TUG2013 conference

Making Math Textbooks and Materials with TEX + KETpic + hyperlink

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Contents

1. KETpic framework

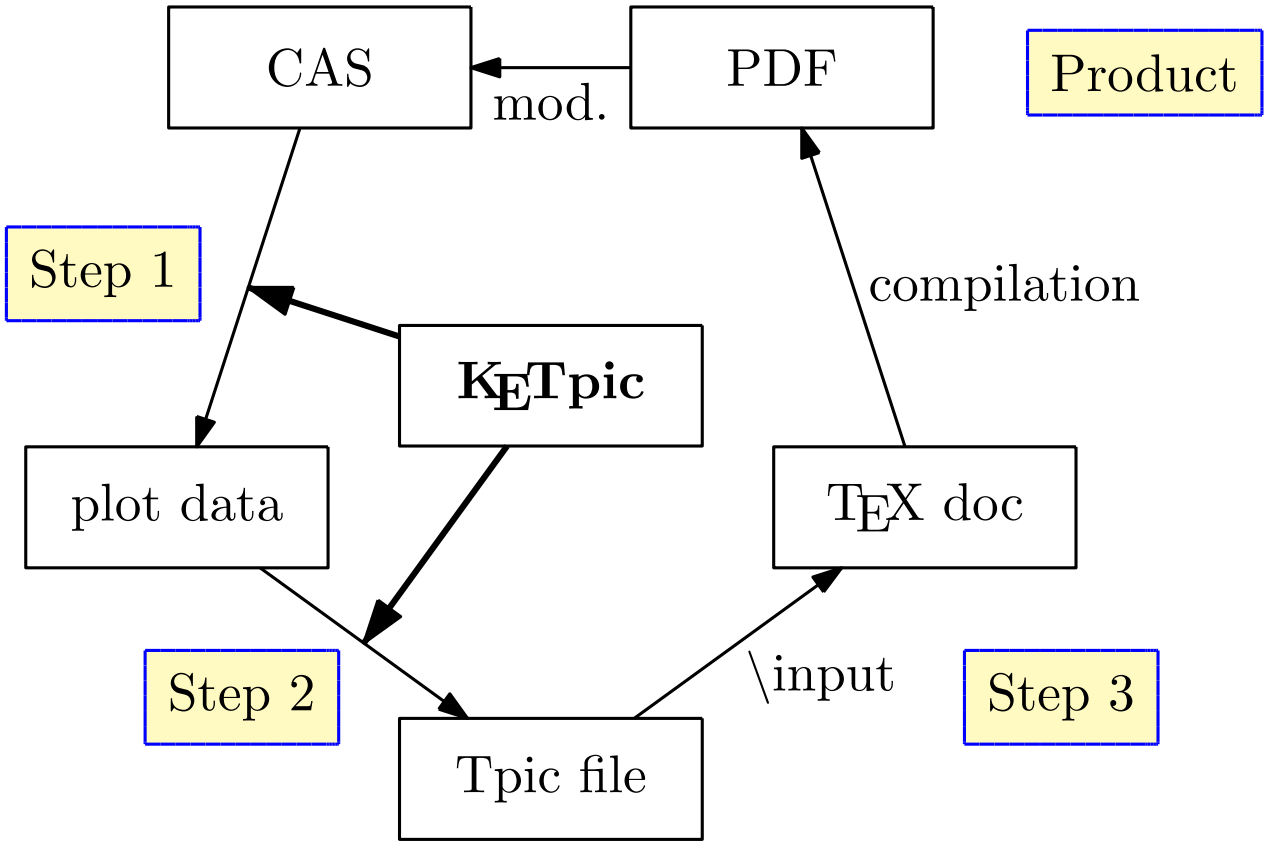
KETpic is

1. a macro package of CAS (computer algebra systems)
2. for generating TEX readable (tpic specials or pict2e) codes of CAS graphical outputs
3. freely downloadable from

http://ketpic.com

1. KETpic framework

The procedure is summarized in **KETpic diagram**



Next

1. KETpic framework

Step 1

```
Setwindow([-%pi/2,5*%pi/2],[-1.2,1.2]);
P1=Plotdata('sin(x)','x=[0,2*%pi]');
P2=Plotdata('cos(x)','x=[0,2*%pi]');
```

diagram

1. KETpic framework

Step 2

```
Openfile('Folder/fig.tex');
 Beginpicture('1cm');
  Drwline(P1);
  Dashline(P2);
 Endpicture(1);
Closefile();
```

diagram

1. KETpic framework

Step 3

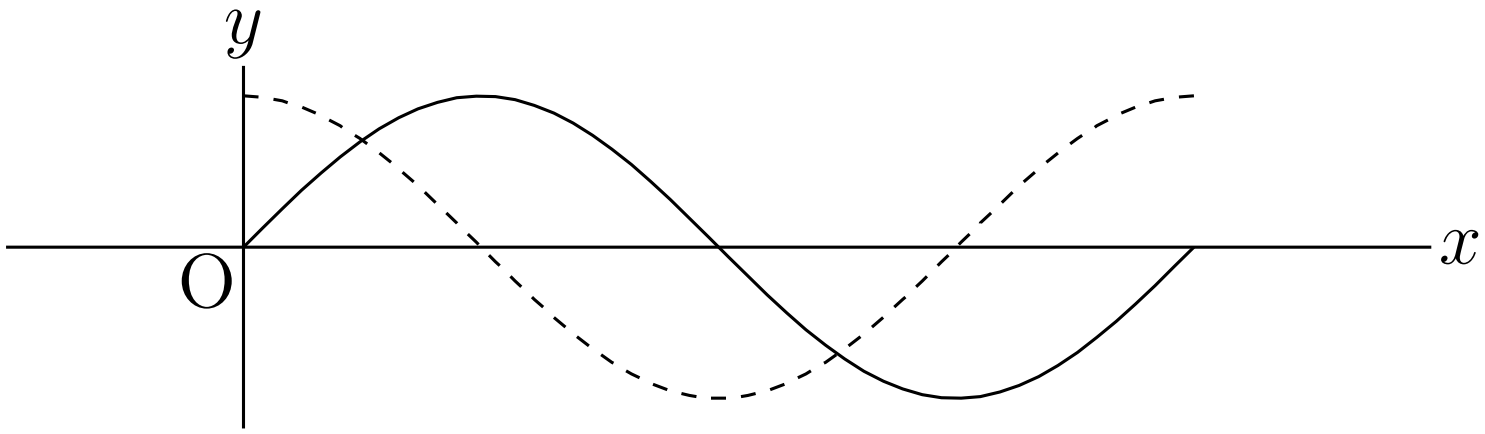
```
\usepackage{ketpic}
\begin{document}
  The graphs of functions $y=\sin x$ and
  $y=\cos x$ are as follows:
   \input{fig.tex}
\end{document}
```

diagram

1. KETpic framework

Product

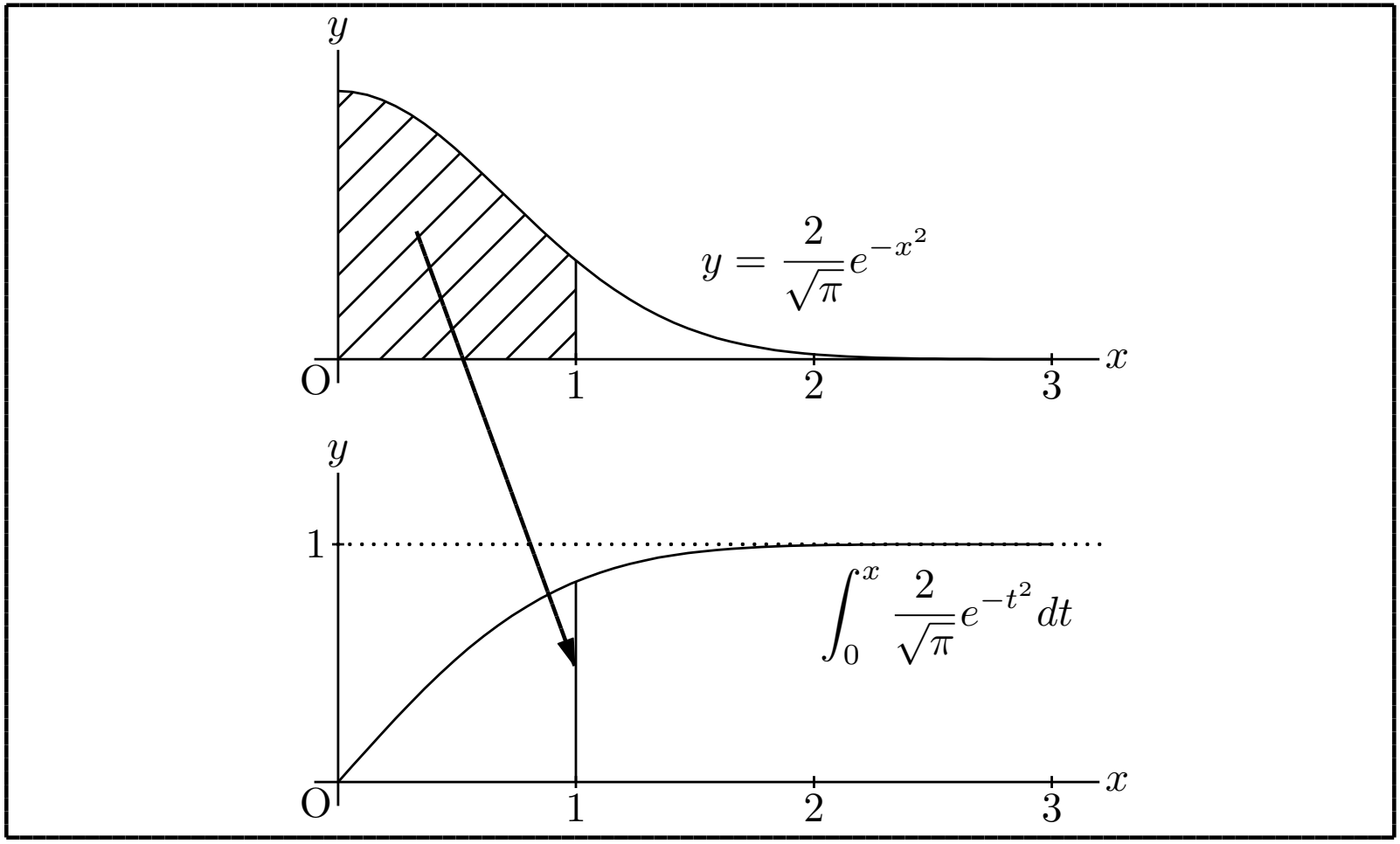
The graphs of functions $y = \sin x$ and $y = \cos x$ are as follows:



diagram

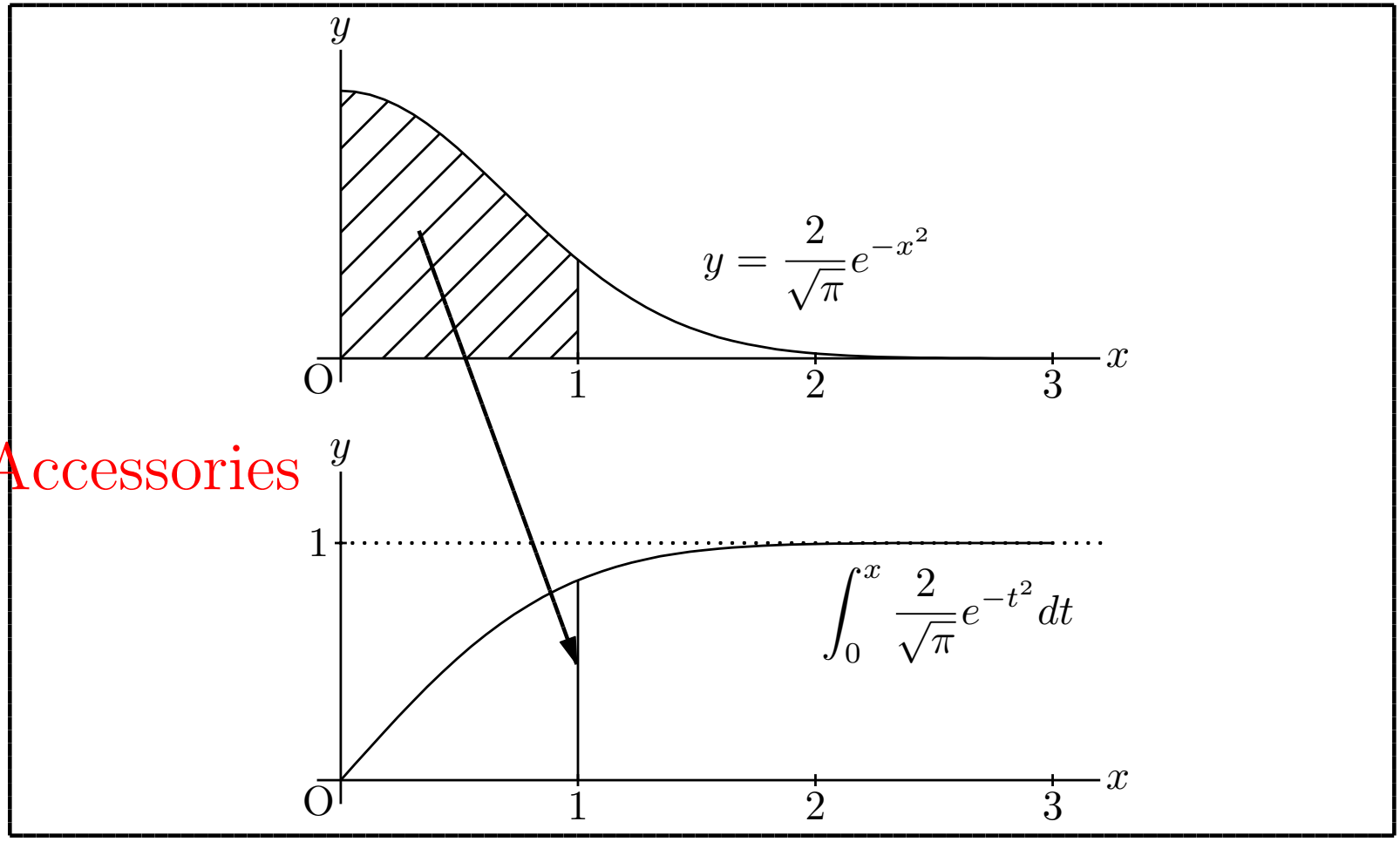
2. Features of KETpic

1. 2D complicated figures with precise shape and length



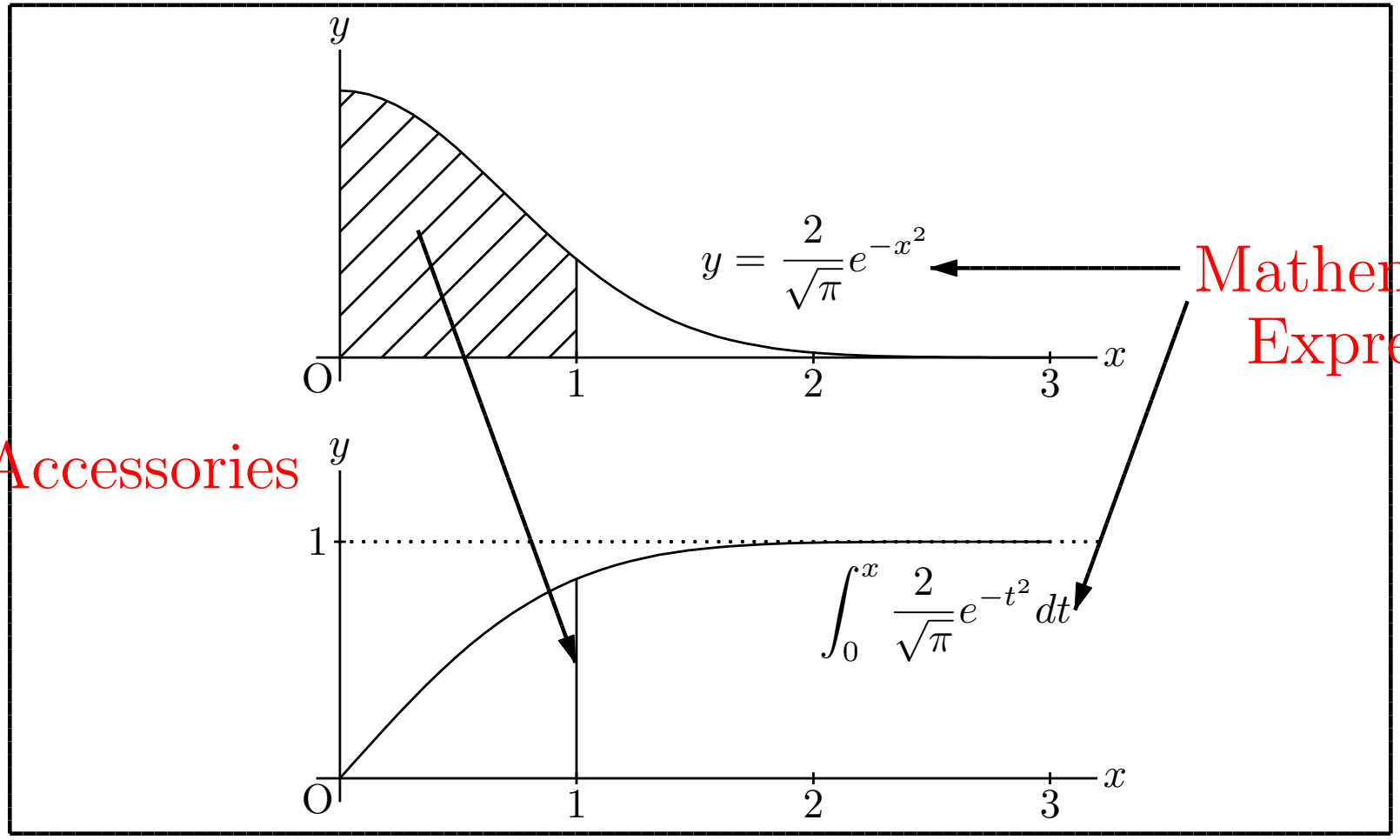
2. Features of KETpic

1. 2D complicated figures with precise shape and length



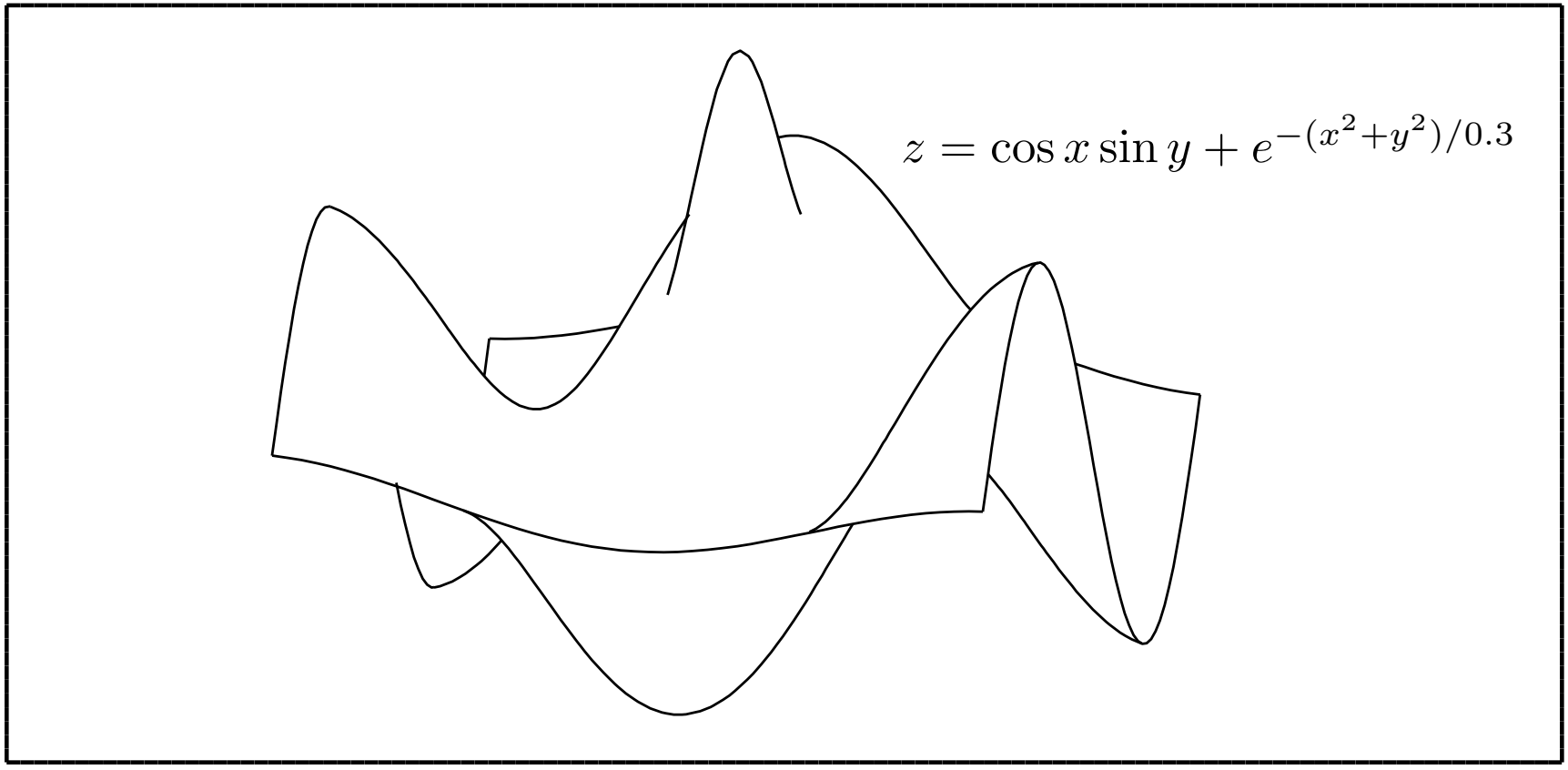
2. Features of KETpic

1. 2D complicated figures with precise shape and length



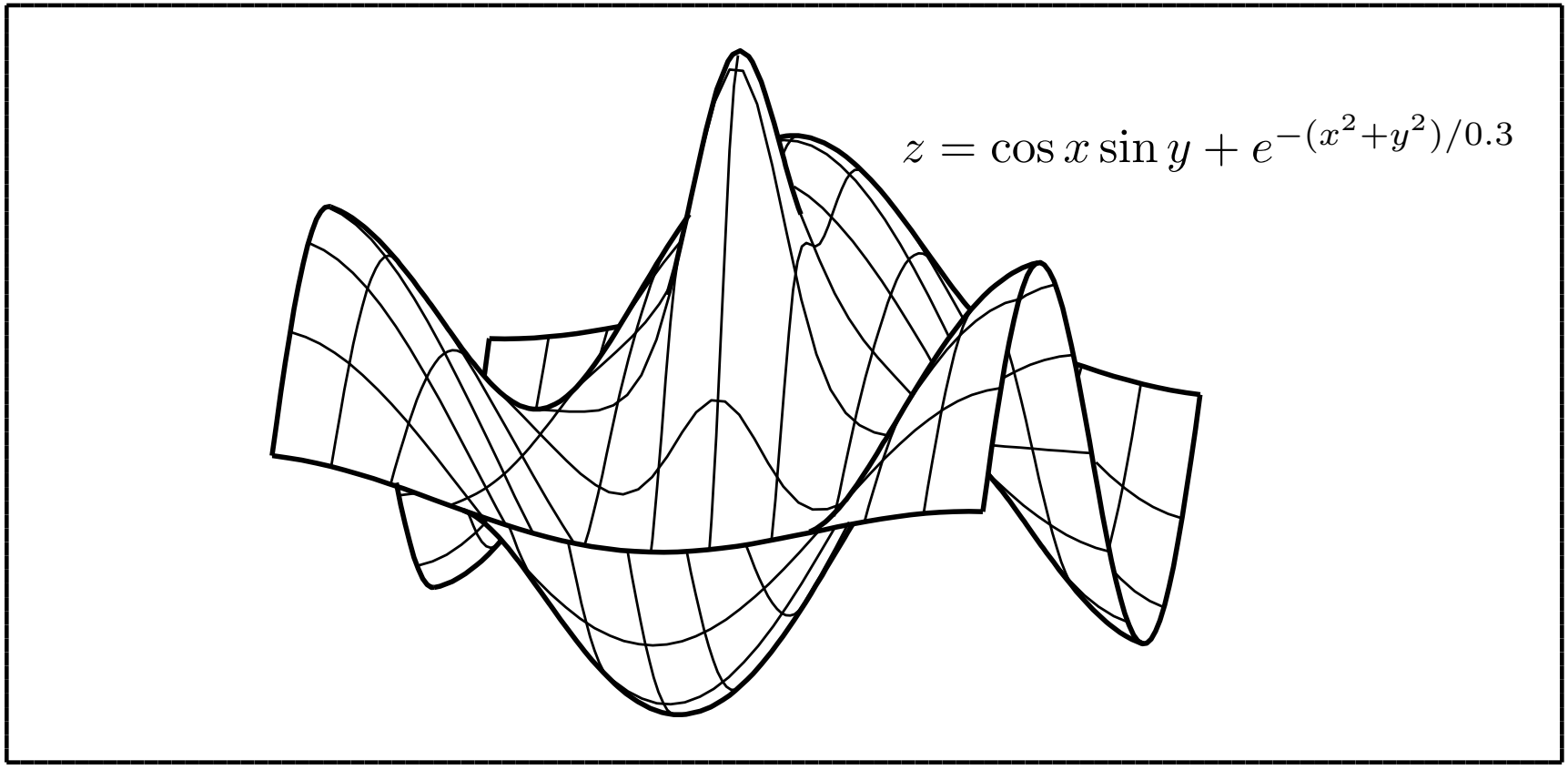
2. Features of KETpic

2. 3D-graphics with precise shape and rich perspective



2. Features of KETpic

2. 3D-graphics with precise shape and rich perspective



2. Features of KETpic

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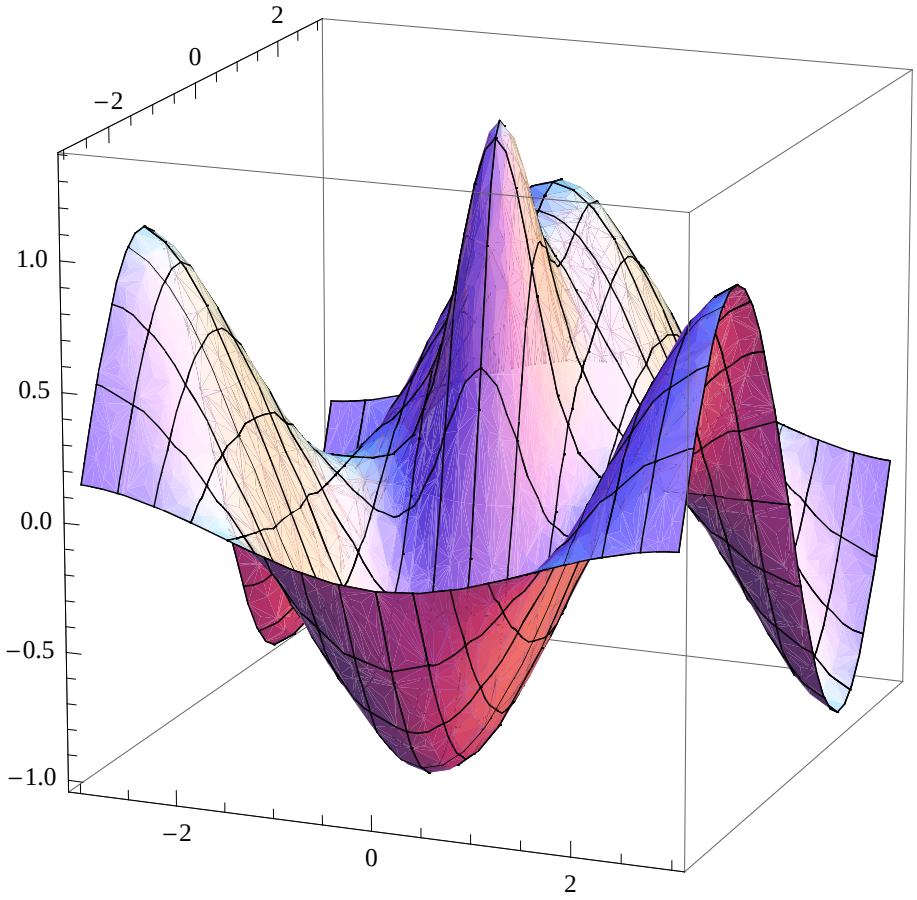
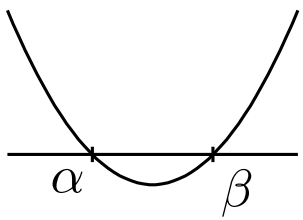
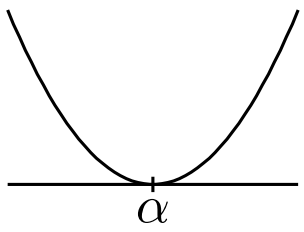
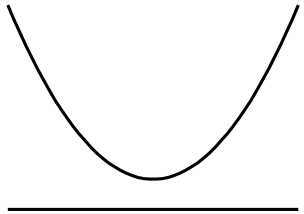


2. Features of KETpic

3. Flexible use of tables (using **Tabledata** command)

	$D > 0$	$D = 0$	$D < 0$
$P(x) =$	$a(x-\alpha)(x-\beta)$	$a(x-\alpha)^2$	
$P(x) = 0$	$x = \alpha, \beta$	$x = \alpha$	
$P(x) > 0$	$x < \alpha, \beta < x$	$x < \alpha, \alpha < x$	all x
$y = P(x)$			

2. Features of KETpic

3. Flexible use of tables (using **Tabledata** command)

```
L1=list(20,26,26,26);
L2=list(6,[6,1,4],6,6,26);
Tb=Tabledata(L1,L2);
DG1=Diagcelldata(Tb,4,[2,4]);
Openfile('Foler/table.tex');
Beginpicture('1mm');
Drwline(Tb(1),DG1(2));
PutcoL(Tb,1,"c","","$P(x)=$","$P(x)=0$","$P(x)>0$","$y=P(x)$");
PutcoL(Tb,2,"c","$D>0$","$a(x-\alpha)(x-\beta)$",⋯,"\input{fig1}");
PutcoL(Tb,3,"c","$D=0$","$a(x-\alpha)^2$", ⋯ ,"\input{fig2}");
PutcoL(Tb,4,"c","$D<0$","","","all $x$","\input{fig3}");
Endpicture(0);
Closefile();
```

2. Features of KETpic

4. Flexible page layouts (using **ketlayer.sty**)

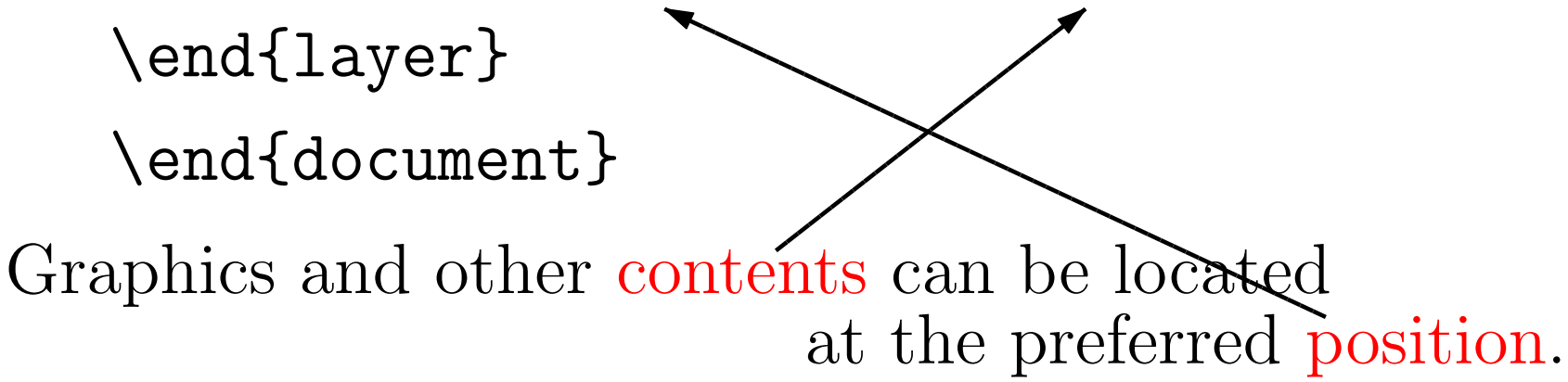
```
\usepackage{ketpic,ketlayer}
\begin{document}
\begin{layer}{180}{0}
\putnotec{150}{25}{\input{fig.tex}}
\end{layer}
\end{document}
```

Graphics and other contents can be located
at the preferred position.

2. Features of KETpic

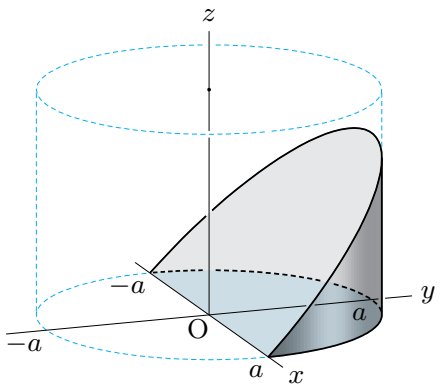
4. Flexible page layouts (using **ketlayer.sty**)

```
\usepackage{ketpic,ketlayer}
\begin{document}
\begin{layer}{180}{0}
\putnotec{150}{25}{\input{fig.tex}}
\end{layer}
\end{document}
```

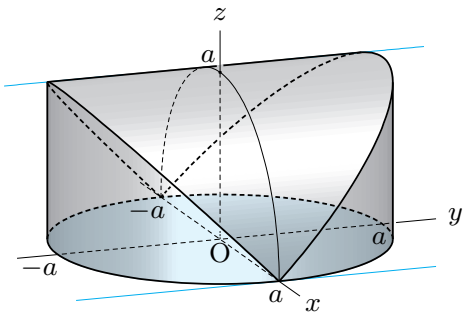


問 9　xy 平面上の円 $x^2+y^2=a^2$ を底面とし，母線が z 軸に平行な直円柱の $z \geqq 0$ の部分を V とするとき，次の問いに答えよ．ただし，a は正の定数とする．

(1)　V が 2 つの平面 $z=0,\ z=y$ によって切り取られる立体の体積を求めよ．

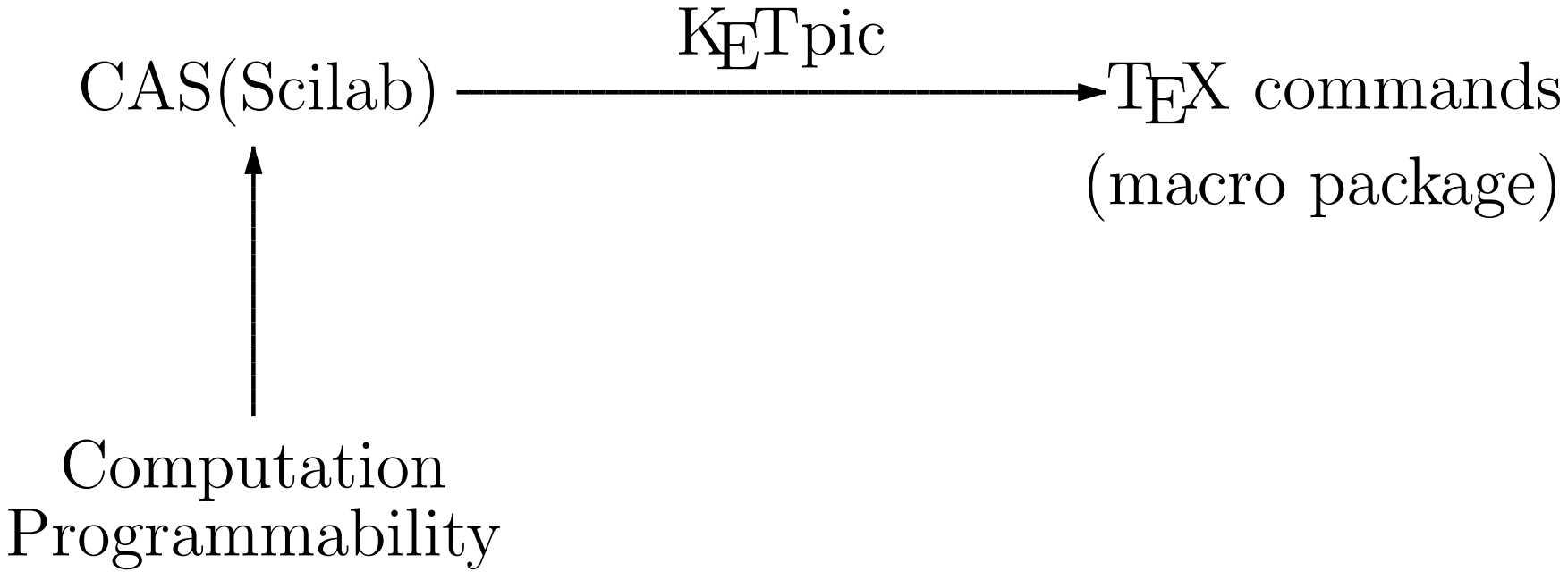


(2)　曲面 $z=\sqrt{a^2-x^2}$ と xy 平面でできる半円柱を W とすると，W は母線が y 軸に平行な直円柱の $z \geqq 0$ の部分になる．V と W が交わってできる立体の体積を求めよ．



3. Generation of TEX commands

3. Generation of TEX commands



3. Generation of TEX commands

1. Definition of new TEX commands
2. Generation of graphical TEX symbols
3. Conditional branching
4. Loop structure

3. Generation of TEX commands

1. Definition of new TEX commands

```
Openfile("Folder/mean.sty");
 Texnewcmd("\mean",2);
  Texsetctr(1,"#1+#2/2");
  Texcom("${\bf MEAN}(#1,#2)="+Texthectr(1)+"$")
 Texend();
Closefile();
```

3. Generation of TEX commands

1. Definition of new TEX commands

```
Openfile("Folder/mean.sty");
 Texnewcmd("\mean",2);
  Texsetctr(1,"#1+#2/2");
  Texcom("${\bf MEAN}(#1,#2)="+Texthectr(1)+"$")
 Texend();
Closefile();
```

This command line is written out honestly to the style file

3. Generation of TEX commands

1. Definition of new TEX commands

```
\newcommand{\mean}[2]{%
\setcounter{ketpicctra}{#1}%
\addtocounter{ketpicctra}{#2}%
\divide\value{ketpicctra} by 2%
${\bf MEAN}(#1,#2)=\theketpicctra$%
}%
```

3. Generation of TEX commands

1. Definition of new TEX commands

```
\usepackage{ketpic,ketlayer,mean}
\begin{document}
The mean value of 6 and 8 is presented as
\begin{center}
\mean{6}{8}
\end{center}
\end{document}
```

3. Generation of TEX commands

1. Definition of new TEX commands

The mean value of 6 and 8 is presented as

$$\mathbf{MEAN}(6, 8) = 7$$

3. Generation of TEX commands

2. Generation of graphical TEX symbols

```
Texnewcmd("\cnum",1);
 Setwindow([0,5],[0,5]);
 Beginpicture("1mm");
  C1=Circledata([2.5,2.5],2.5);
  Drwline(C1);
  Texletter([2.5,2.5],"c","#1");
 Endpicture(0);
Texend();
```

3. Generation of TEX commands

2. Generation of graphical TEX symbols

```
\[
\frac{d^2x}{dt^2}-2\frac{dt}{dx}+x=0\quad \cnum{D}
\]
The characteristic equation of \cnum{D} is
\[
\lambda^2-2\lambda+1=0\quad \cnum{C}
\]
```

3. Generation of TEX commands

2. Generation of graphical TEX symbols

$$\frac{d^2x}{dt^2} - 2\frac{dt}{dx} + x = 0 \quad \mathbb{D}$$

The characteristic equation of $\mathbb{D}$ is

$$\lambda^2 - 2\lambda + 1 = 0 \quad \mathbb{C}$$

3. Generation of TEX commands

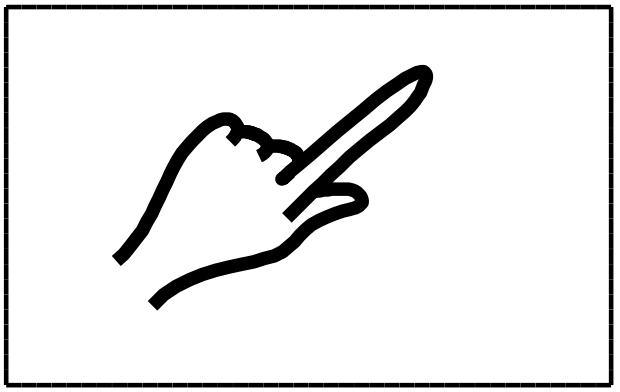
2. Generation of graphical TEX symbols

```
Texnewcmd("\lefthand");
 Setwindow([0,5],[0,5]);
 Beginpicture("5mm");
  Sp1=Splinedata(PL);
  Drwline(Sp1);
 Endpicture(0);
Texend();
```

3. Generation of TEX commands

2. Generation of graphical TEX symbols

`\lefthand`



3. Generation of TEX commands

3. Conditional branching

```
Texnewcmd("\parity",1);
 Texcom("#1");
 Texsetctr(1,"#1/2");
 Texsetctr(2,"#1+1/2");
 Texif(Texthectr(1)+"="+Texthectr(2));
   Texcom("\ is even");
 Texelse()
   Texcom("\ is odd");
 Texendif();
Texend();
```

3. Generation of TEX commands

3. Conditional branching

```
\parity{125}
```

125 is odd

```
\parity{264}
```

264 is even

3. Generation of TEX commands

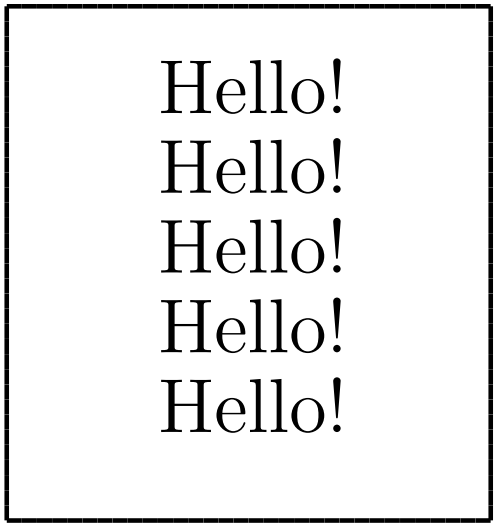
4. Loop structure

```
Texnewcmd("\repeated",2);
 Texfor(1,1,"#2");
  Texcom("\noindent");
  Texcom("#1");
  Texcom("\\");
 Texendfor(1);
Texend();
```

3. Generation of TEX commands

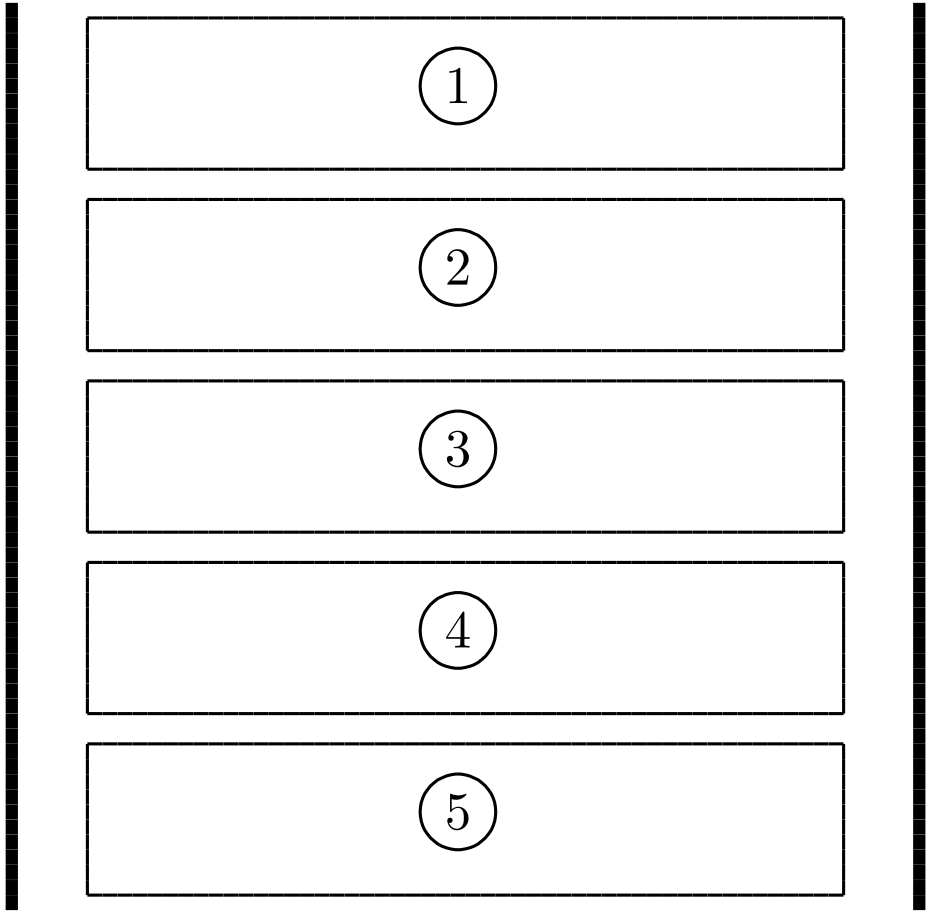
4. Loop structure

```
\repeated{Hello!}{5}
```



4. Generation of many similar pages

Prototype (Determinant of a matrix)



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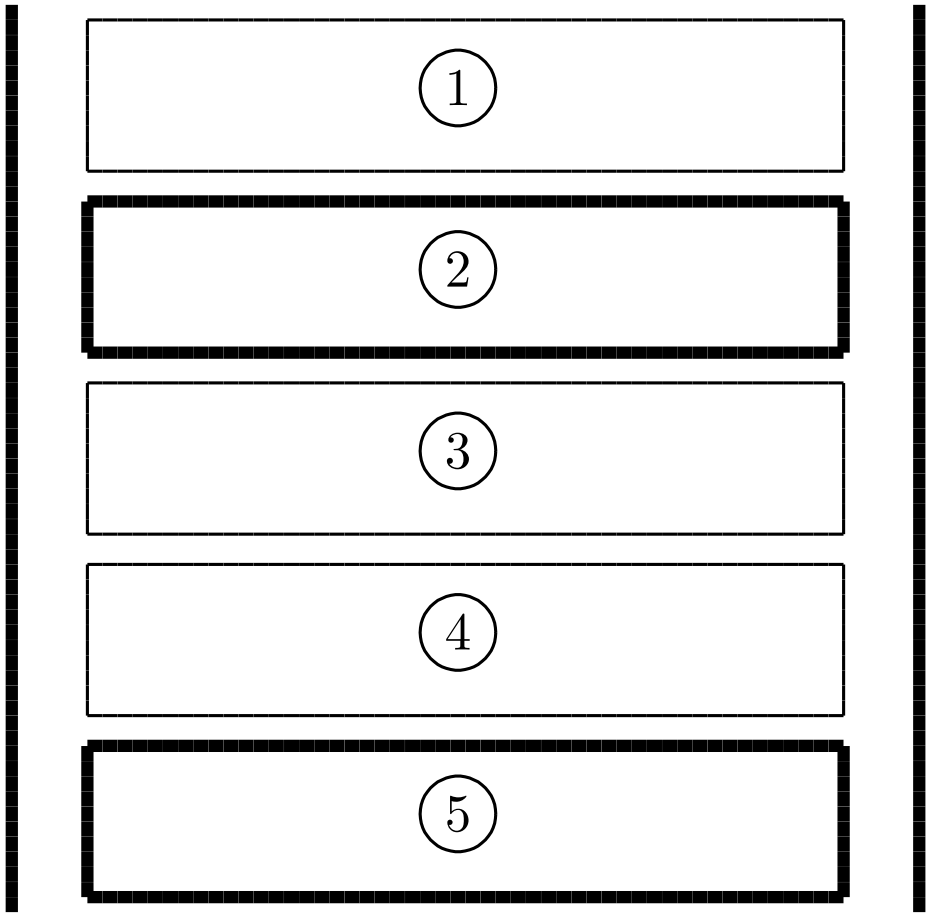
Prototype (Determinant of a matrix)



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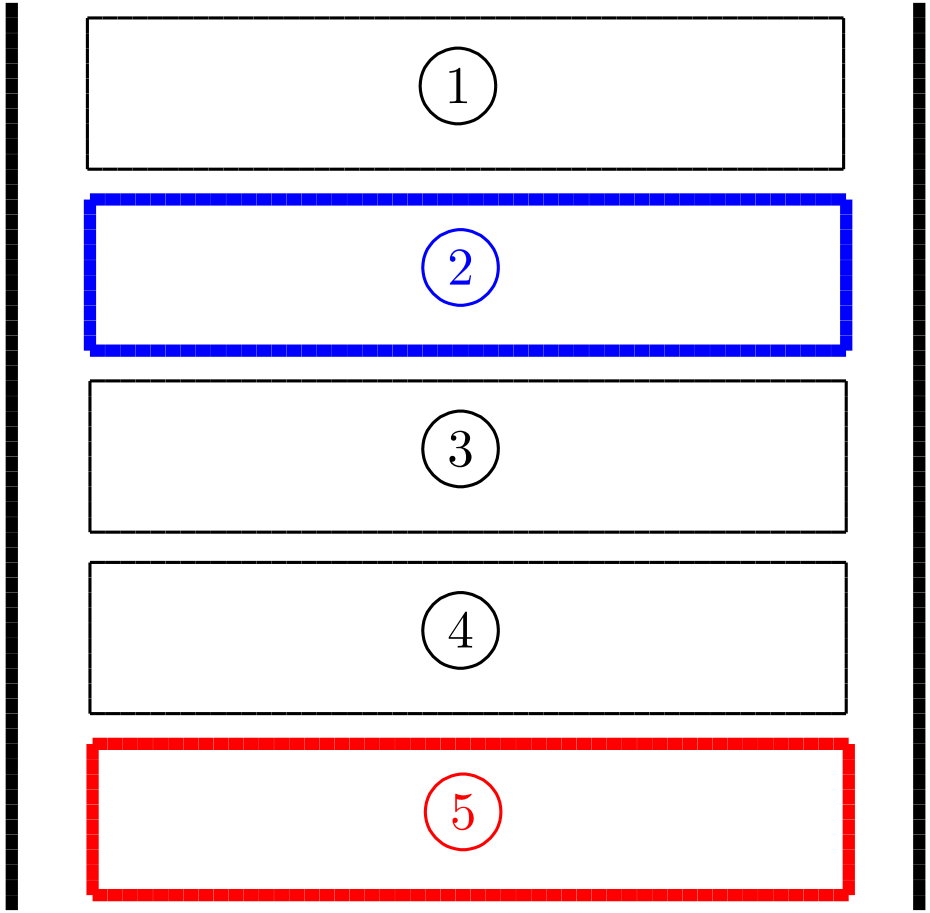

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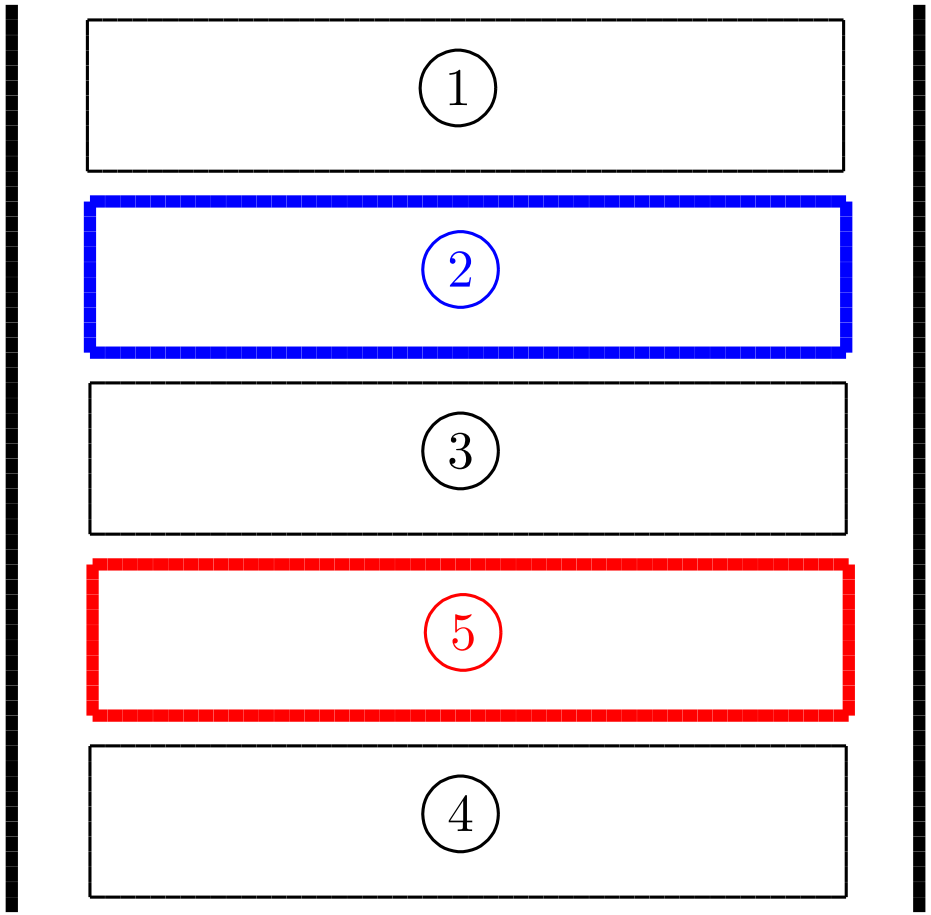
Prototype (Determinant of a matrix)



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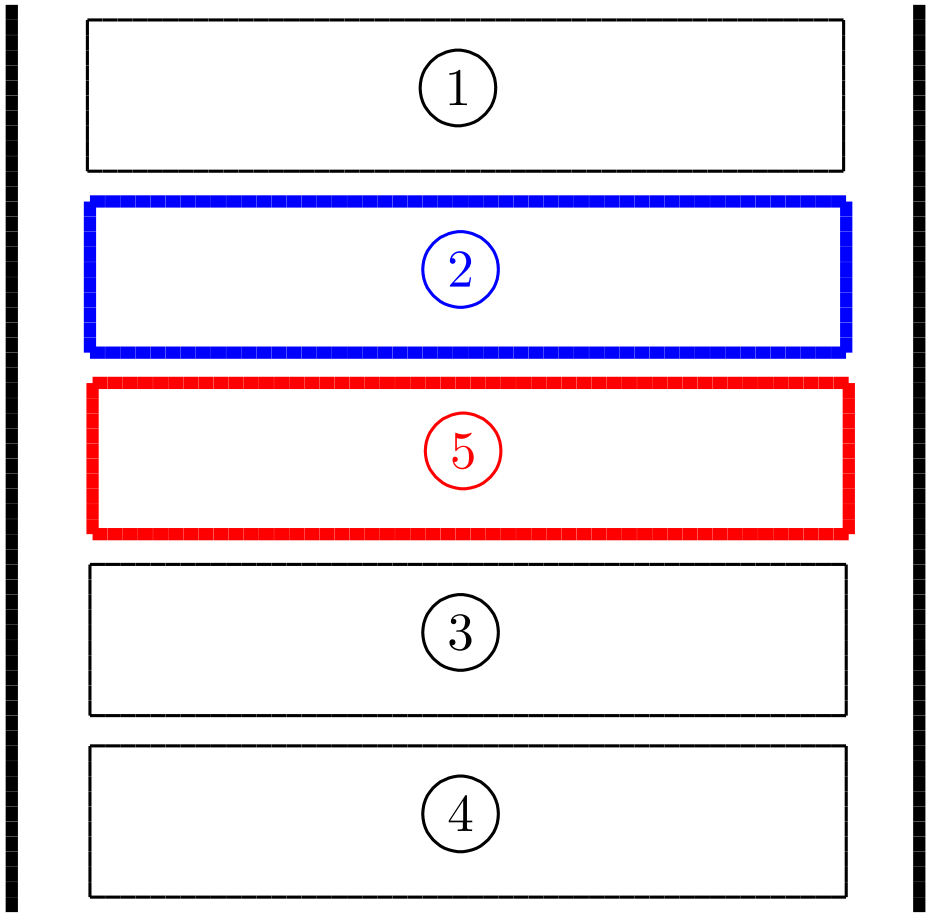
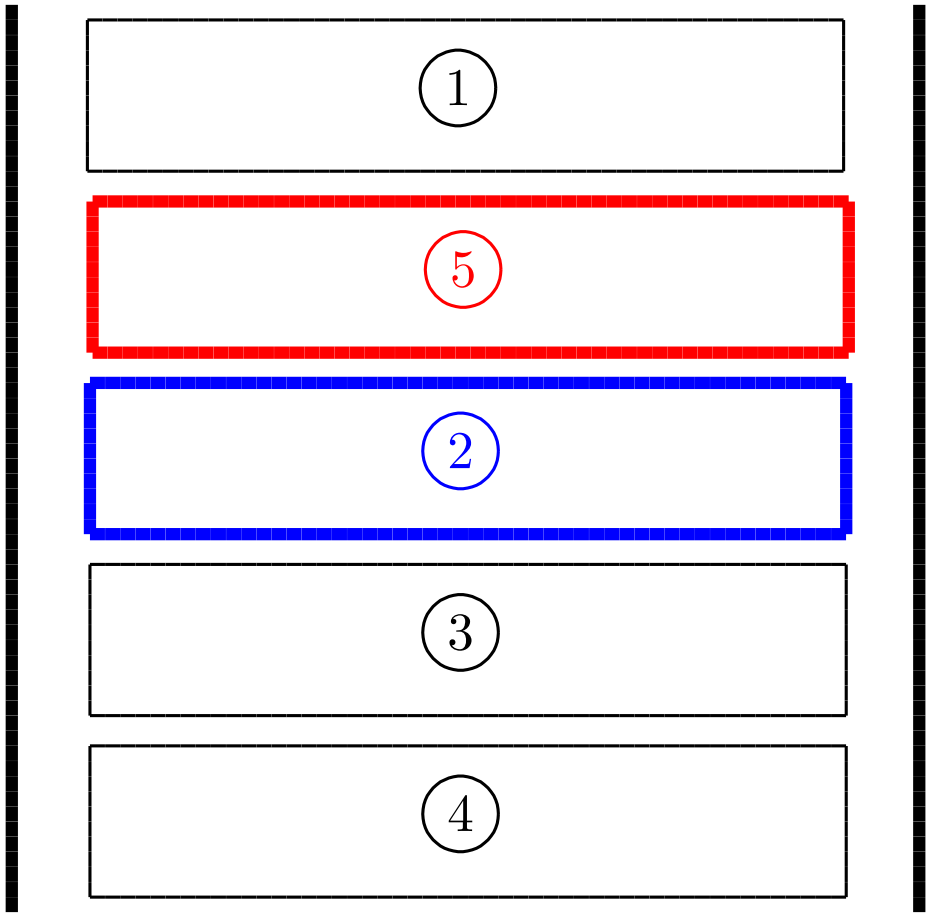


4. Generation of many similar pages

Prototype (Determinant of a matrix)



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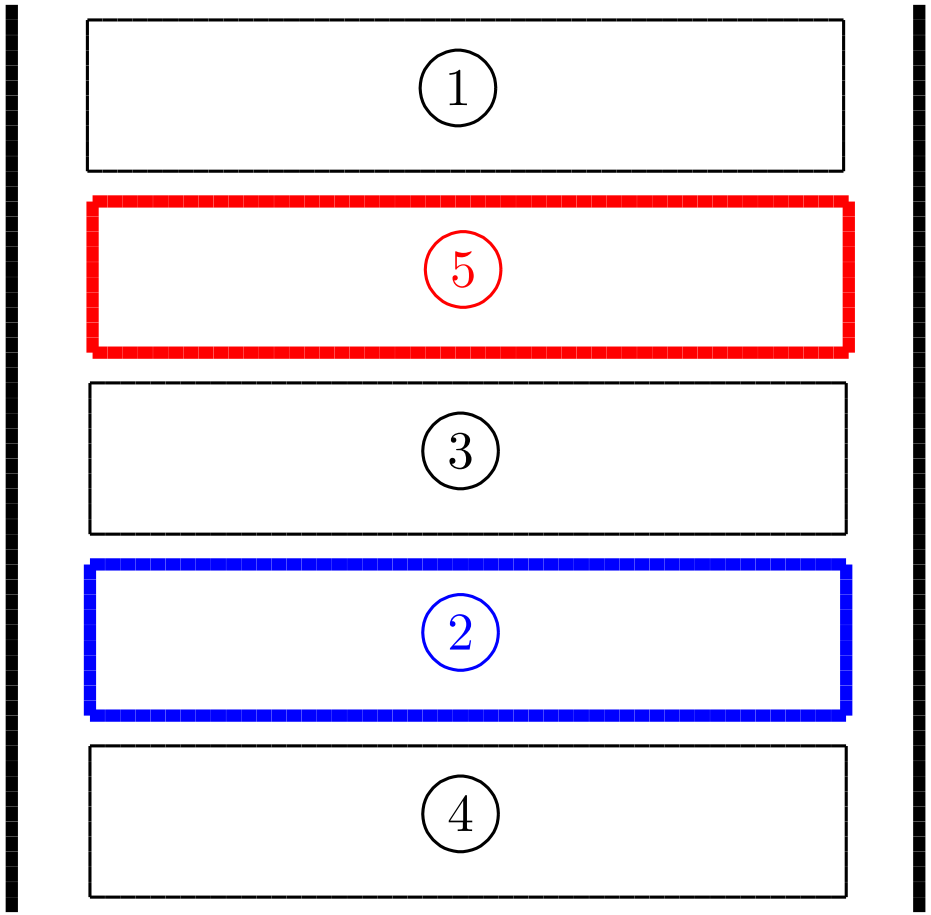
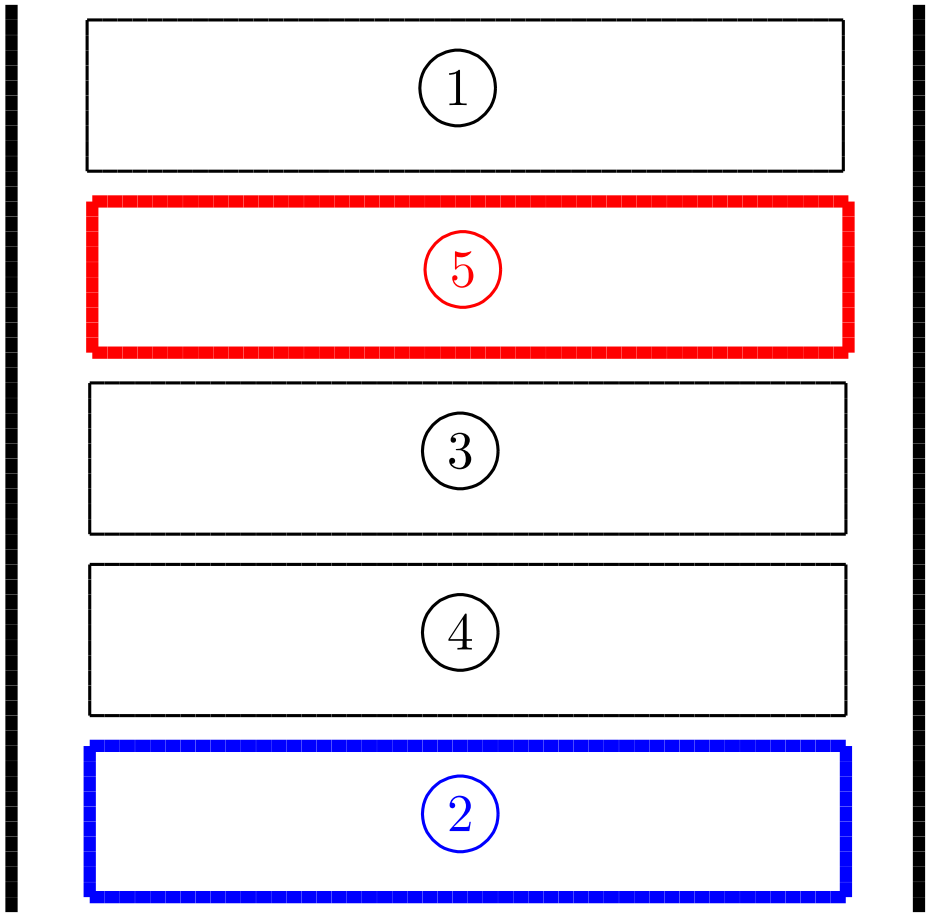
Prototype (Determinant of a matrix)



4. Generation of many similar pages

Prototype (Determinant of a matrix)



Start

```
for p=1:1:5
 for q=1:1:5
  if q==p then continue;
  else
    for r=1:1:5
     if r==p then continue;
     elseif r==q then continue;
     else
       ..........
        Texcom("\sameslide");
        Texcom("\begin{layer}{130}{0}");
        Texcom("\lineseg[32]{30}{30}{60}{-90}");
        Texcom("\lineseg[32]{90}{30}{60}{-90}");
        Texcom("\boxframe{35}{31}{50}{10}{\cnum{"+string(p)+"}}");
        Texcom("\boxframe{35}{43}{50}{10}{\cnum{"+string(q)+"}}");
        Texcom("\boxframe{35}{55}{50}{10}{\cnum{"+string(r)+"}}");
        Texcom("\boxframe{35}{67}{50}{10}{\cnum{"+string(s)+"}}");
        Texcom("\boxframe{35}{79}{50}{10}{\cnum{"+string(t)+"}}");
        Texcom("\end{layer}");
       ..........
      end;
    end;
  end;
 end;
end;
```

```
for p=1:1:5
 for q=1:1:5
  if q==p then continue;
  else
    for r=1:1:5
     if r==p then continue;
     elseif r==q then continue;
     else
       ..........
        Texcom("\sameslide");
        Texcom("\begin{layer}{130}{0}");
        Texcom("\lineseg[32]{30}{30}{60}{-90}");
        Texcom("\lineseg[32]{90}{30}{60}{-90}");
        Texcom("\boxframe{35}{31}{50}{10}{\cnum{"+string(p)+"}}");
        Texcom("\boxframe{35}{43}{50}{10}{\cnum{"+string(q)+"}}");
        Texcom("\boxframe{35}{55}{50}{10}{\cnum{"+string(r)+"}}");
        Texcom("\boxframe{35}{67}{50}{10}{\cnum{"+string(s)+"}}");
        Texcom("\boxframe{35}{79}{50}{10}{\cnum{"+string(t)+"}}");
        Texcom("\end{layer}");
       ..........
      end;
    end;
  end;
 end;
end;
```

Loop program of Scilab

5. Use of “hyperref” package

Example (Exponential of complex number)

Insertion (by **Texcom**) of

`\hypertarget` `\hyperlink`

(at specified position) into Loop program

5. Use of "hyperref" package

Example (Exponential of complex number)

Insertion (by **Texcom**) of

`\hypertarget` `\hyperlink`

(at specified position) into Loop program

Materials with many linkages between pages which allow students to intuitively appreciate mathematical concepts

5. Use of “hyperref” package

Example (Exponential of complex number)

Sample 3