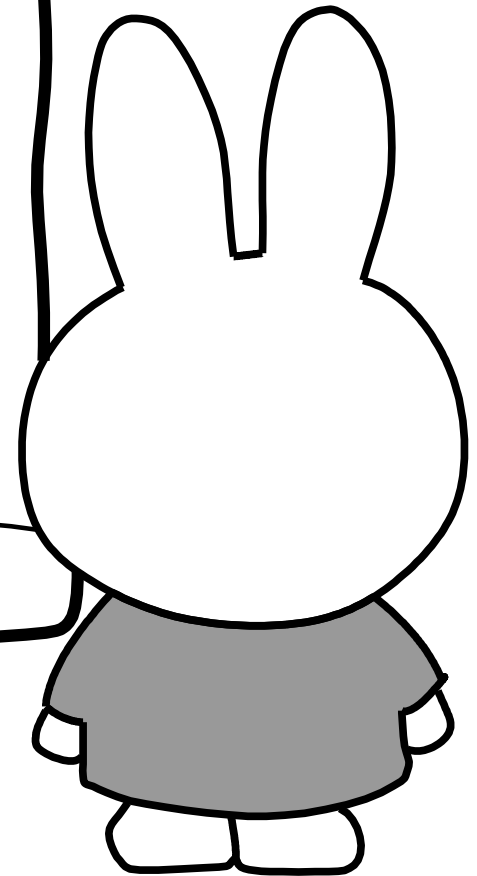
## Today's Talk

1. Overview of  $\text{KETpic}$
2. Meta Commands of  $\text{KETpic}$
3. Developing “layer” environment as an application



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1. Overview of  $\text{KETpic}$
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# Overview of $\text{KETpic}$

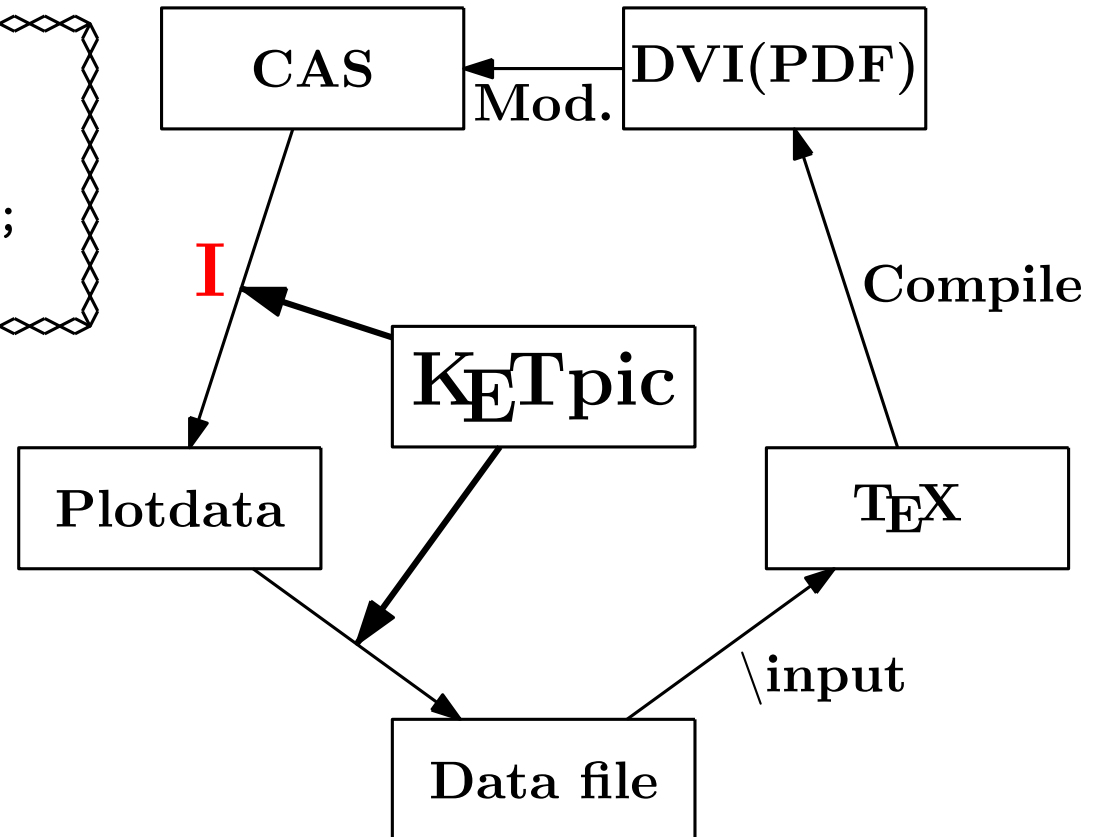
- (1) a CAS macro package to insert figures into  $\text{LATEX}$  documents
- (2) developed since 2006
  - Maple, Mathematica, Maxima,
  - Scilab, Matlab, Risa/Asir, R
- (3) monochromatic and line drawing
- (4) precise and expressive
- (5) easy to read and write scripts because of symbolic expressions





# Process of drawing with $\text{K}_E\text{T}_{pic}$

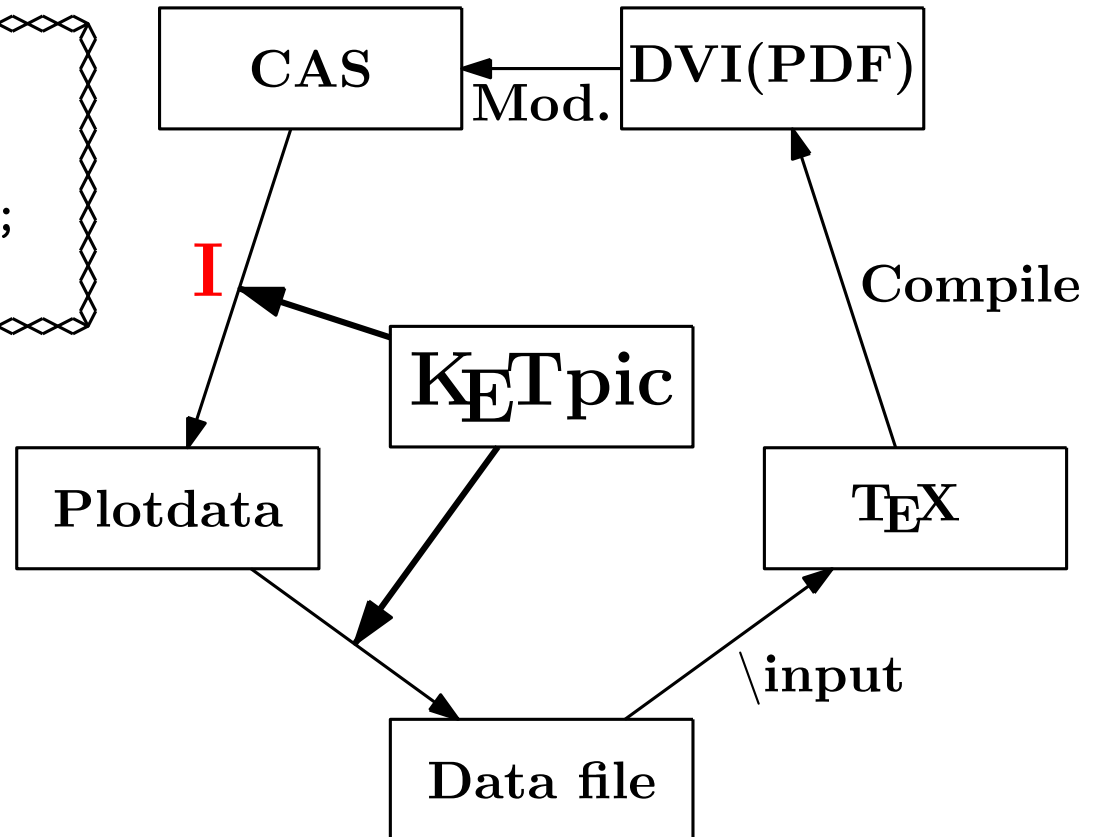
```
G=list();  
for a=[2, 2.5, 3, 3.5]  
  G($+1)=Plotdata('a^x','x');  
end;
```



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The point is **readability**

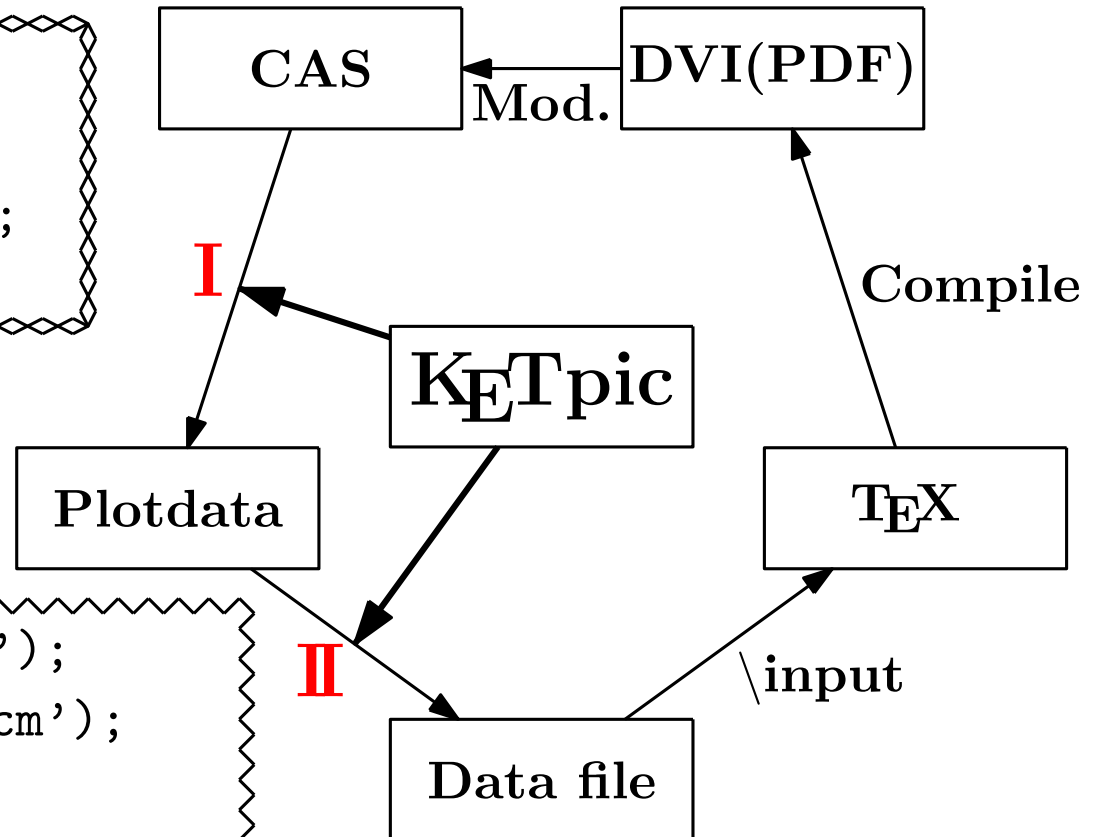


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  G($+1)=Plotdata('a^x','x');  
end;
```

The point is **readability**

```
Openfile('fig.tex');  
  Beginpicture('1cm');  
    Drwline(G);  
  Endpicture(1);  
Closefile()
```

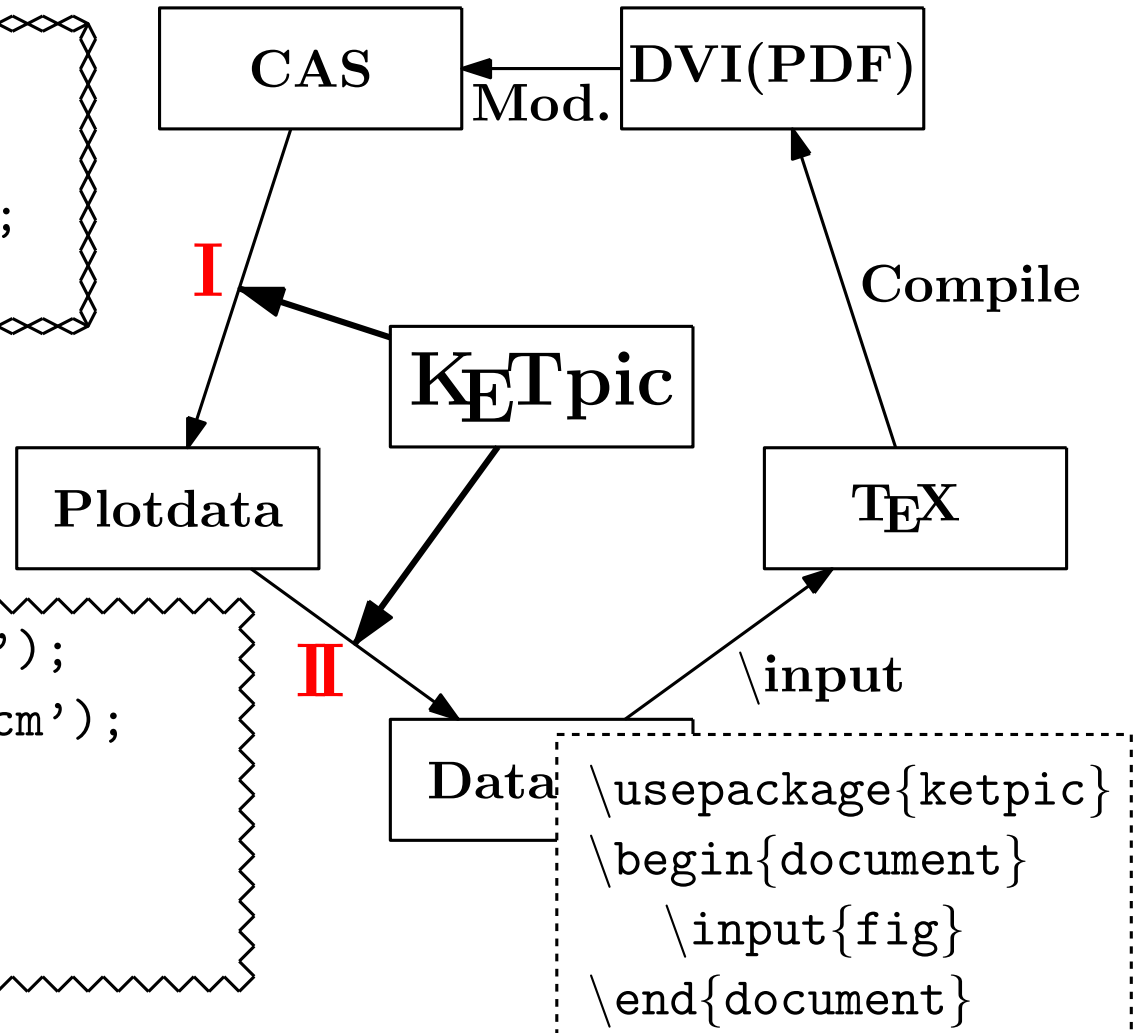


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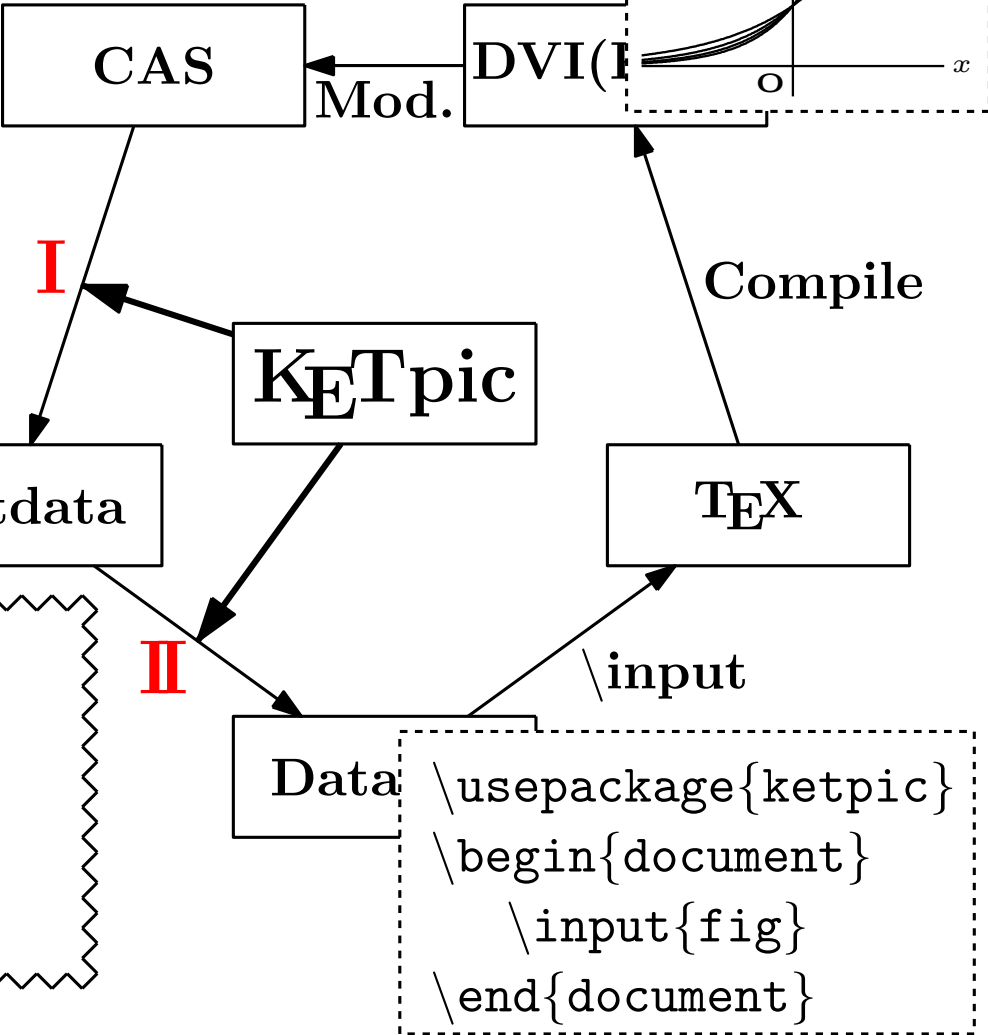


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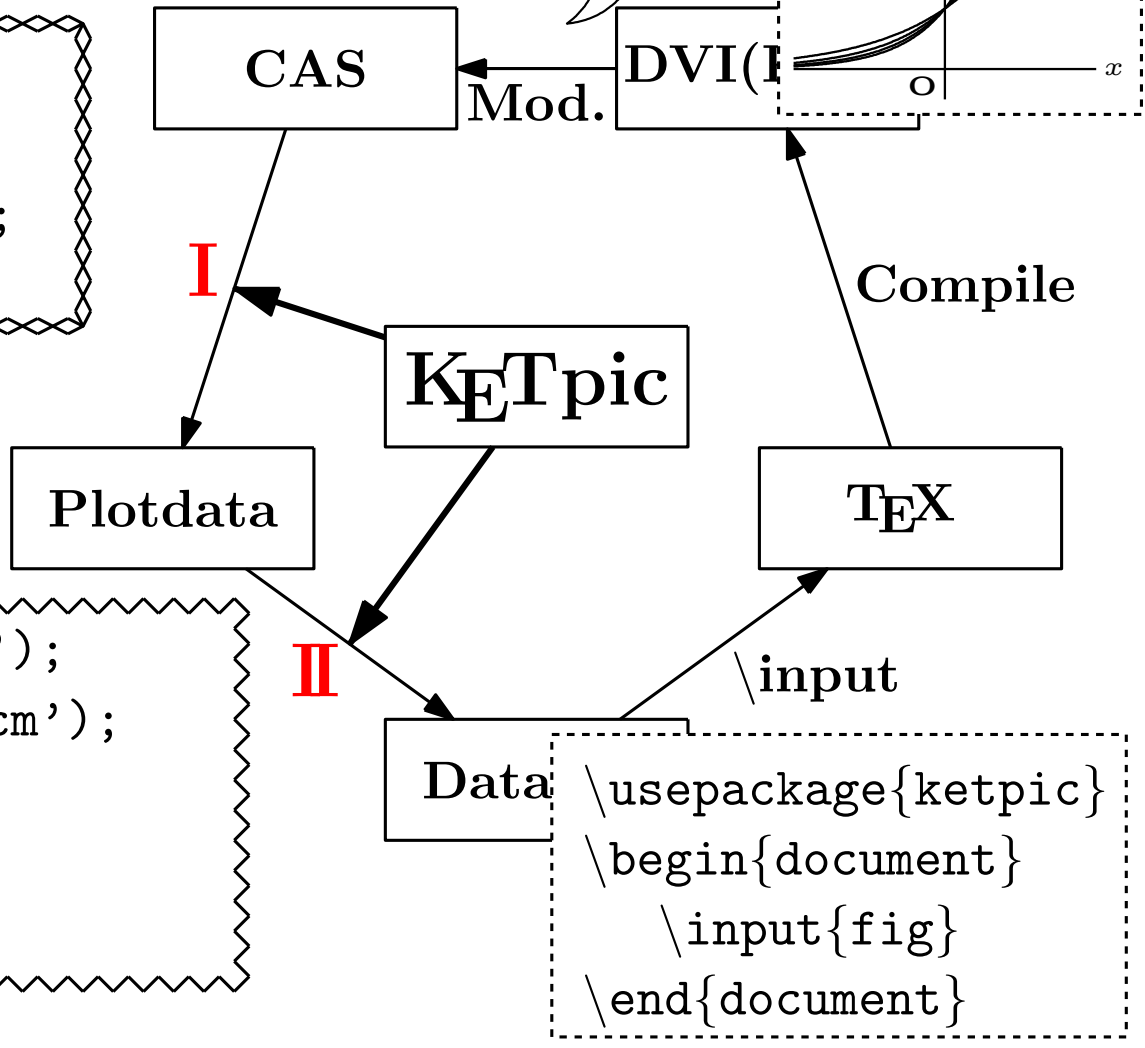
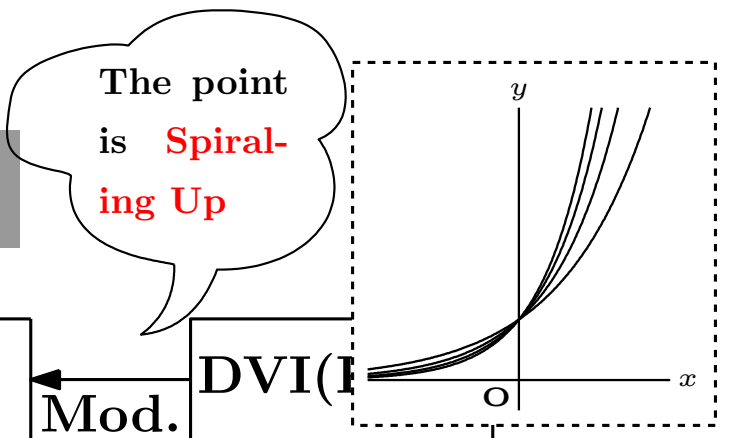


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```
G=list();
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end;
```

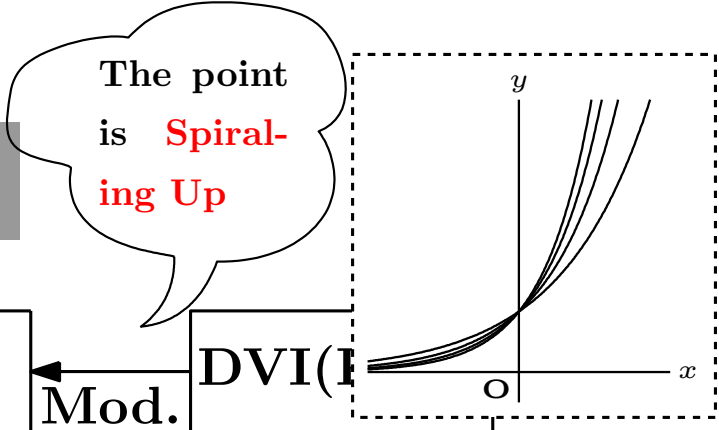
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Beginpicture('1cm');
  Drwline(G);
Endpicture(1);
Closefile()
```



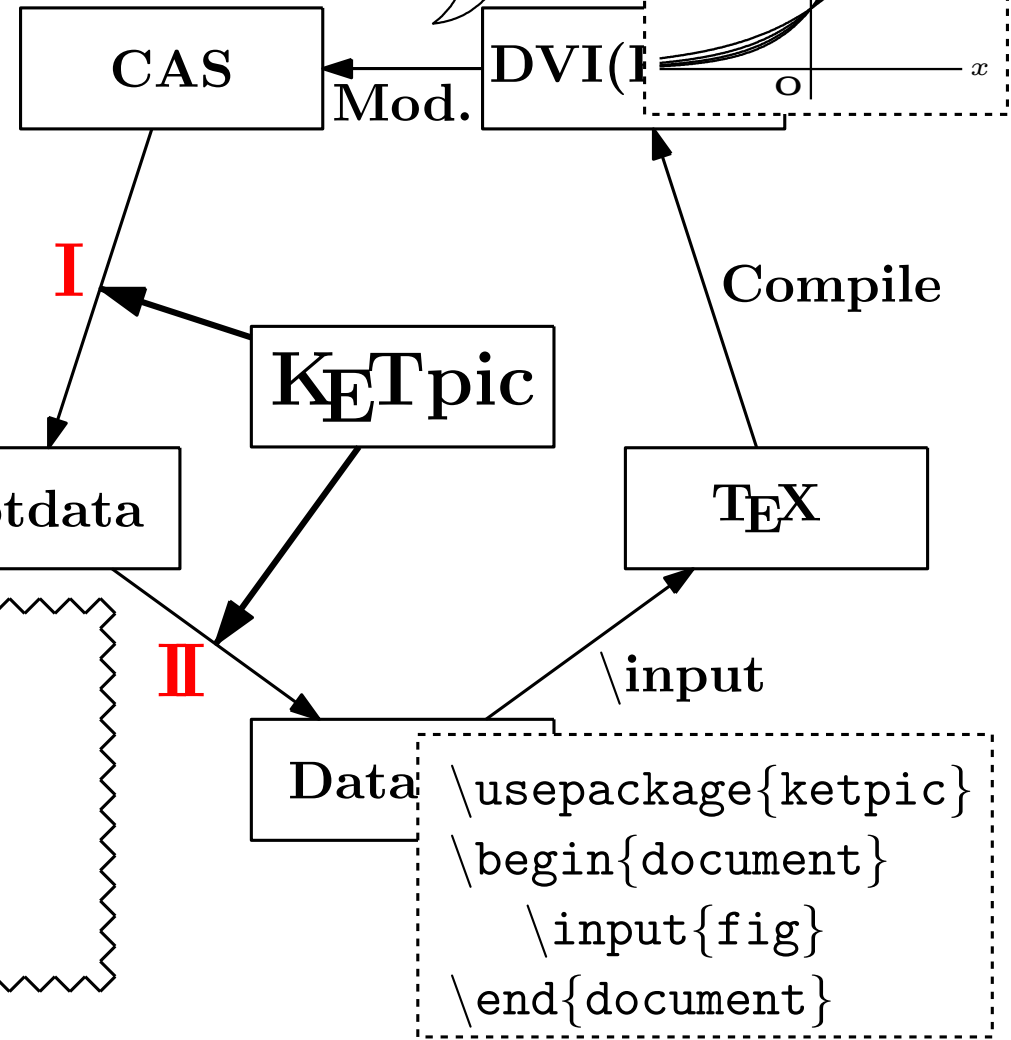
```
\usepackage{ketpic}
\begin{document}
  \input{fig}
\end{document}
```

# Process of drawing with $\text{K}_{\text{E}}\text{T}_{\text{p}}\text{ic}$



```
G=list();
for a=[2, 2.5, 3, 3.5]
  G($+1)=Plotdata('a^x','x');
end;
H=0.5;
Gb=Framedata([-H,H],[1-H,1+H]);
```

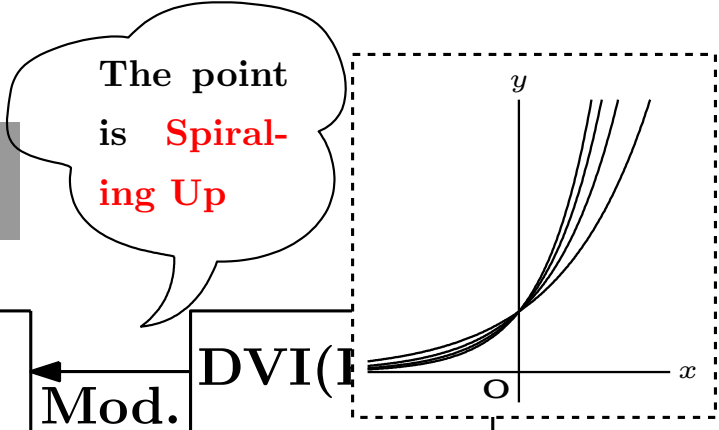
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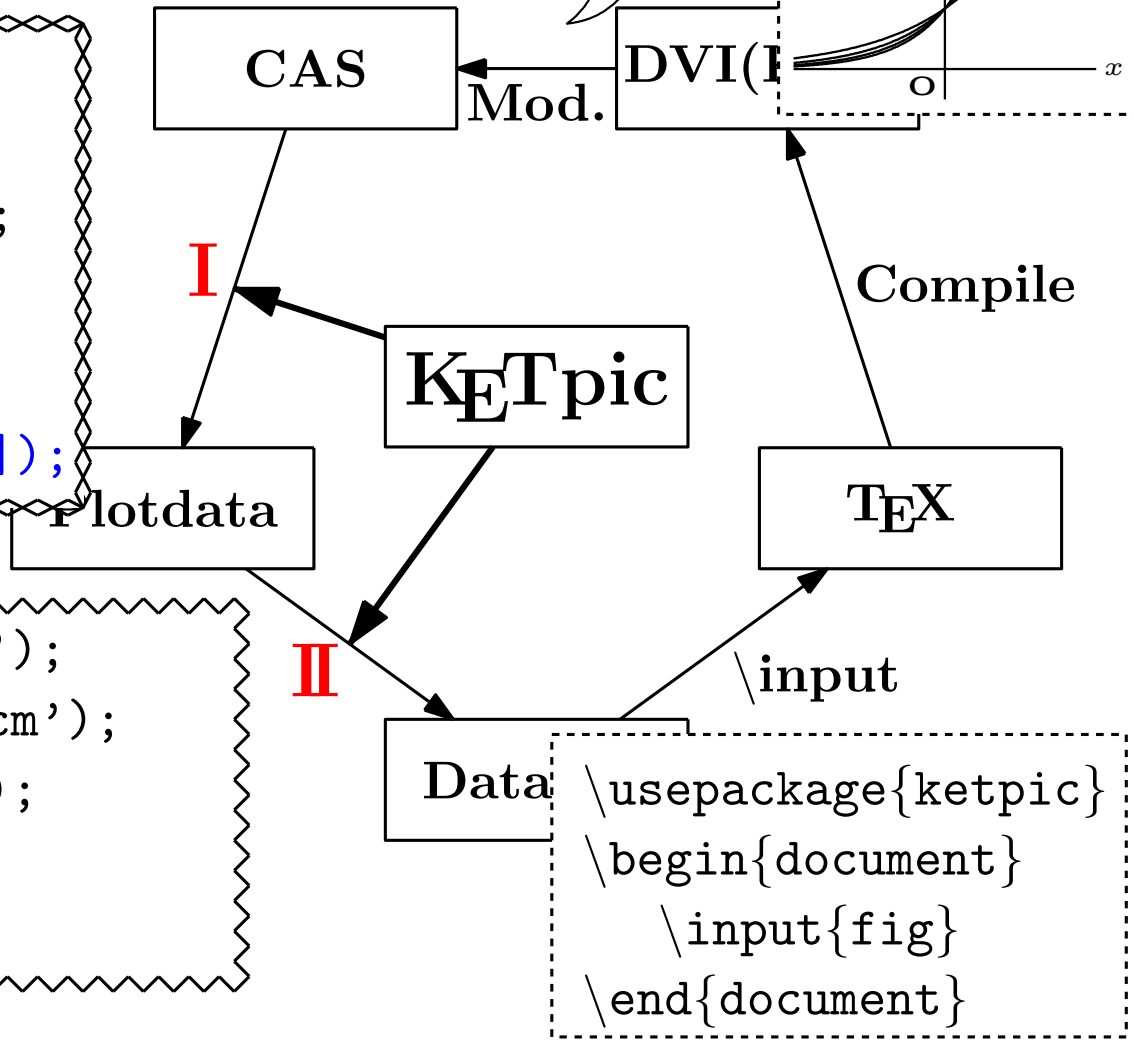


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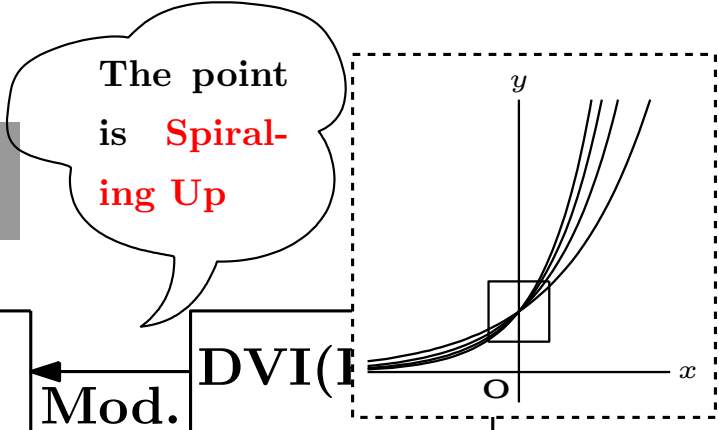


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  Drwline(G, Gb);
Endpicture(1);
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```

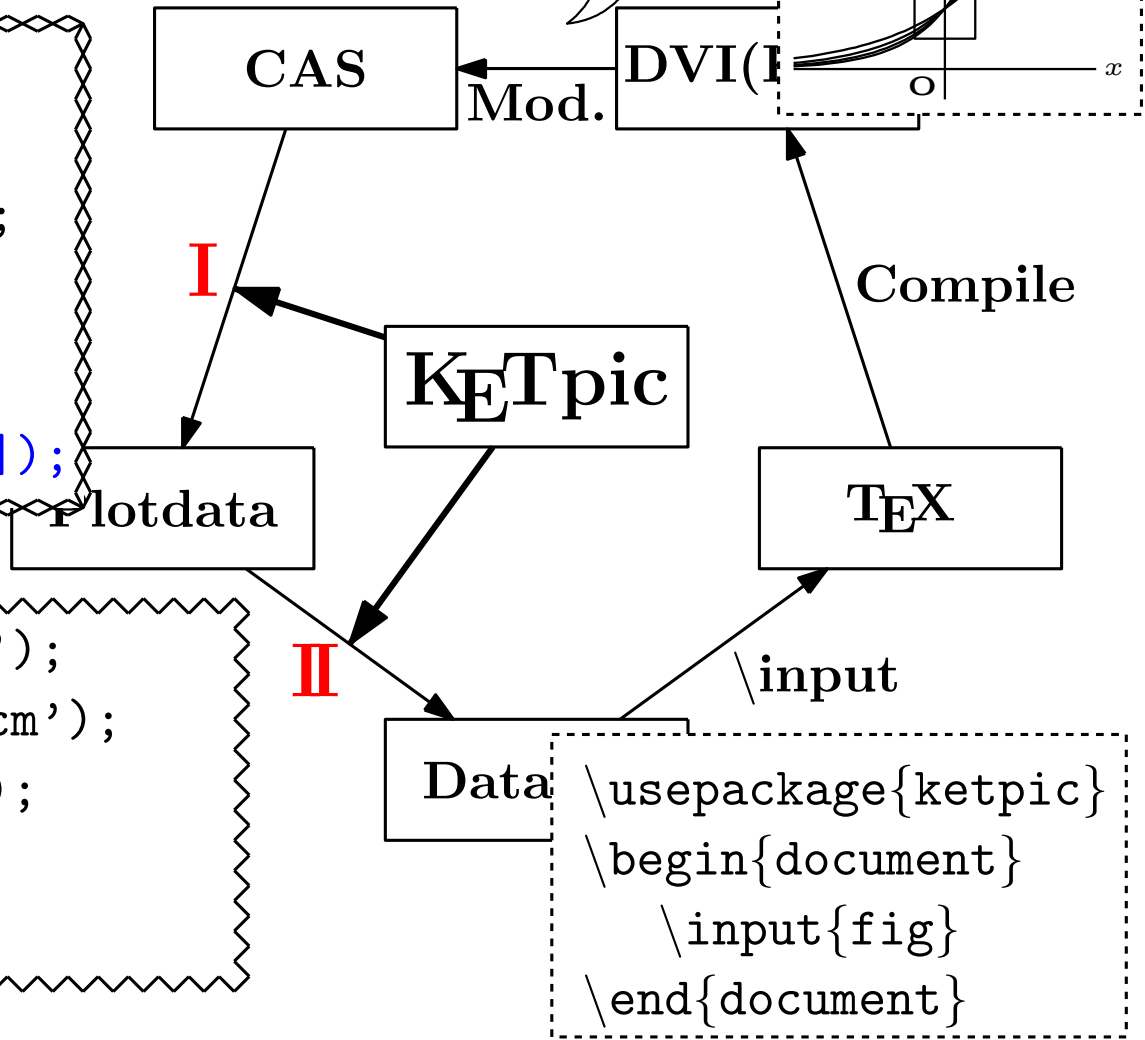


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Openfile('fig.tex');
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```



## Objective

We expect students to understand the meaning of Euler's number  $e$  more clearly, that is,

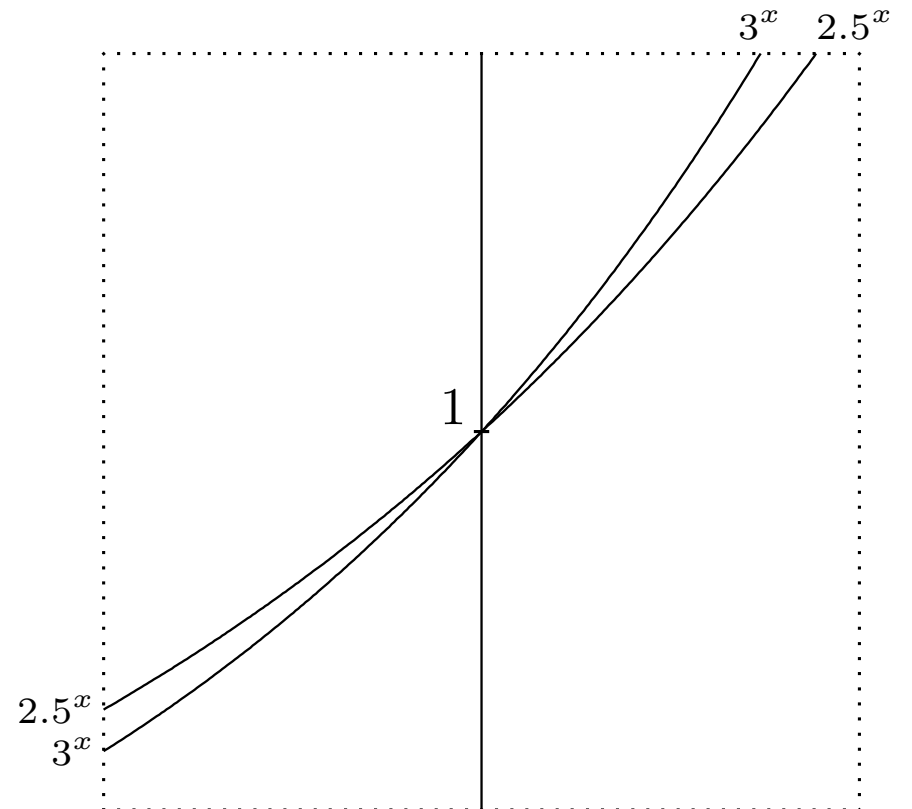
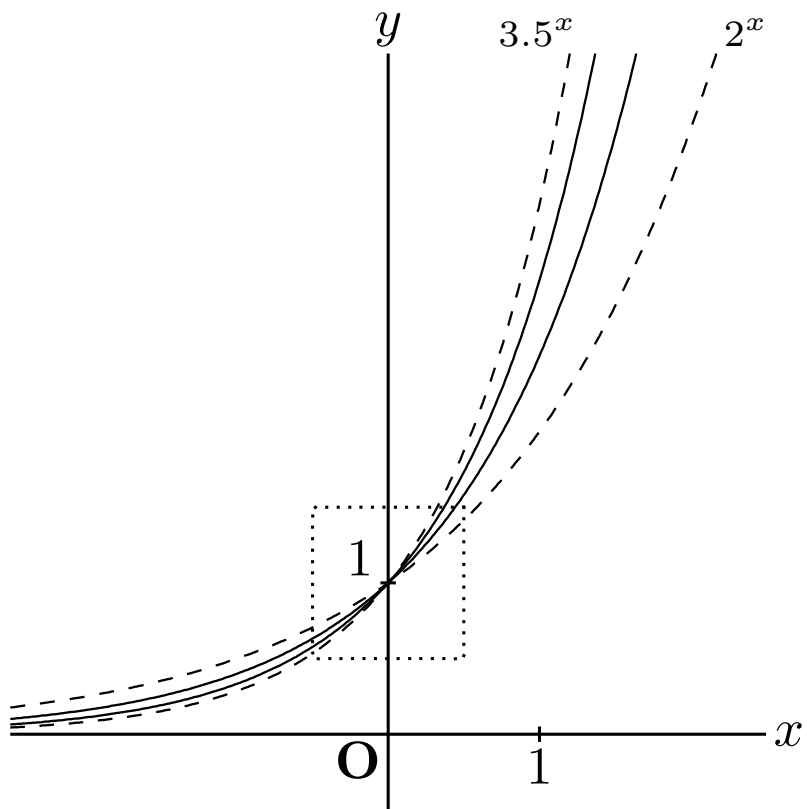
$e$  is the constant satisfying

(1) the slope of  $y = e^x$  at  $x = 0$  is equal to 1

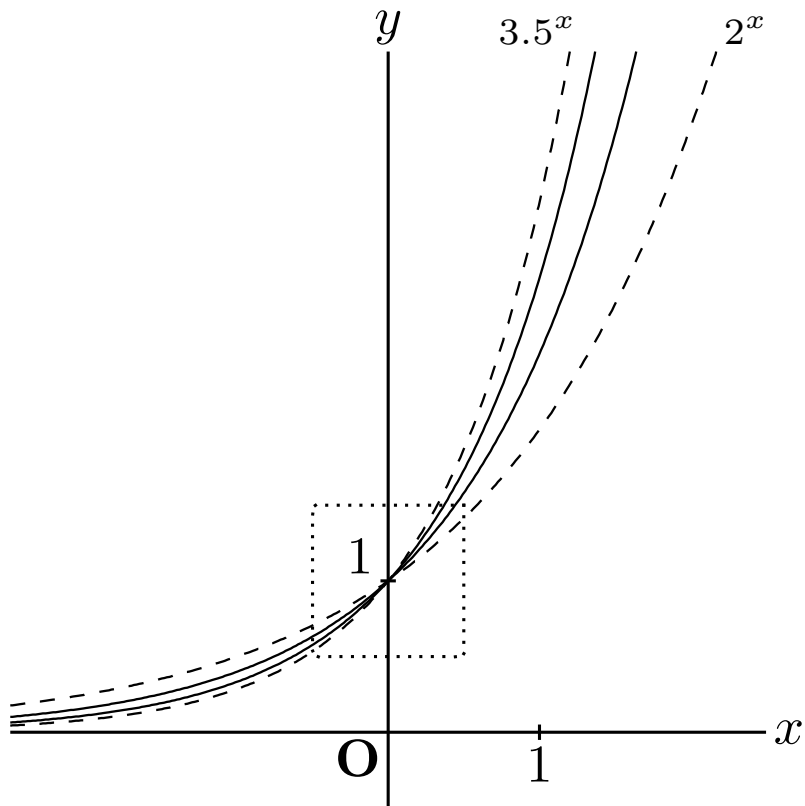
$$\lim_{\xi \rightarrow 0} \frac{e^{\xi} - 1}{\xi} = 1$$

(2)  $2.5 < e < 3$

# Example 1



# Example 1



I

```
H=0.5;  
Gf=Framedata([-H,H],[1-H,1+H]);
```

II

```
Drwline(G(2),G(3));  
Dashline(G(1),G(4));  
Dottedline(Gf,0.75);  
FontSize("ss");  
P=[log(4.5)log(3.5),4.5];  
Expr(P,"nw-2","3.5^x");  
Q=[log(4.5)log(2),4.5];  
Expr(Q,"ne","2^x");  
FontSize("n");  
Htickmark(1,"1");  
Vtickmark(1,"nw","1");
```

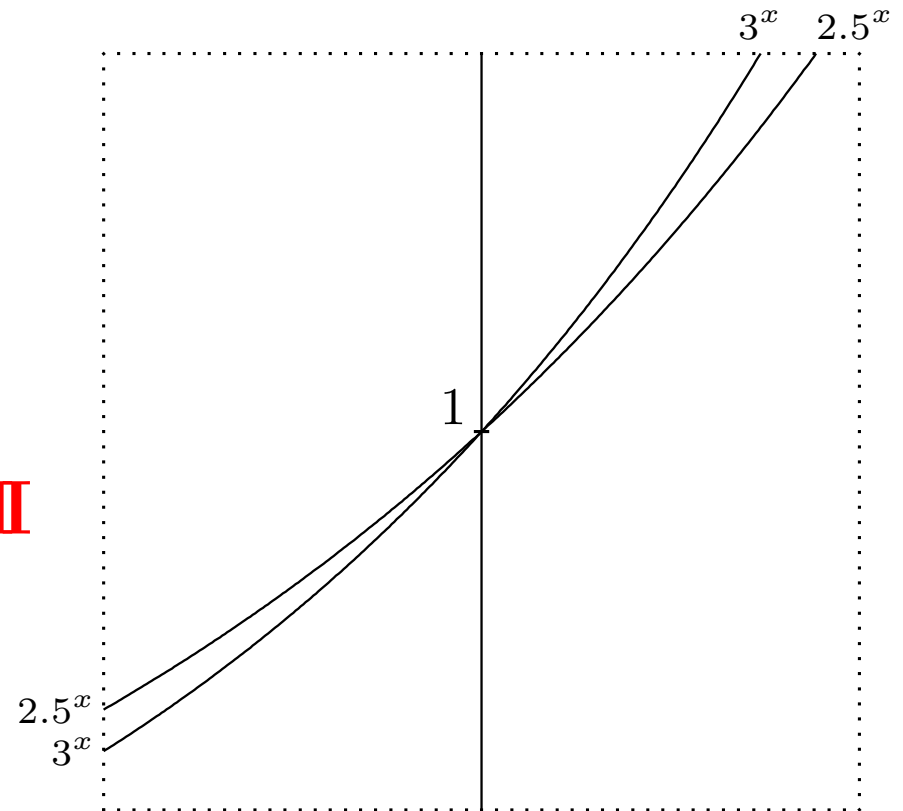
# Example 1

```
Setwindow([-H,H],[1-H,1+H]);  
Gv=Listplot([0,Ymin],[0,Ymax]);
```

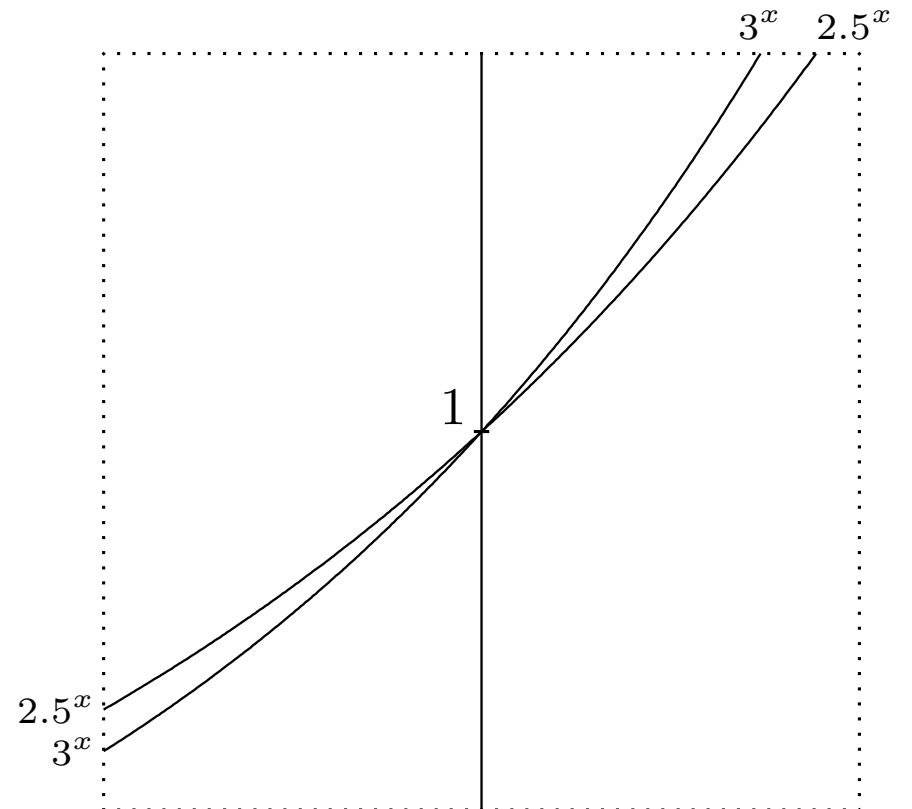
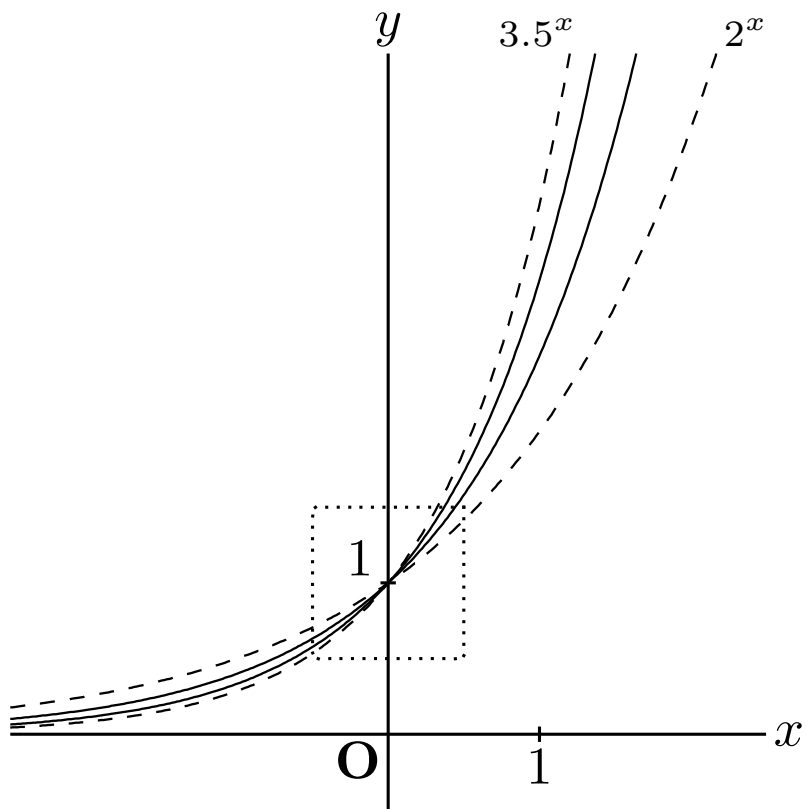
I

```
Beginpicture("5cm");  
  Drwline(G(2),G(3),Gv);  
  Dottedline(Gf,0.75);  
  Vtickmark(1,"nw","1");  
  Expr([-H,2.5^(-H)],"w","2.5^x");  
  Expr([-H,3^(-H)],"w","3^x");  
Endpicture(0)
```

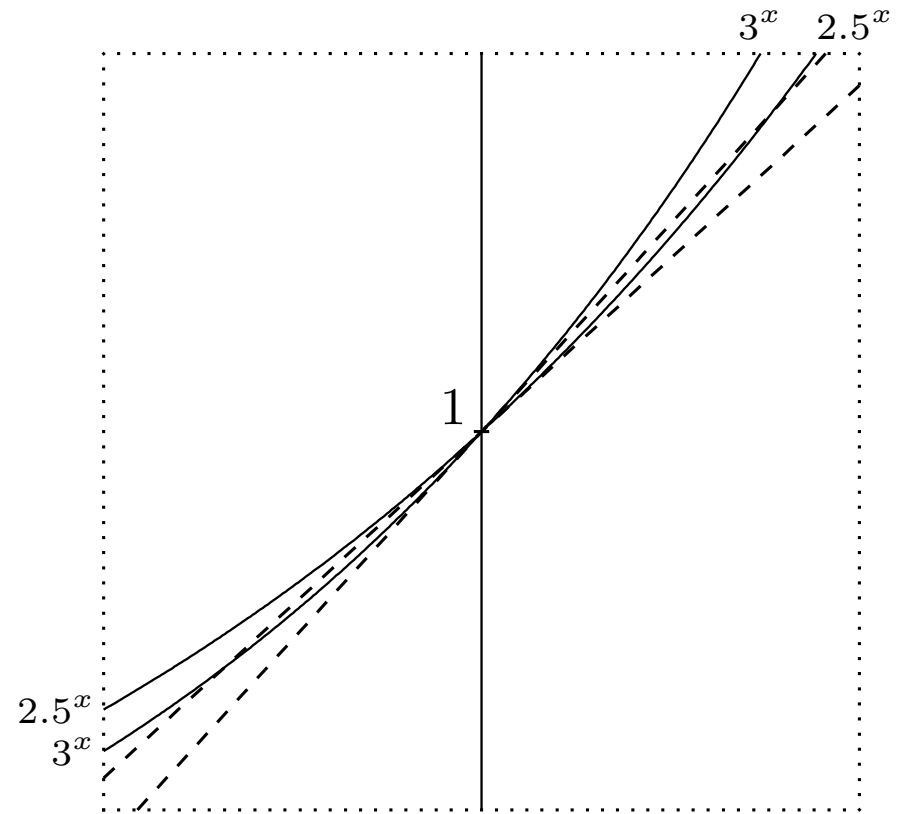
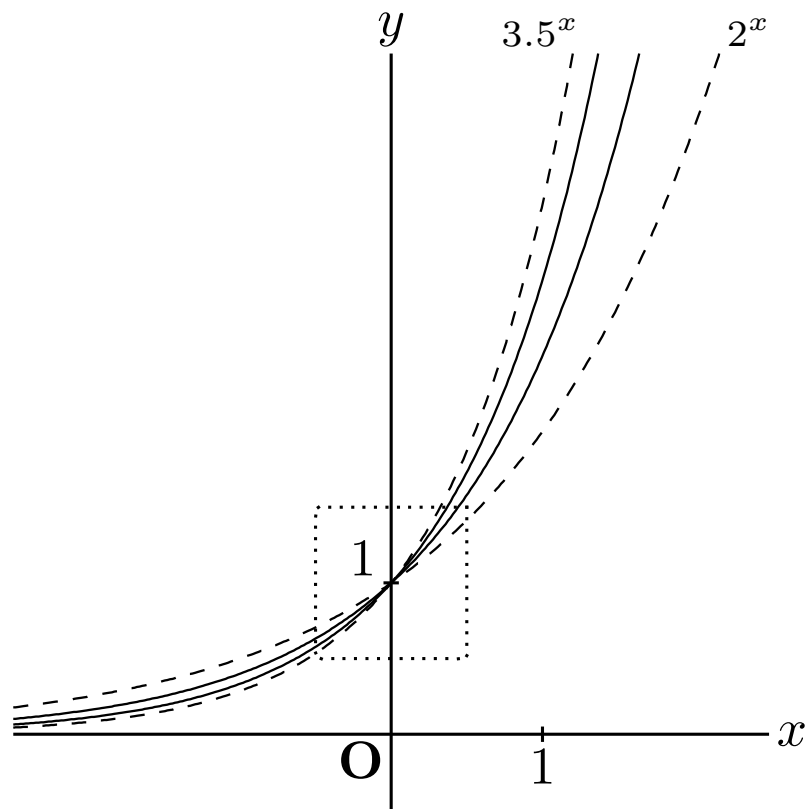
II



# Example 1

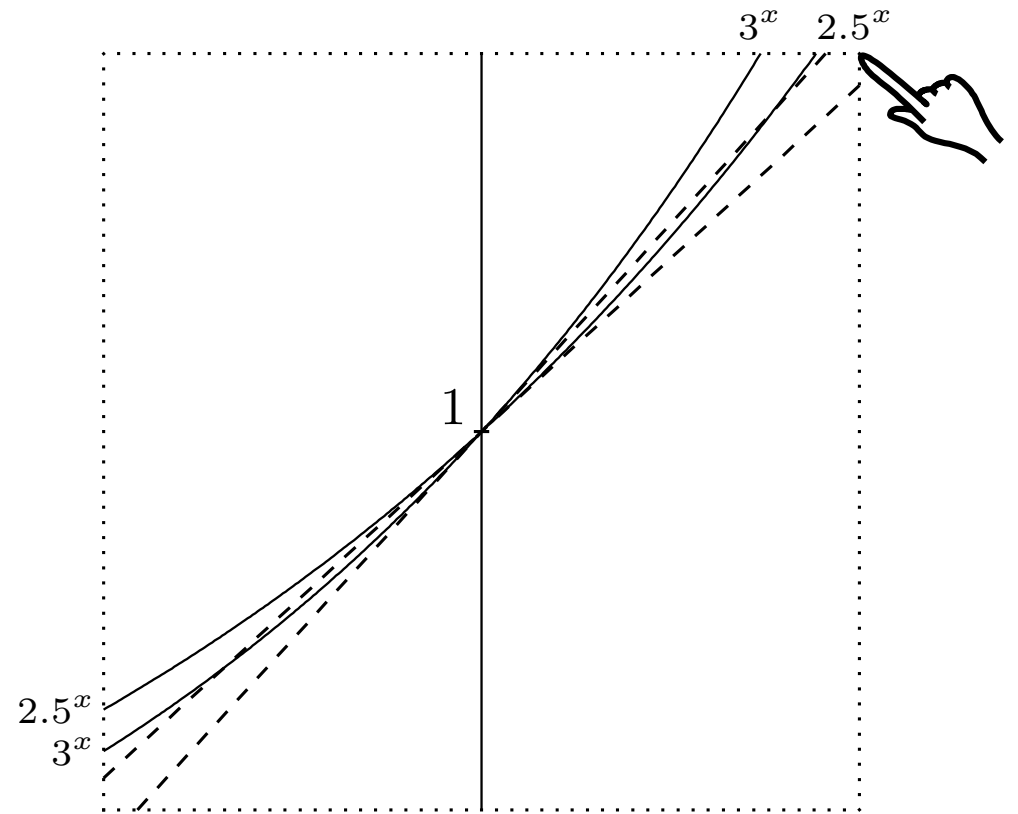
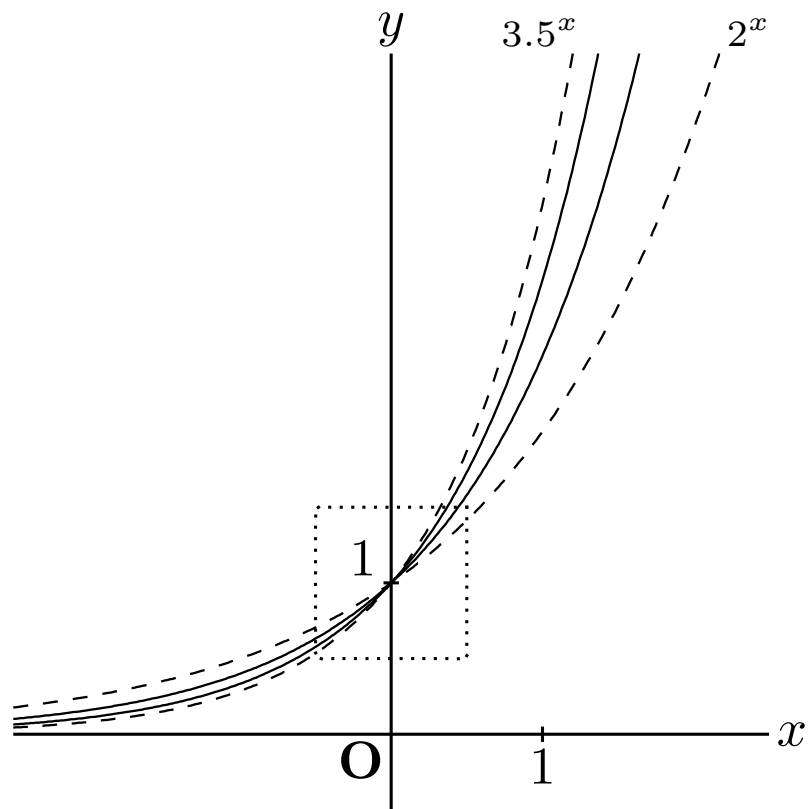


# Example 1





# Example 1

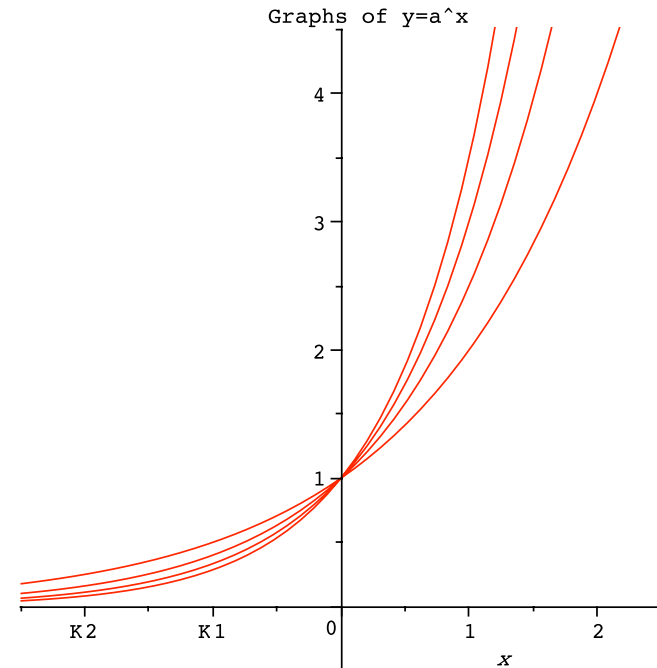


## Predominant over “includegraphics”

```
a:=[2, 2.5, 3, 3.5]:  
xm:= -2.5:xM:=2.5:ym:=-0.5:yM:=4.5:  
G:=[];  
for i to nops(a) do  
  G:=[op(G),plot(a[i]^x,x=xm..xM)]  
end do;  
display(G,[options])
```

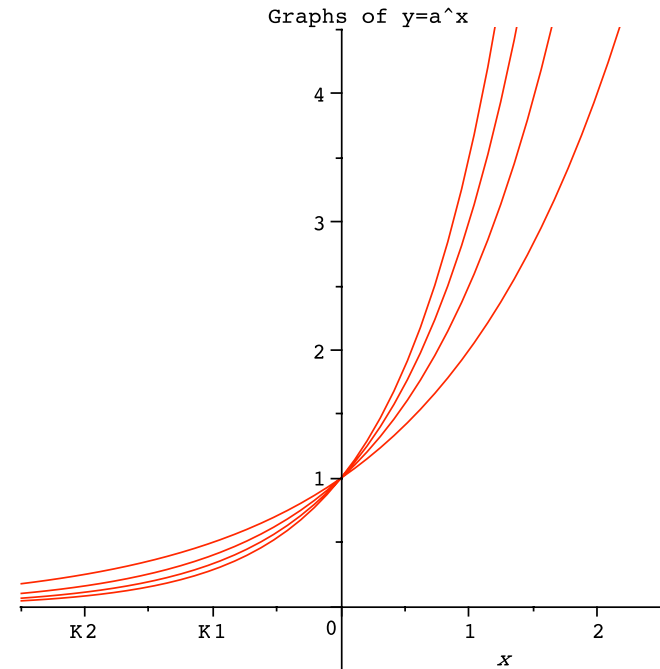
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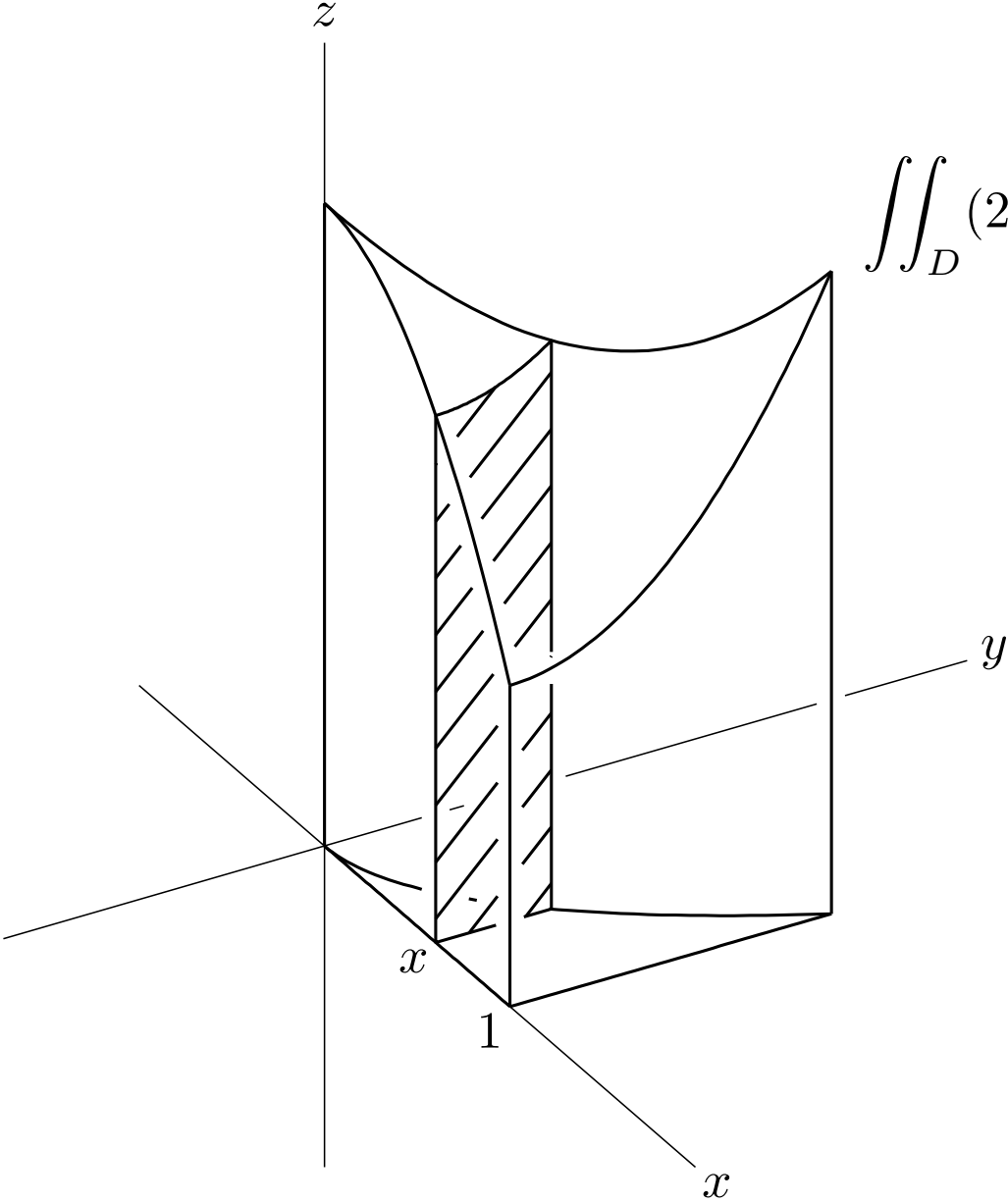
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```



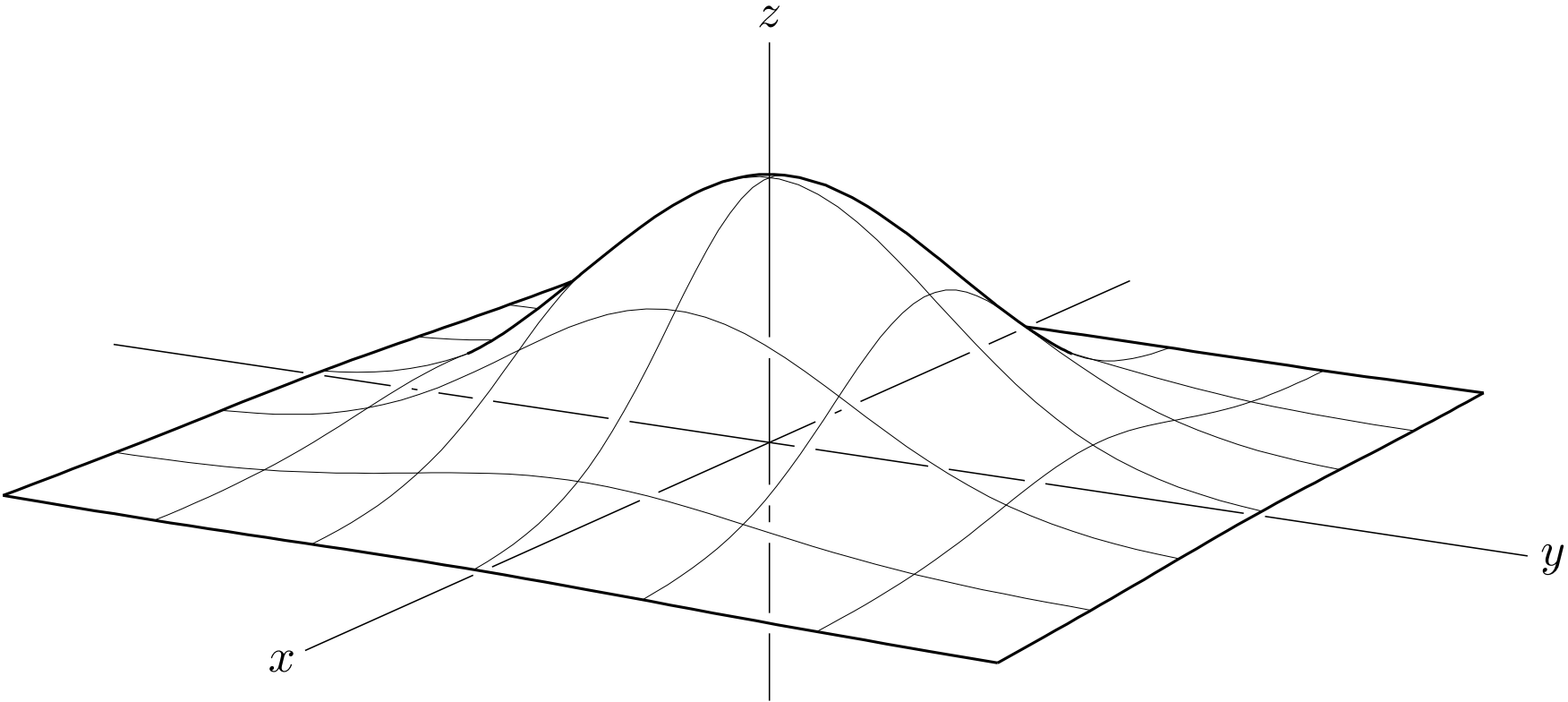
**For many mathematics teachers, it is not so easy to modify these figures as they need to**

**Example 2**



$$\iint_D (2 - x^2 + y^2) dx dy$$

# Example 3



As mentioned above,  $\text{K}_E\text{T}_{pic}$  is a powerful tool to make figures to be inserted into  $\text{L}_A\text{T}_E\text{X}$  documents.

As mentioned above,  $\text{KE}\text{Tpic}$  is a powerful tool to make figures to be inserted into  $\text{L}\text{A}\text{T}\text{E}\text{X}$  documents.

But, it goes far beyond that.



Recently, we realized that

- (1)  $\text{KE}\Gamma\text{pic}$  is applicable to making graphical symbols as well
- (2) we need to add some commands to  $\text{KE}\Gamma\text{pic}$  for making graphical symbols

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**METACOMMANDS**

Recently, we realized that

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**METACOMMANDS**

Mixing  $\text{K}_E\text{T}_{pic}$  with  $\text{T}_E\text{X}$  macro effectively

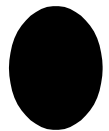
# Simple Examples of new symbols

Find  $k$  satisfying

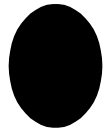
$$P\left(\frac{\bar{X} - 45}{\sqrt{U^2/20}} \geq k\right) = 0.005$$

$$k = 2 . \boxed{a} 6$$

$a$  : (1) (2) (3) (4) (5) (6) (7) (8) (9) (0)



## Making Symbols



```
Openphr( '\cirmark' );  
  Tmp=Circledata([0,0],1);  
  F1=Scaledata(Tmp,Sx,Sy);  
  Beginpicture('1mm');  
    Shade(list(F1));  
    Drwline(F1);  
  Endpicture(0);  
Closephr();
```

## Making Symbols

1

```
Openphr( '\circmark' );  
  Tmp=Circledata( [0,0] ,1);  
  F1=Sc Openphr( '\dashmark#1' );  
  Begin Beginpicture( '1mm' );  
  Sha Dashline(F1);  
  Drw Letter( [0,0] , 'c' , '#1' );  
  Endpi Endpicture(0);  
Closeph Closephr();
```

For more complicated cases, we need

- (1) handling **variables**
- (2) using **conditional branches**
- (3) using **iterations**

These three are essential factors in general programming, but cumbersome or difficult in  $\text{\LaTeX}$  programming alone



We implemented metacommands accordingly:

(1) Variables = Counters in  $\text{\LaTeX}$

```
Texsetctr(2, '#1+2*Texctr(1)');
```

(2) “if” structure

```
Texif(Texthctr(1)+'=0');
```

```
Texelse();
```

```
Texendif();
```

(3) “for” structure

```
Texfor(1,1,'#1');
```

```
Texendfor(1);
```

These metacommands together with a command

`Texletter`(*position, direction, letters*)

allow us to make new symbols so easily  
and utilize them

(1) with variable size or thickness

(2) at desired positions in the document

An example

Making of “\diachain{n}”

An example

Making of “\diachain{n}”

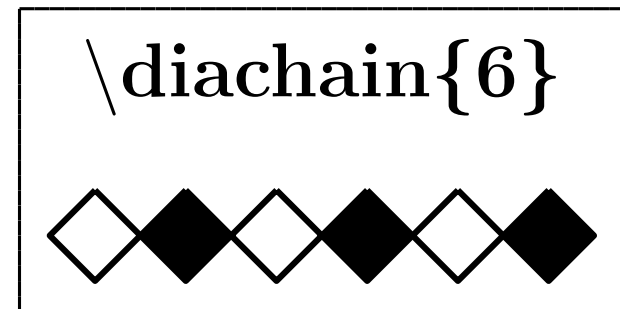
\diachain{6}



## An example

## Making of “\diachain{n}”

```
Texnewcmd('\diachain',1);
  Tmp=Framedata([0,0],L);
  G=Rotatedata(Tmp,%pi/4);
  Texfor(1,'1','#1');
    Beginpicture('1mm');
      Drwline(G,2);
      Texsetctr(2,'Texctr(1)/2*2-Texctr(1)');
      Texif(Texthctr(2)+'=0');
        Shade(G);
      Texendif();
    Endpicture(0);
  Texendfor(1);
Texend();
```

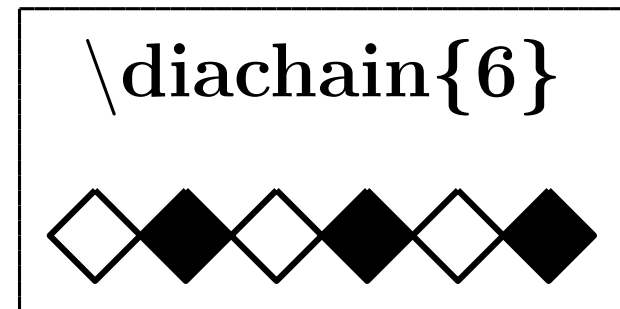


## An example

## Making of “\diachain{n}”

```
Texnewcmd('\diachain',1);
  Tmp=Framedata([0,0],L);
  G=Rotatedata(Tmp,%pi/4);
  Texfor(1,'1','#1');
    Beginpicture('1mm');
      Drwline(G,2);
      Texsetctr(2,'Texctr(1)/2*2-Texctr(1)');
      Texif(Texthctr(2)+'=0');
        Shade(G);
      Texendif();
    Endpicture(0);
  Texendfor(1);
Texend();
```

*Indent style  
is important*



## “layer” environment

We developed two  $\text{\TeX}$  macro packages

`ketpic.sty`, `ketlayer.sty`

Using  $\text{\KTeXpic}$  meta commands

(1) download them from

<http://ketpic.com>

(2) put `\usepackage{ketpic,ketlayer}`

(3) then you can use this environment

## Features of “layer” environment

- (1) likeness to “overpic.sty”
- (2) a much broader range of applications
- (3) some symbols to be put in the documents
- (4) flexible layout of any character, symbol or figure in the document



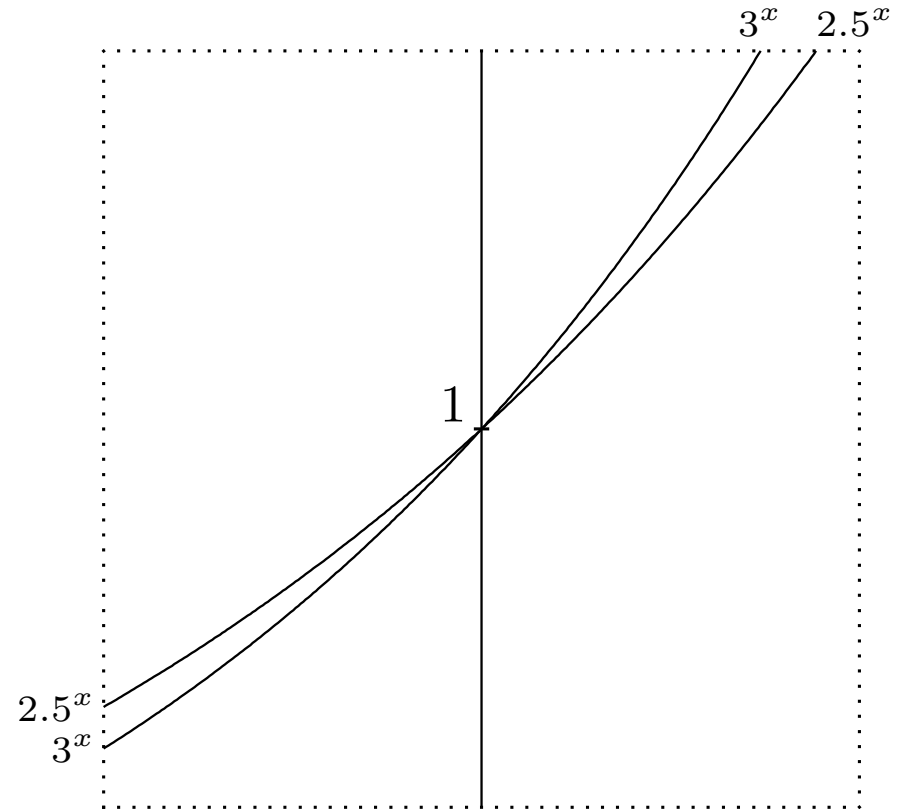
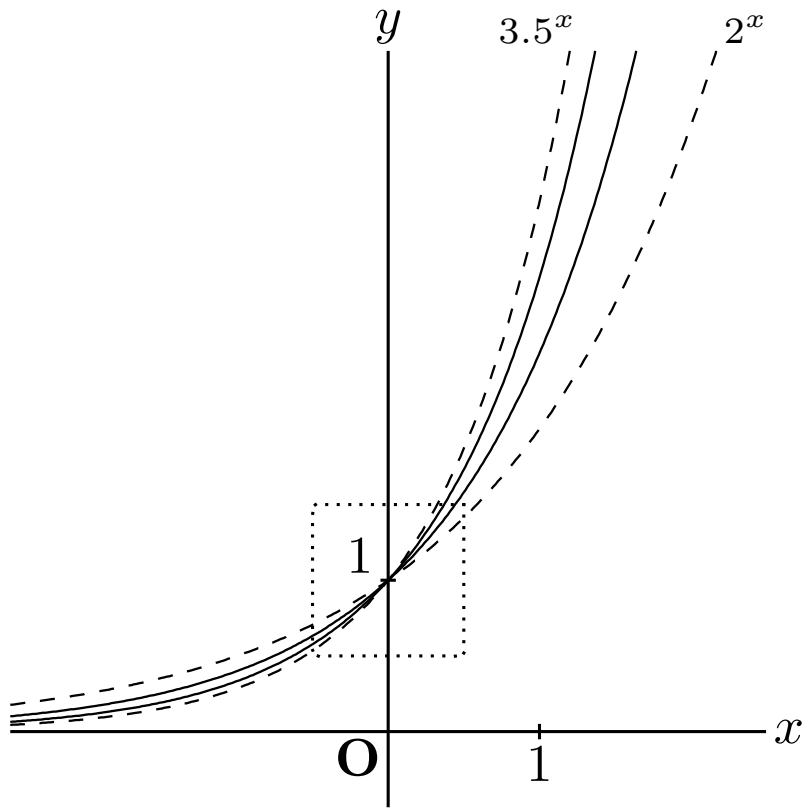
## Usage of layer environment

- (1) begin with `\begin{layer}{width}{height}`
- (2) then grids are appeared
- (3) put any letter, picture, symbol at any position

Ex) `\putnote{40}{20}{object}`

- (4) end with `\end{layer}`
- (5) after confirming, set *height* to 0
- (6) then grids are disappeared

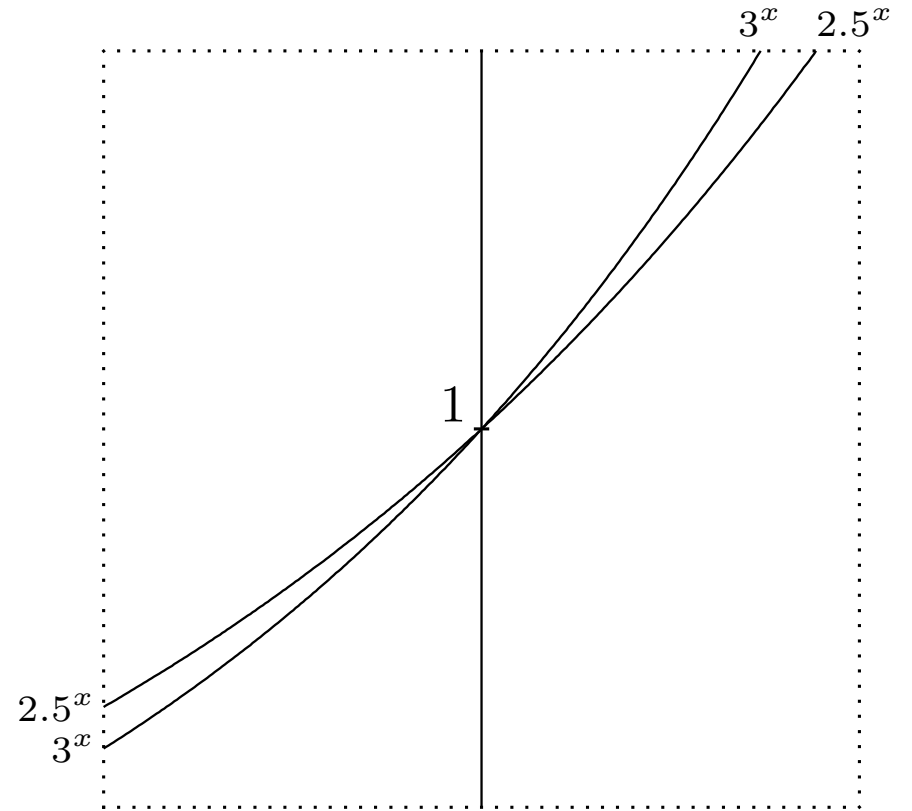
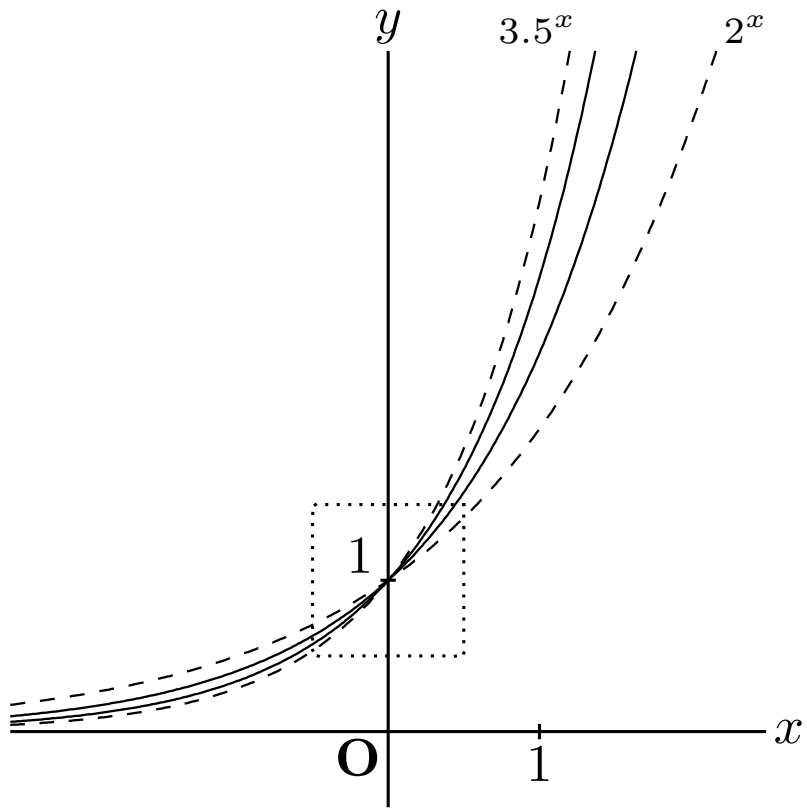
# Examples



# Examples

`\begin{layer}{130}{90}`

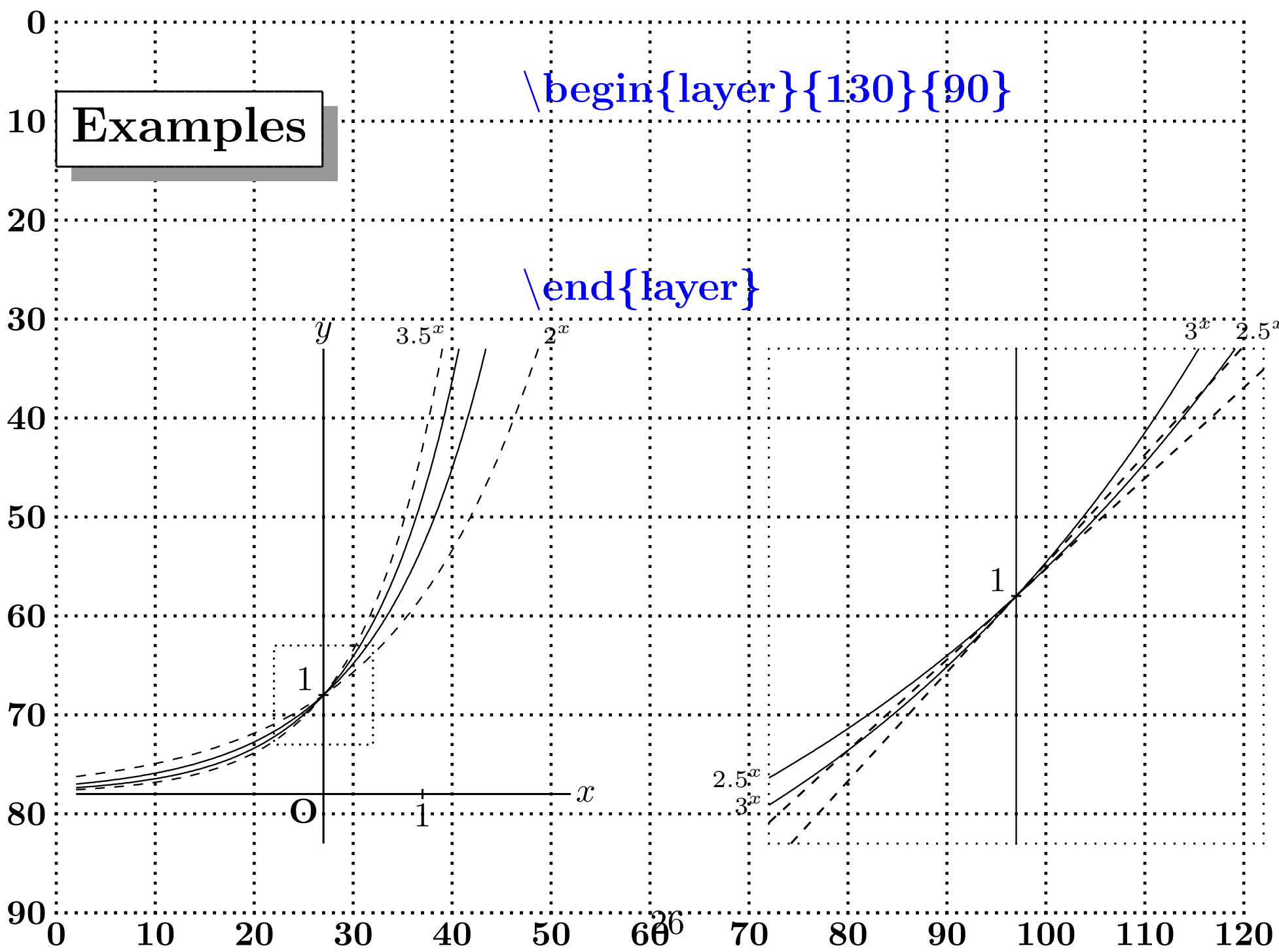
`\end{layer}`



# Examples

`\begin{layer}{130}{90}`

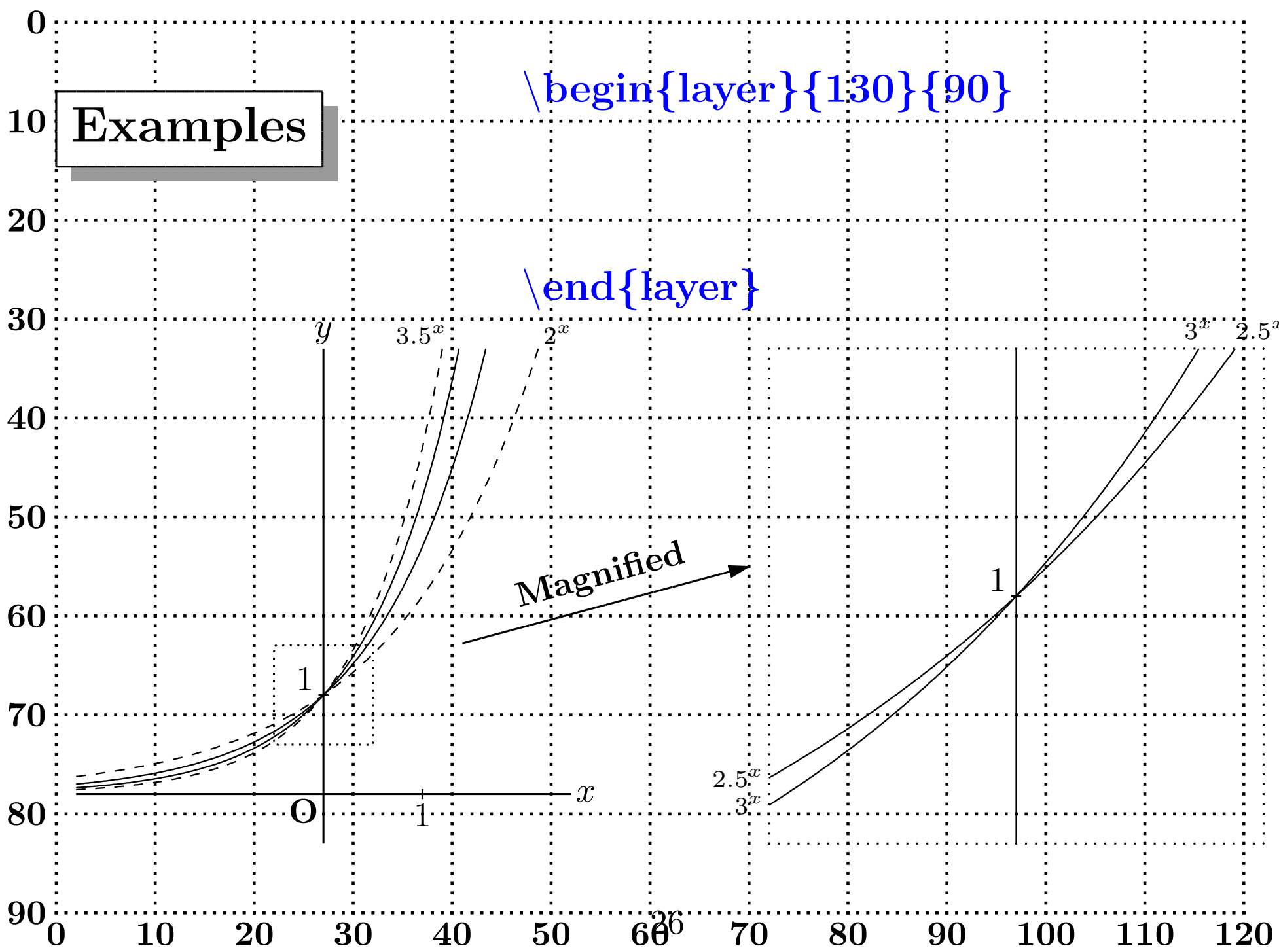
`\end{layer}`



# Examples

`\begin{layer}{130}{90}`

`\end{layer}`

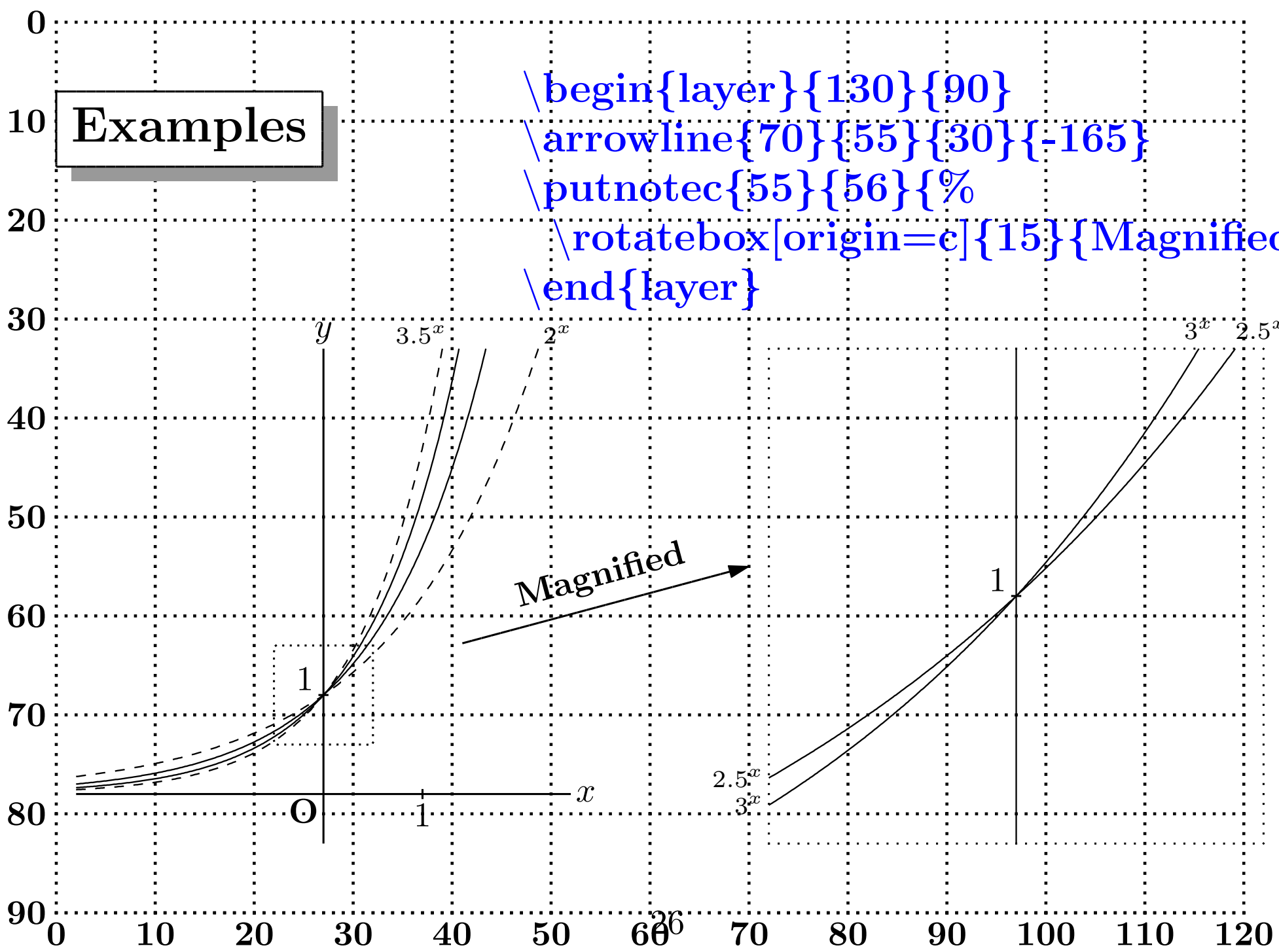


# Examples

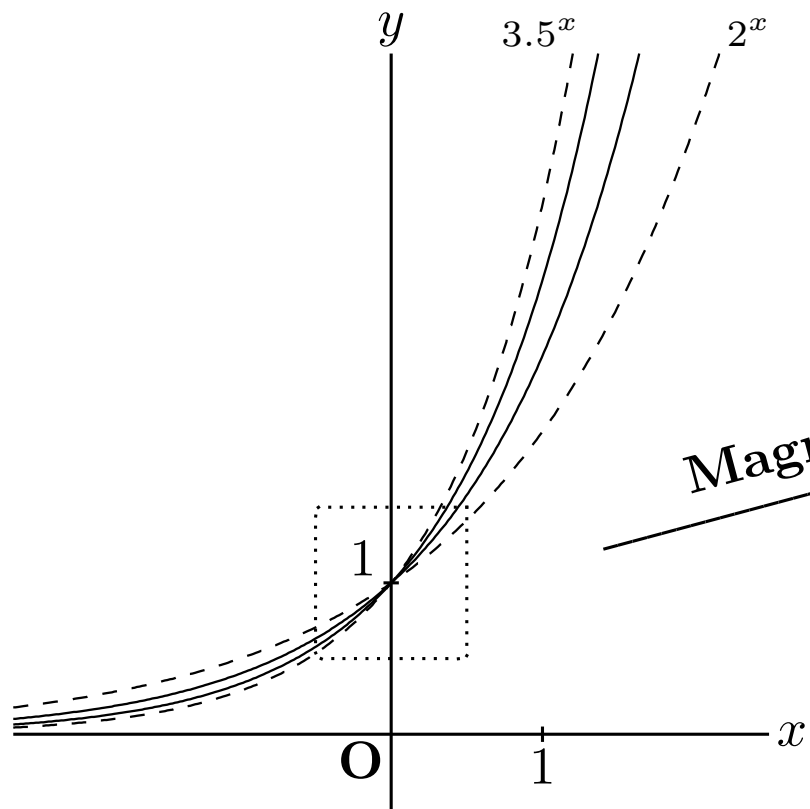
```

\begin{layer}{130}{90}
\arrowline{70}{55}{30}{-165}
\putnote{55}{56}{%
\rotatebox[origin=c]{15}{Magnified}}
\end{layer}

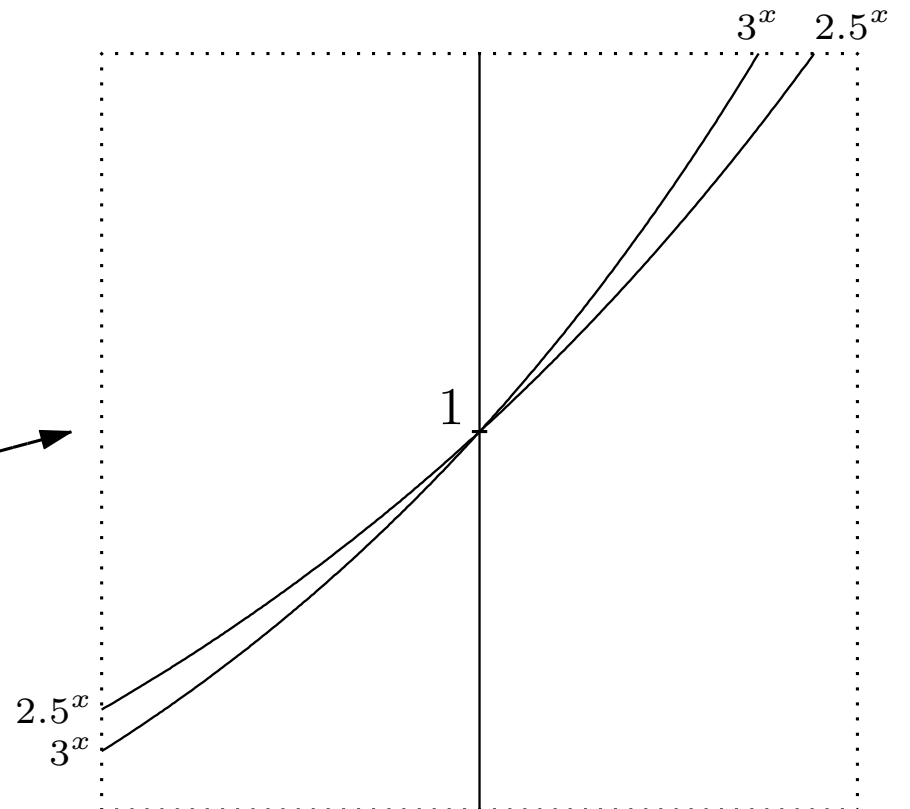
```



# Examples



Magnified



# Conclusions

- (1) The functionality of  $\text{KE}\Gamma\text{pic}$  is not limited to making figures
- (2)  $\text{KE}\Gamma\text{pic}$  has a much broader range of applications
- (3)  $\text{KE}\Gamma\text{pic}$  can be used widely in mathematics education to make and improve class materials and textbooks effectively by inserting figures or symbols **without difficulty**



# Our main claim

$\text{KE}T_{\text{pic}}$  is **the most suitable** for **average** mathematics teachers like us who utilize  $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$  on a daily basis, though **not so skillful** using other various mathematical softwares, and who have a strong **desire** and **motivation** to prepare better textbooks as well as printed materials in their class.

**Thank you**  
**Děkuji vám**