CADGME2016 Targu Mures

Collaborative use of KETCindy with CAS

Masataka Kaneko & Setsuo Takato

KAKENHI 15K01037

CONTENTS

1. What is KETCindy?

Collaboration between dynamically and statically displayed graphics

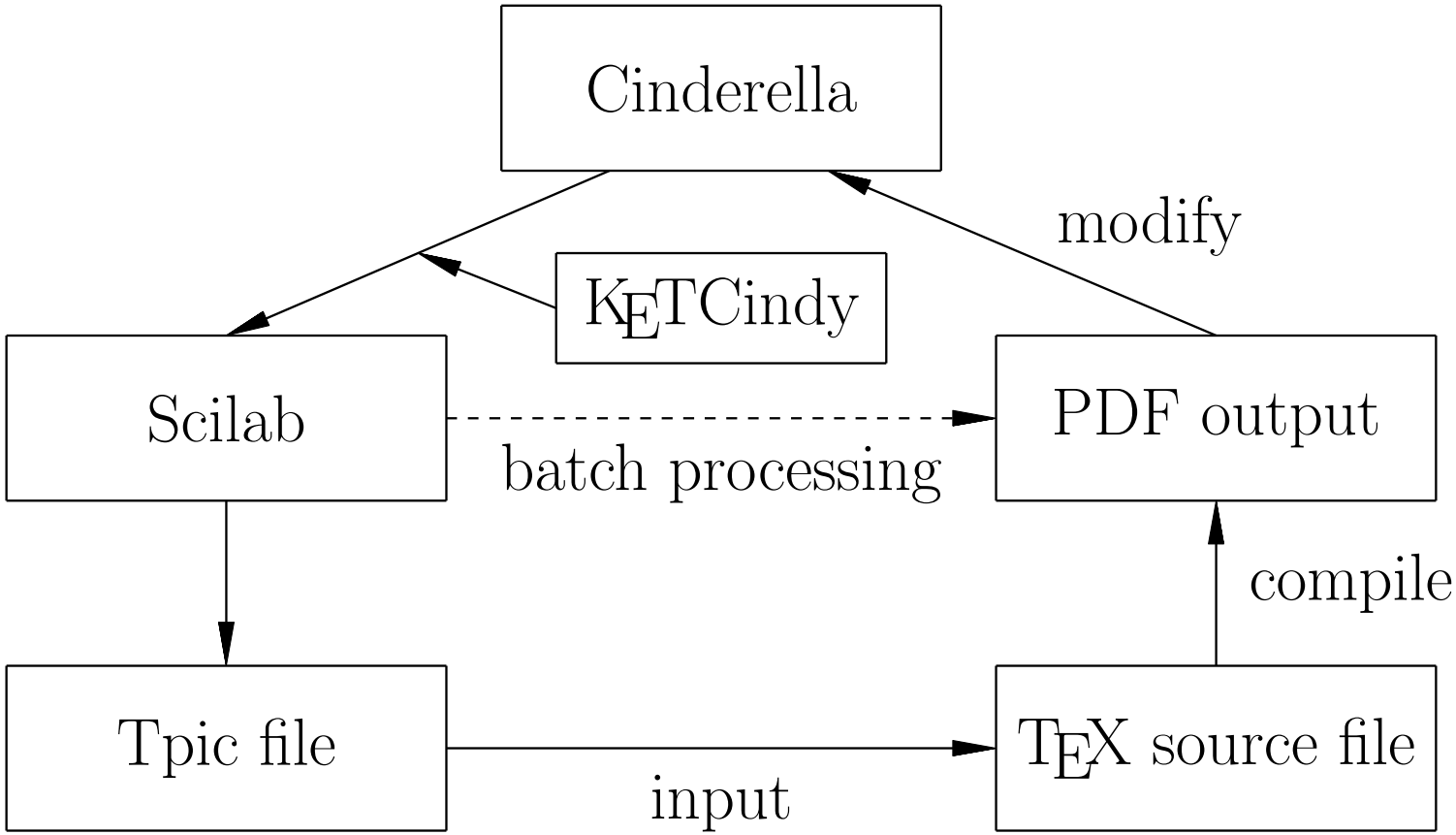
1. Interactive simulation and clarification of mathematical mechanism with the aid of dynamic graphics on Cinderella screen
2. Paper and pencil based deduction and calculation with the aid of the static graphics generated on TEX documents

1. What is KETCindy?

Synchronizatoin of mathematical expressions on texts and graphics

1. High quality mathematical expressions on TEX
2. Mathematical expressions of homogeneous quality on the TEX graphics generated via KETCindy
3. Flexibly formatted TEX graphical output (PDF) via the scripting language of Cinderella (Cindyscript)

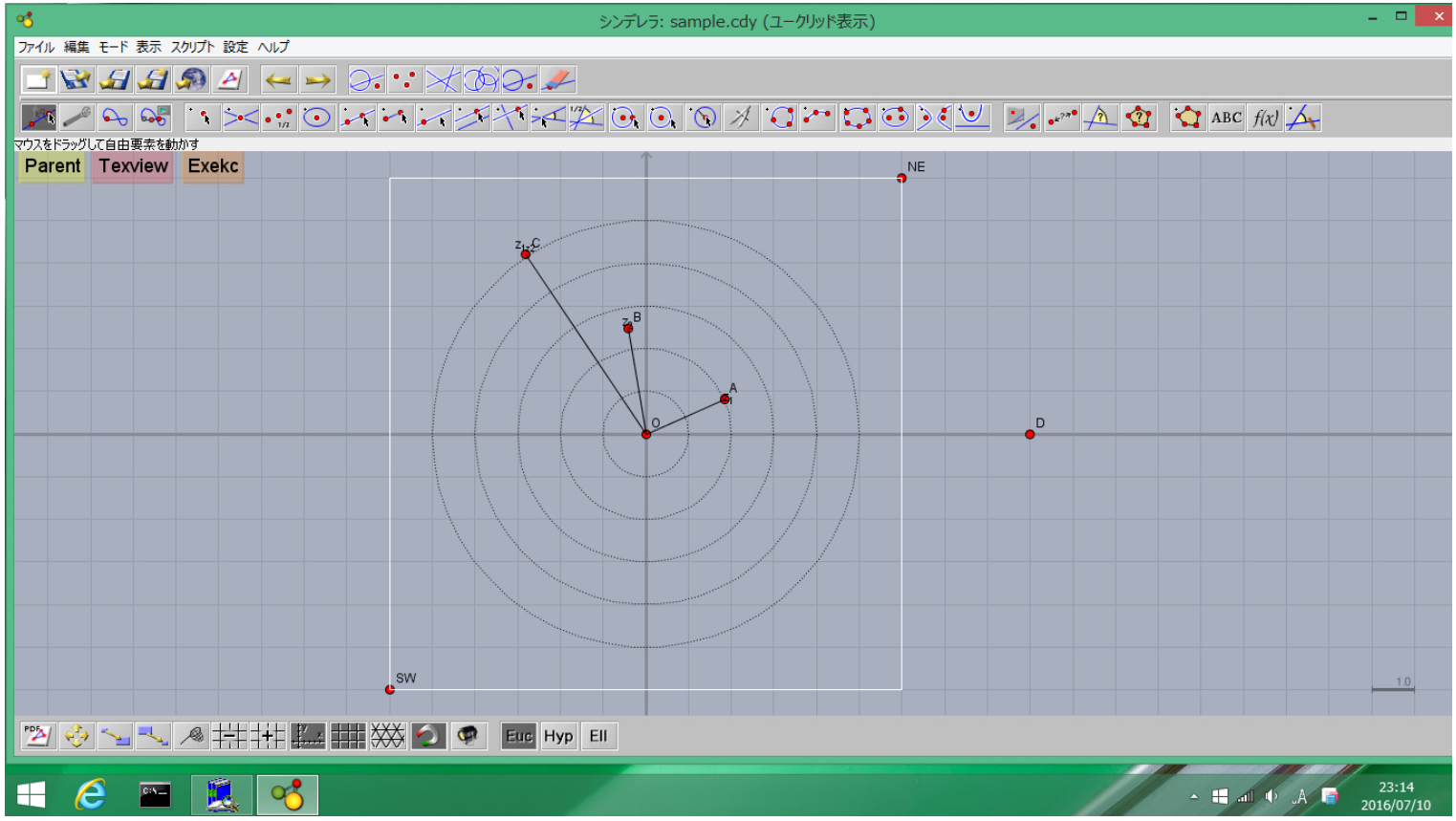
1. What is KETCindy?



http://ketpic.com

2. Sample case of KETCindy use

Dynamic graphics



2. Sample case of KETCindy use

Static graphics

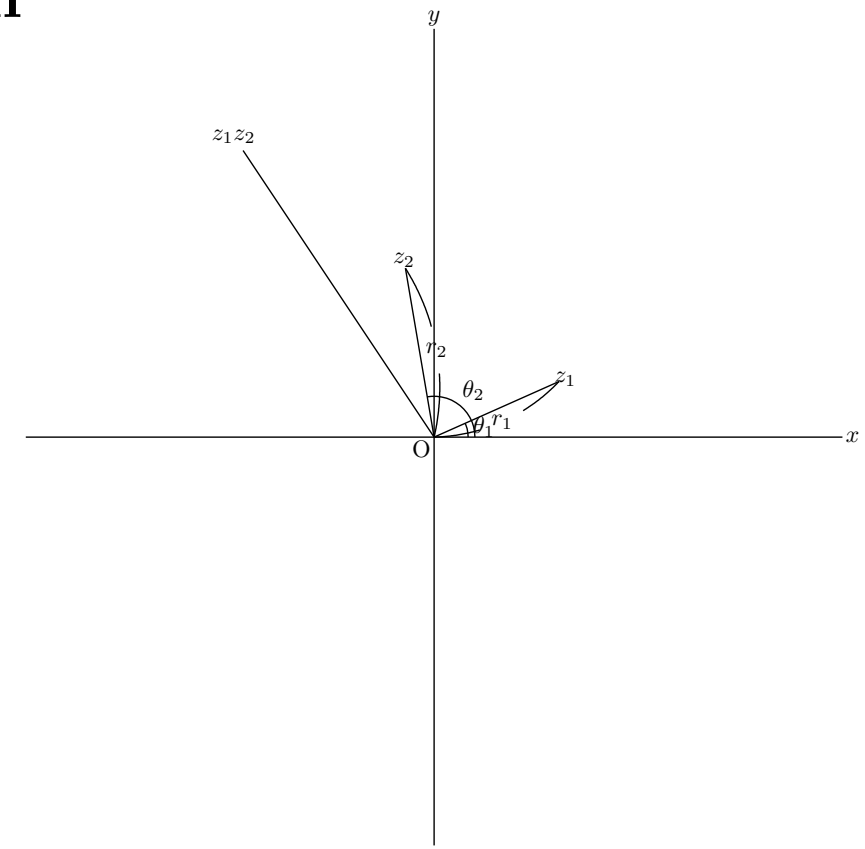
Euler's formula and polar form

When

$$z_1 = r_1 e^{i\theta_1} \quad z_2 = r_2 e^{i\theta_2}$$

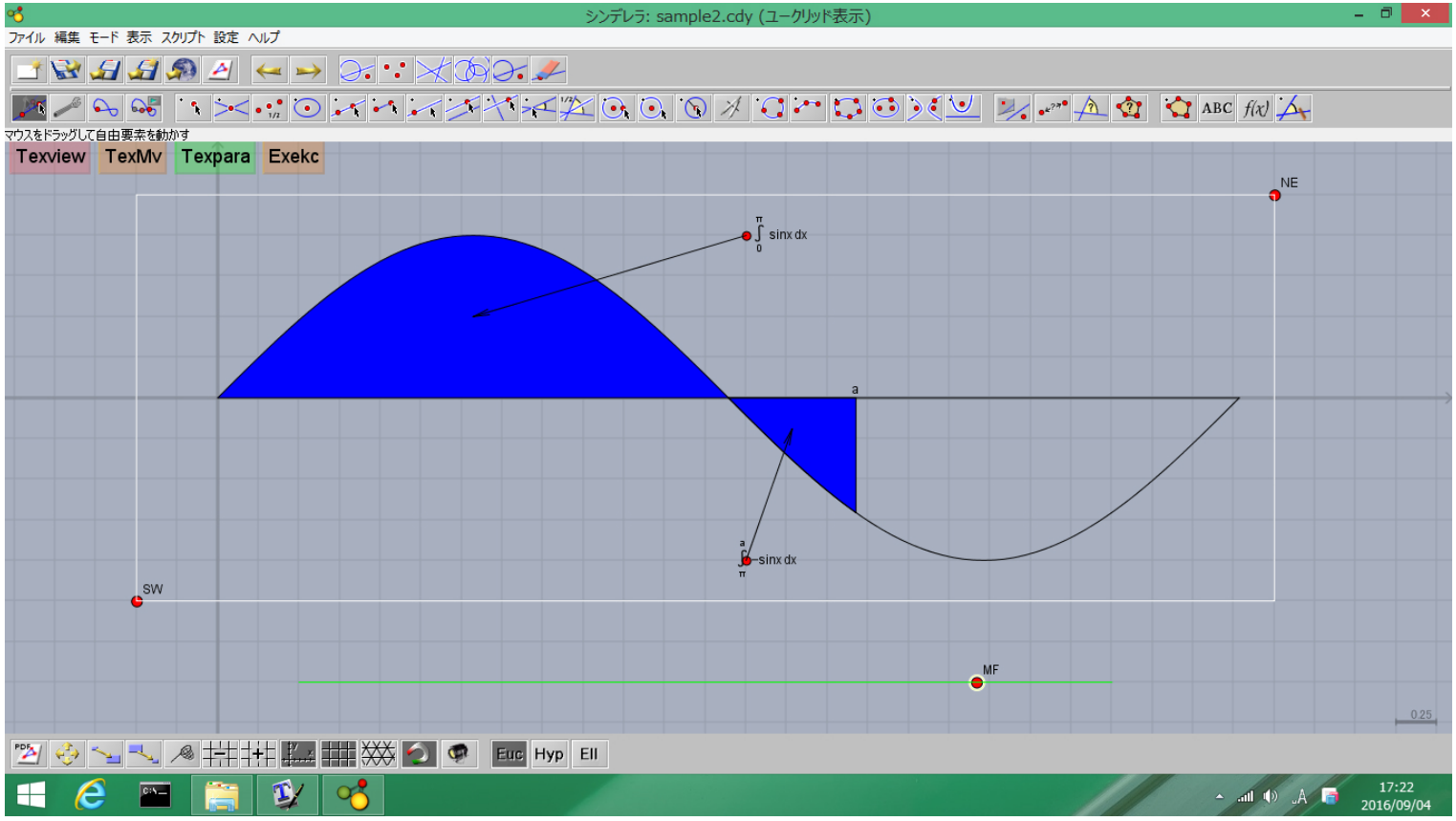
then

$$z_1 z_2 = r_1 r_2 e^{i(\theta_1+\theta_2)}$$



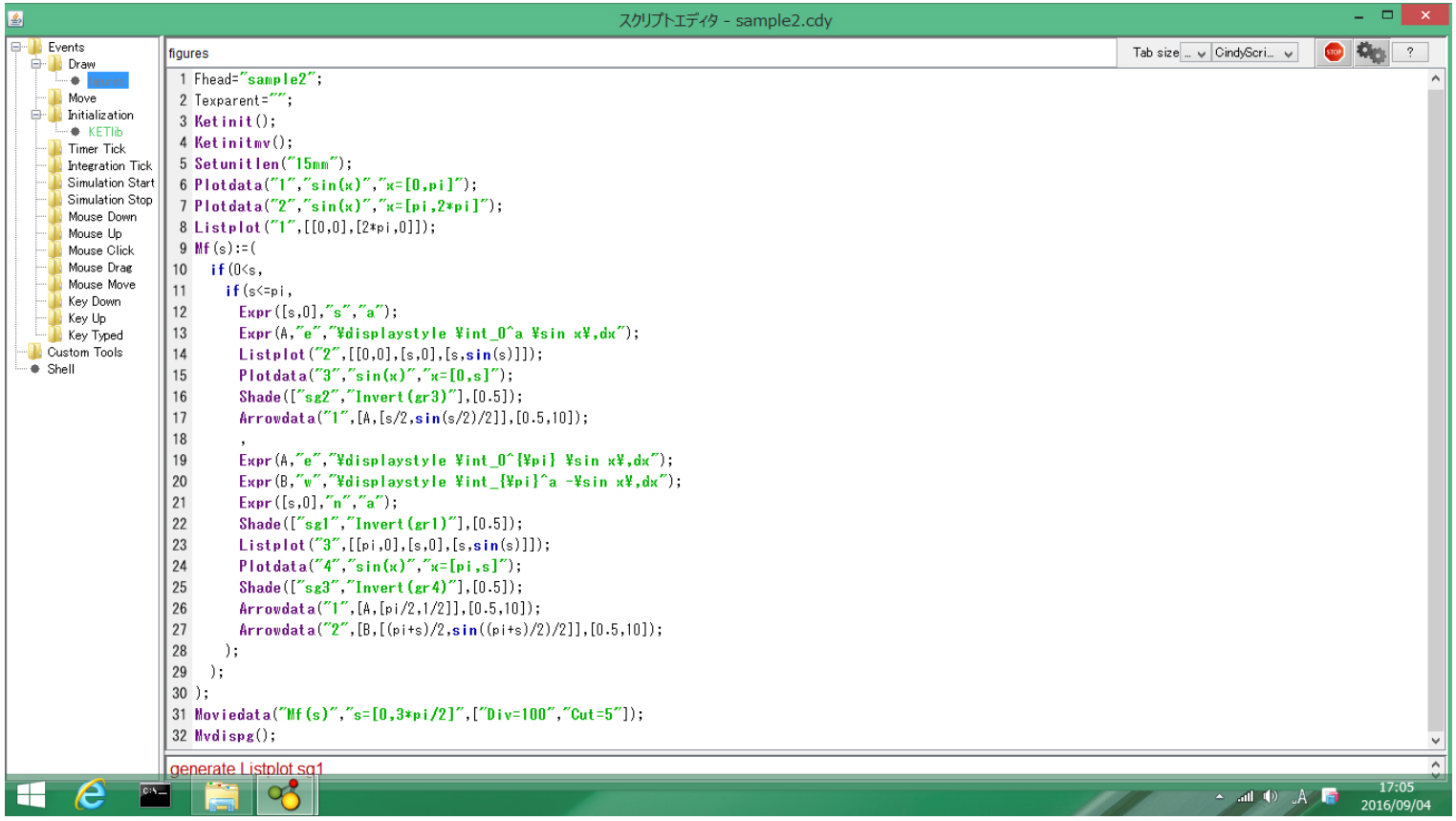
2. Sample case of KETCindy use

Cinderella screen



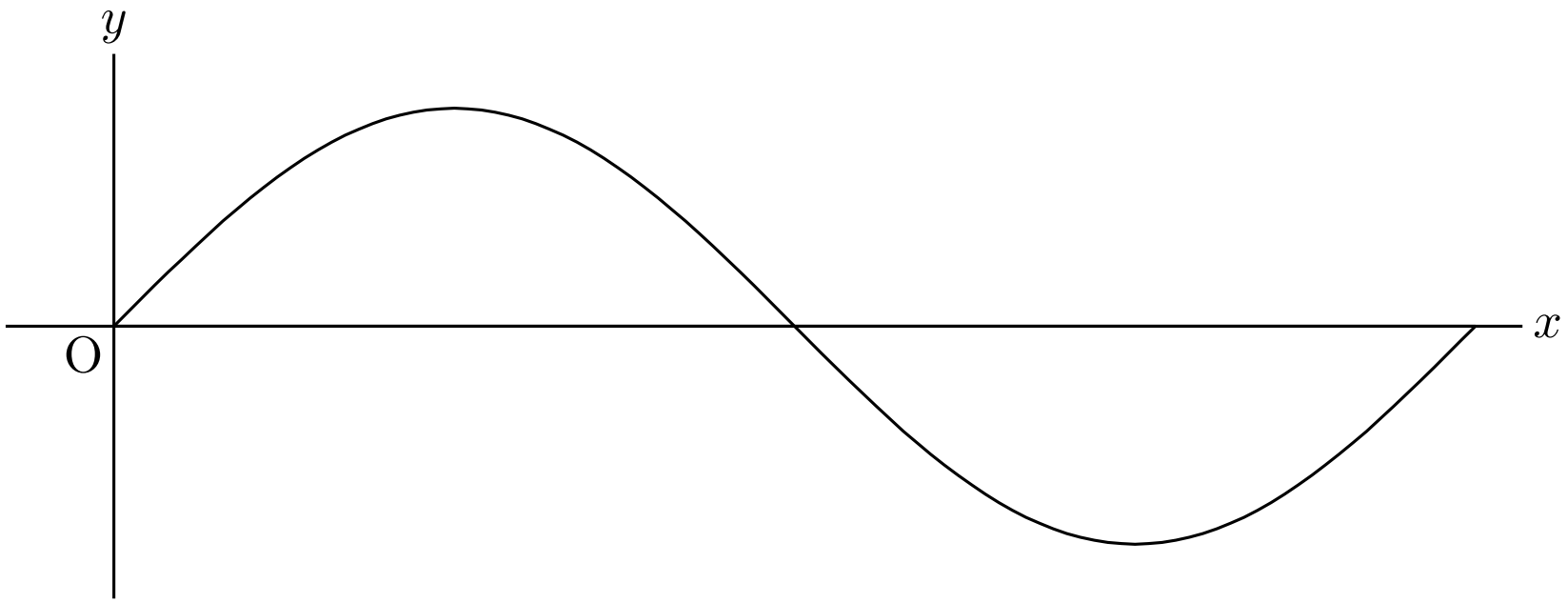
2. Sample case of KETCindy use

Cindyscript screen



2. Sample case of KETCindy use

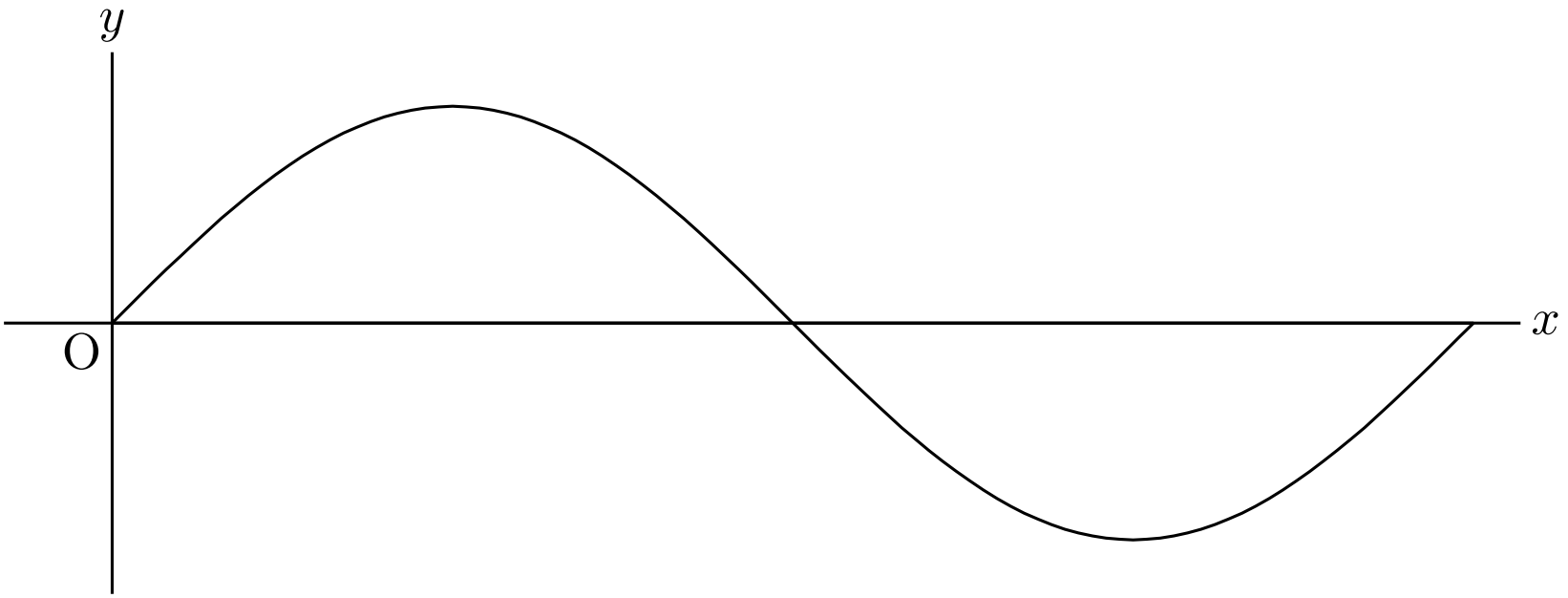
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

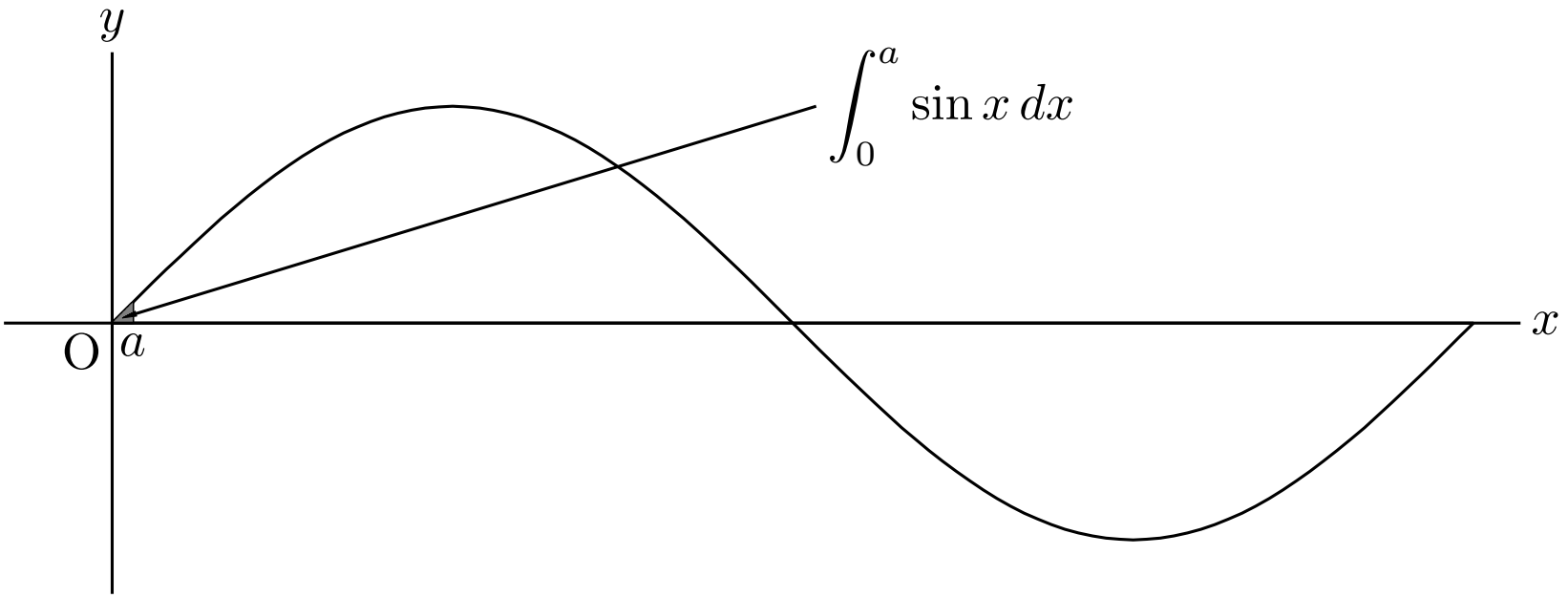
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

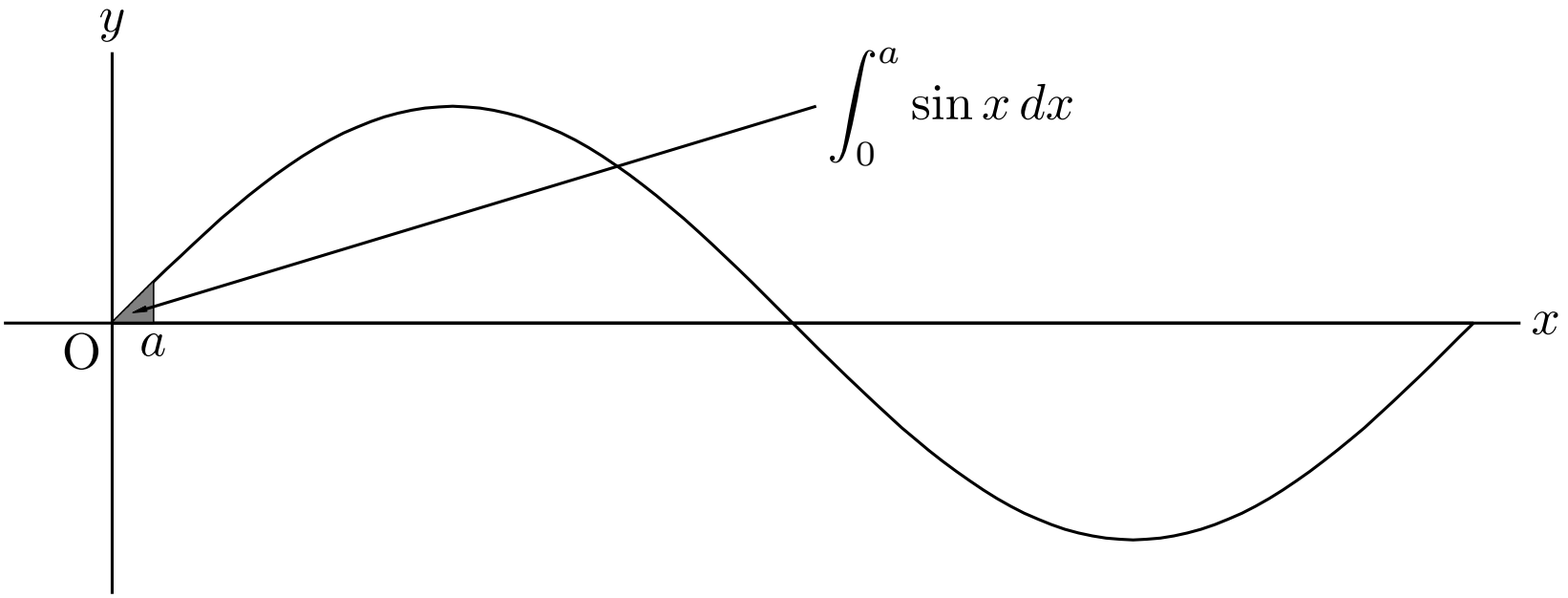
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

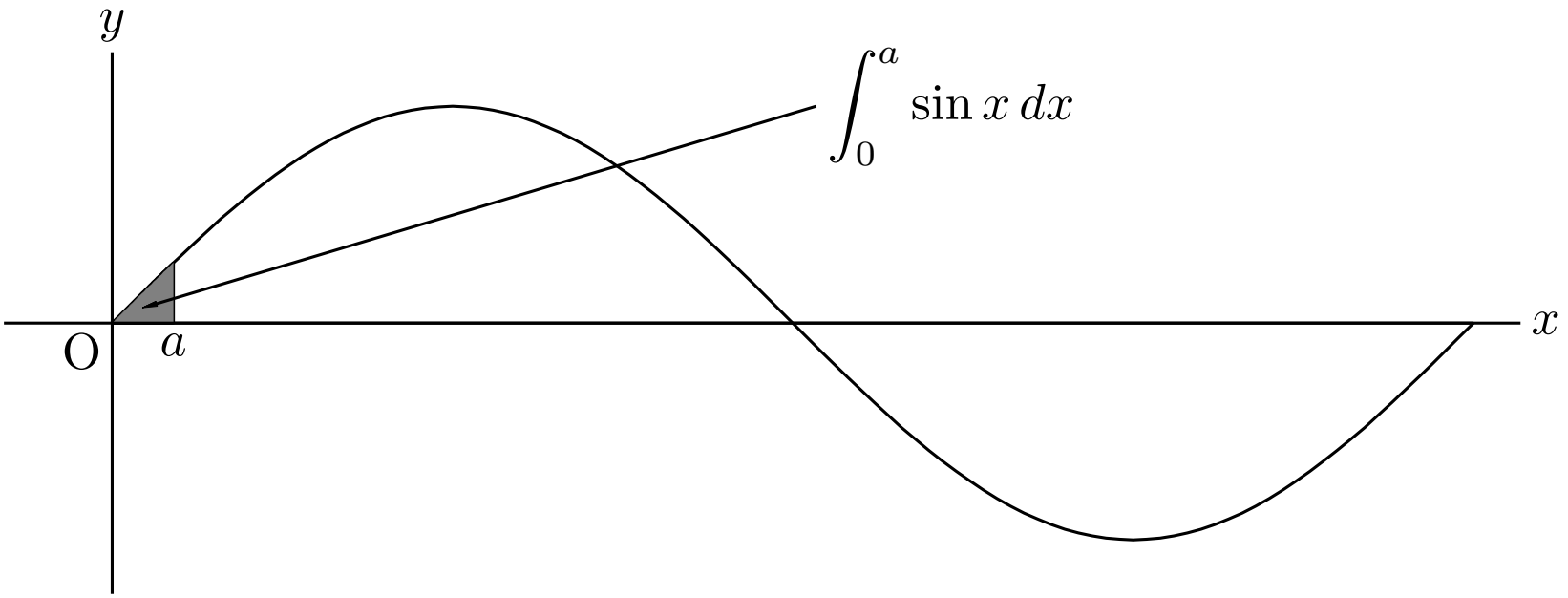
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

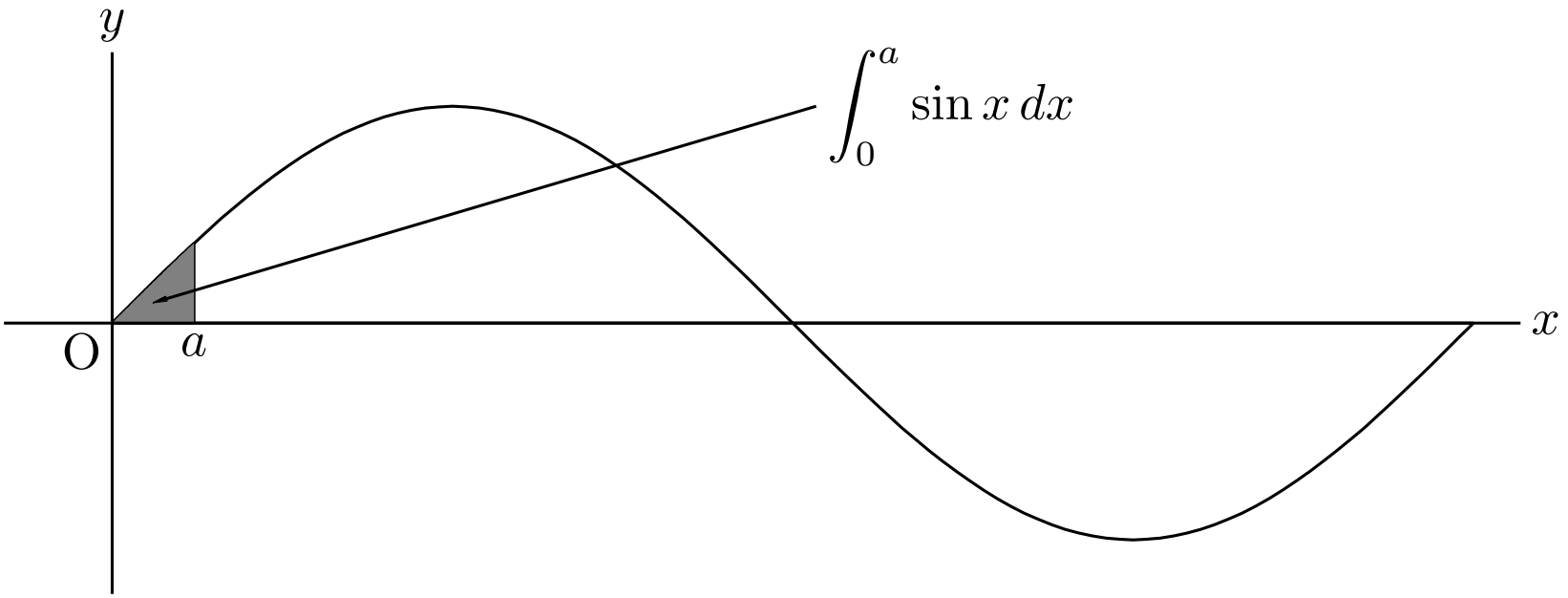
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

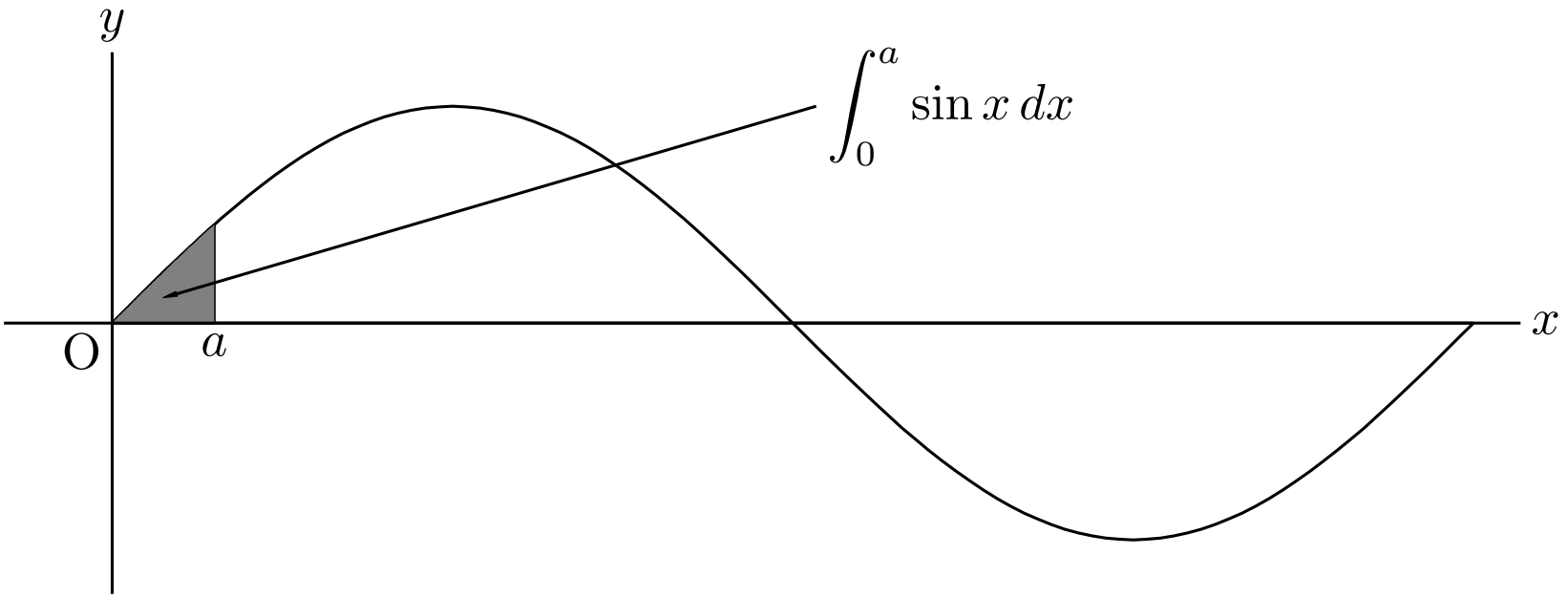
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

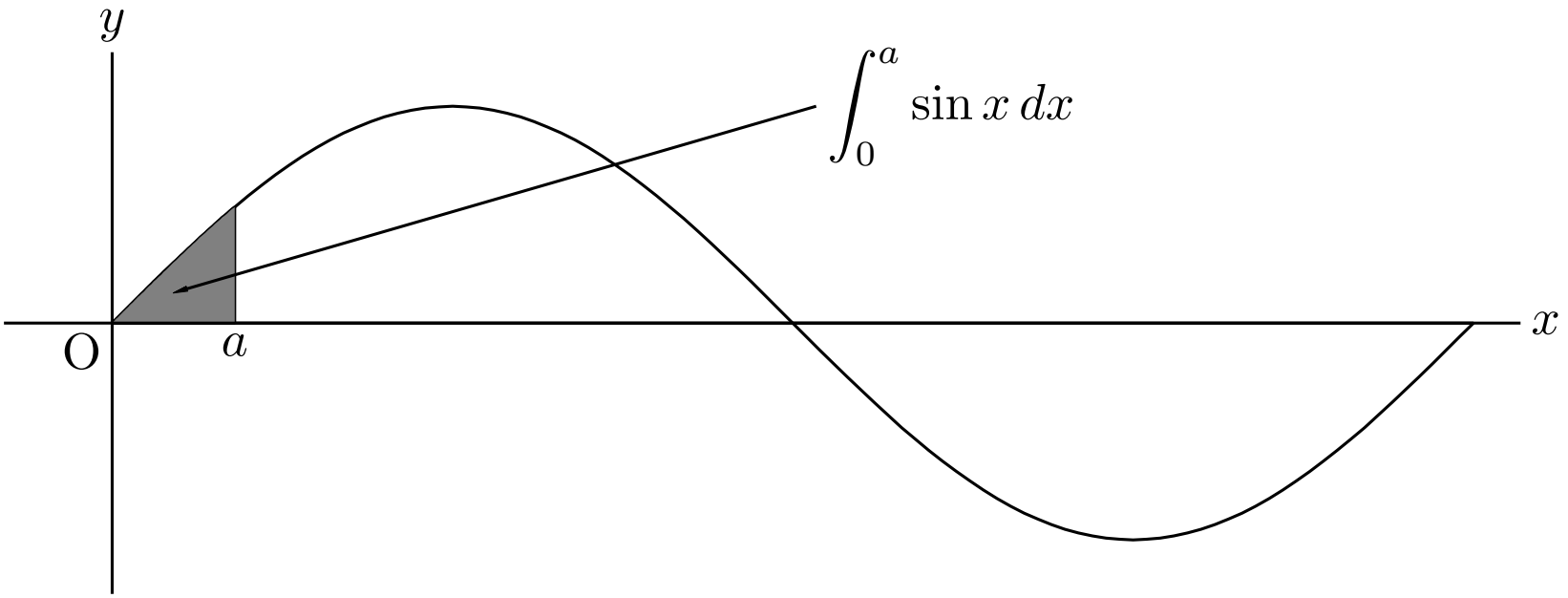
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

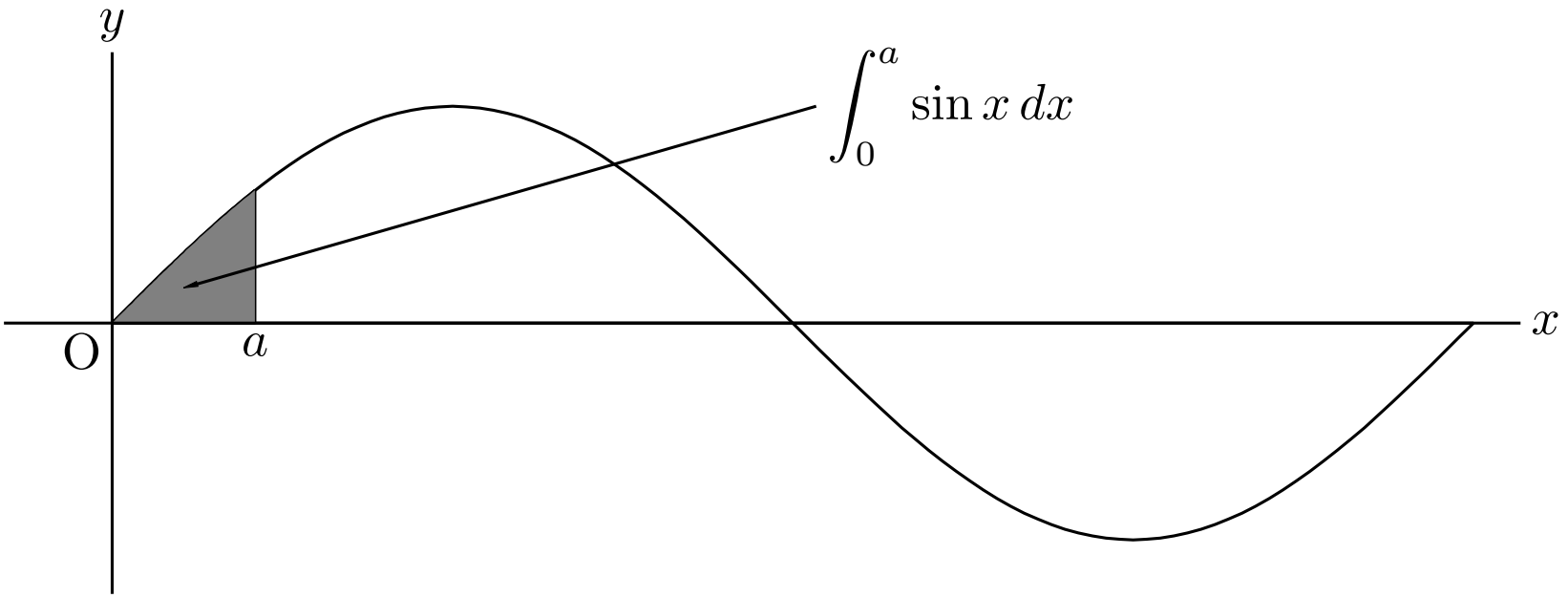
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

Flexibly formatted TEX output

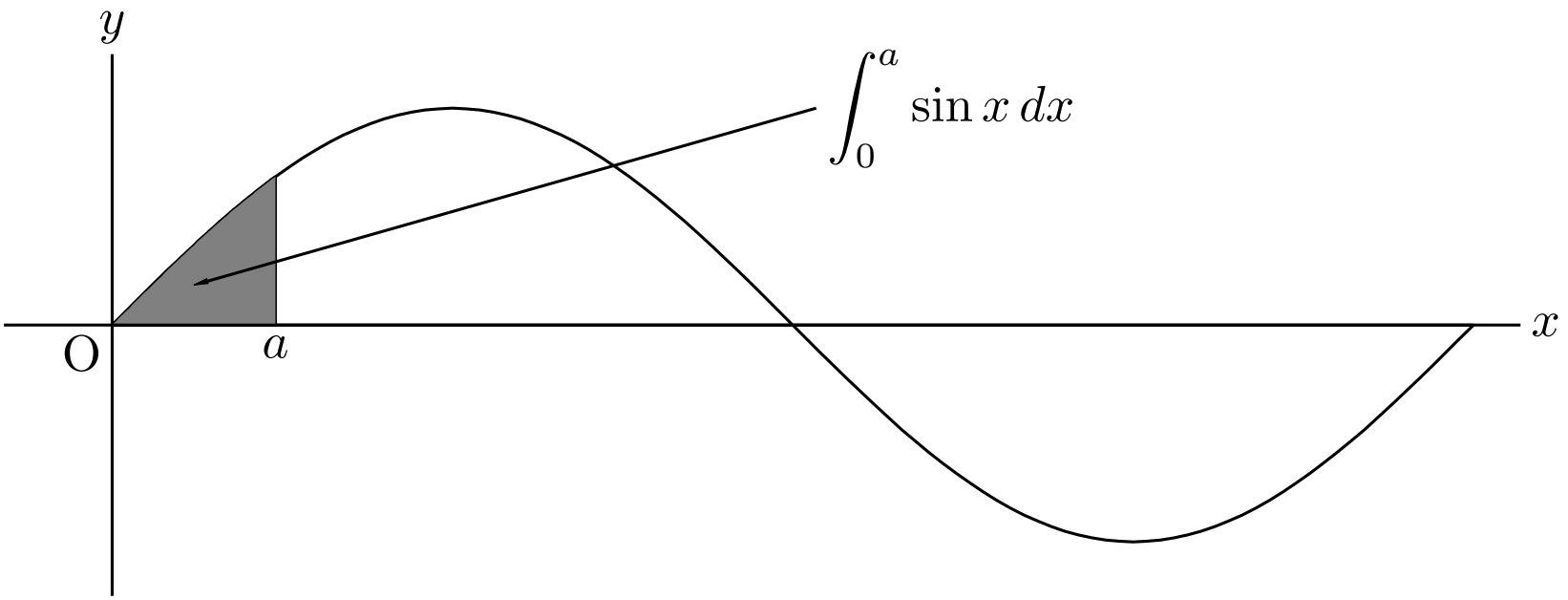


$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

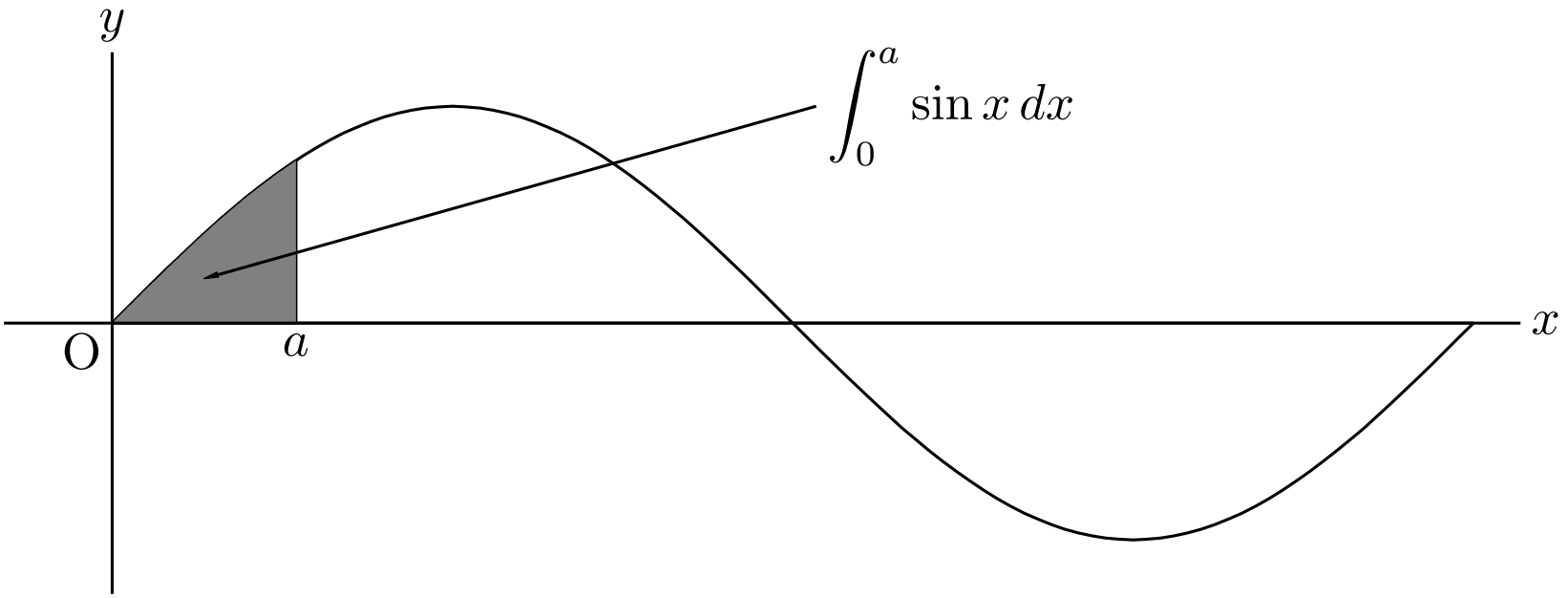
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

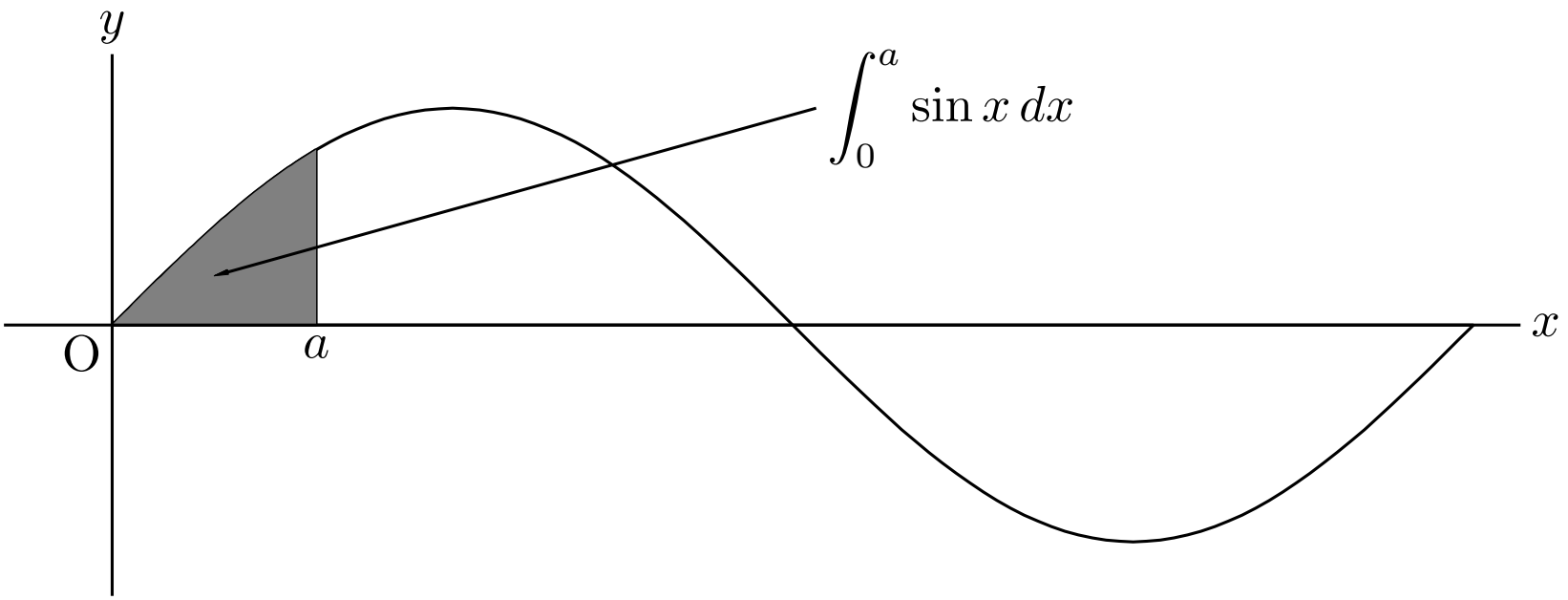
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

Flexibly formatted TEX output

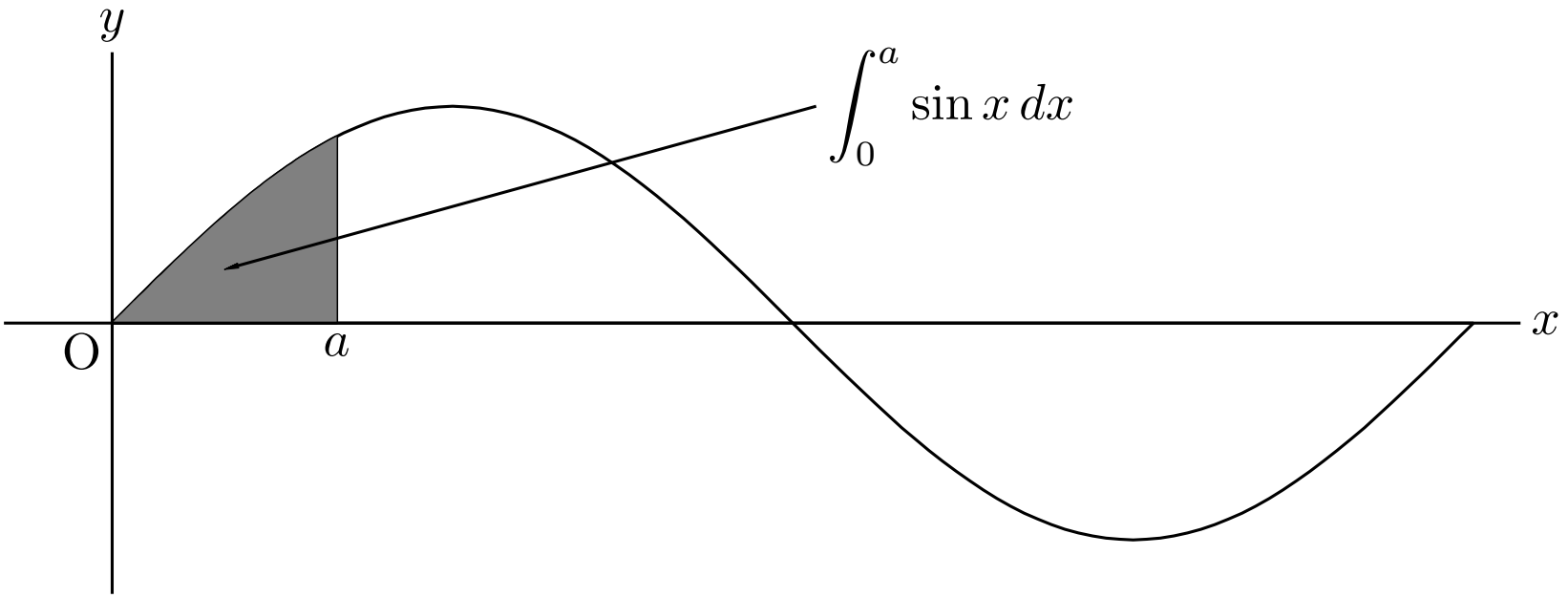


$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

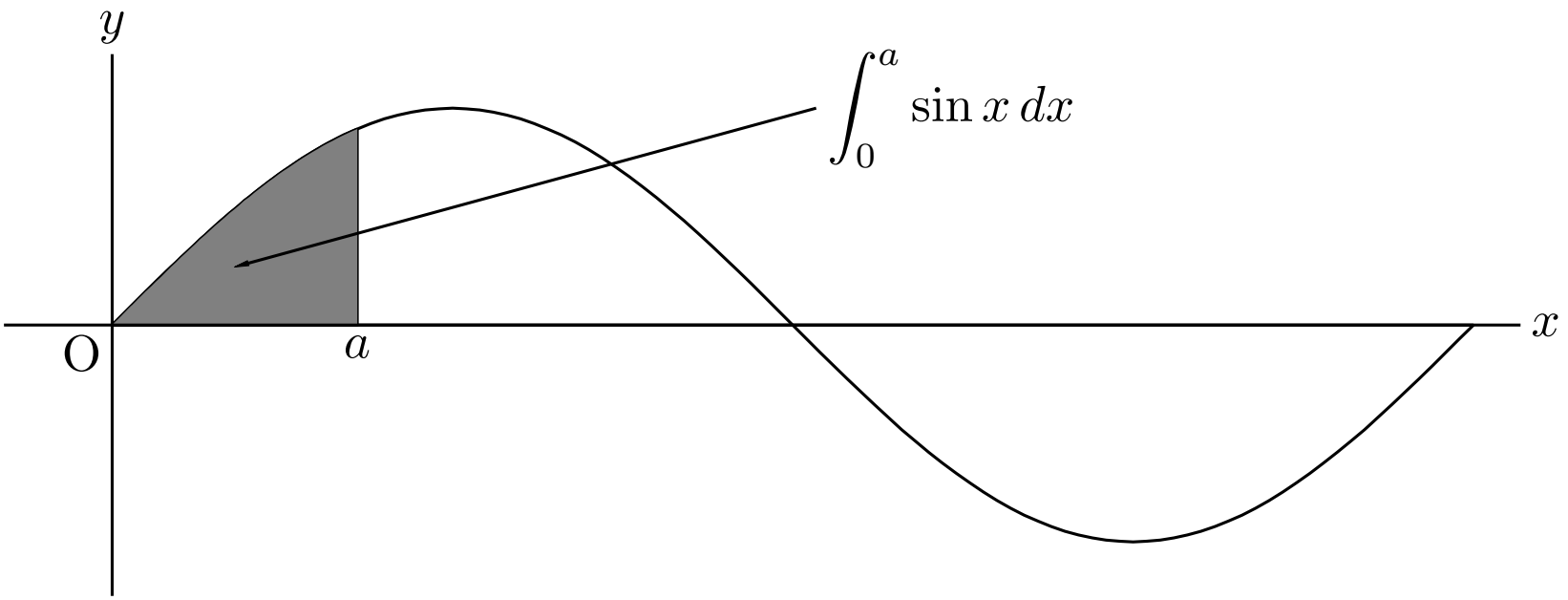
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

Flexibly formatted TEX output

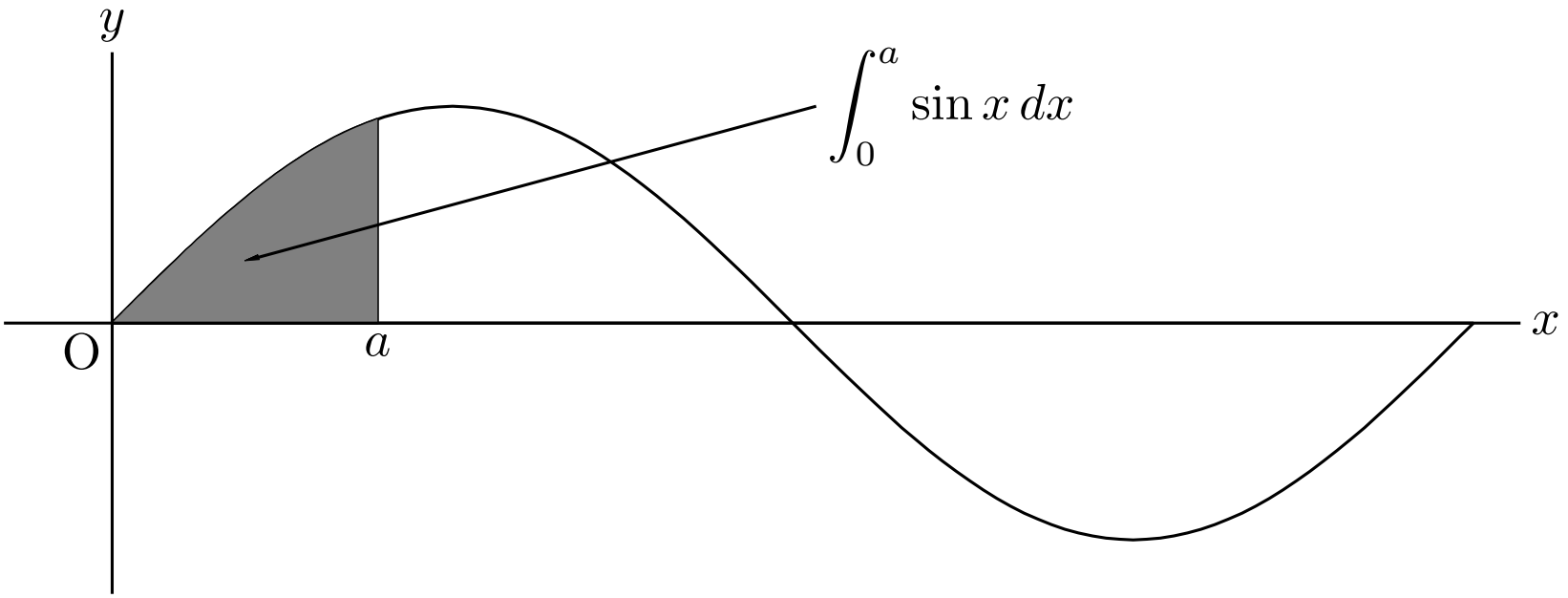


$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

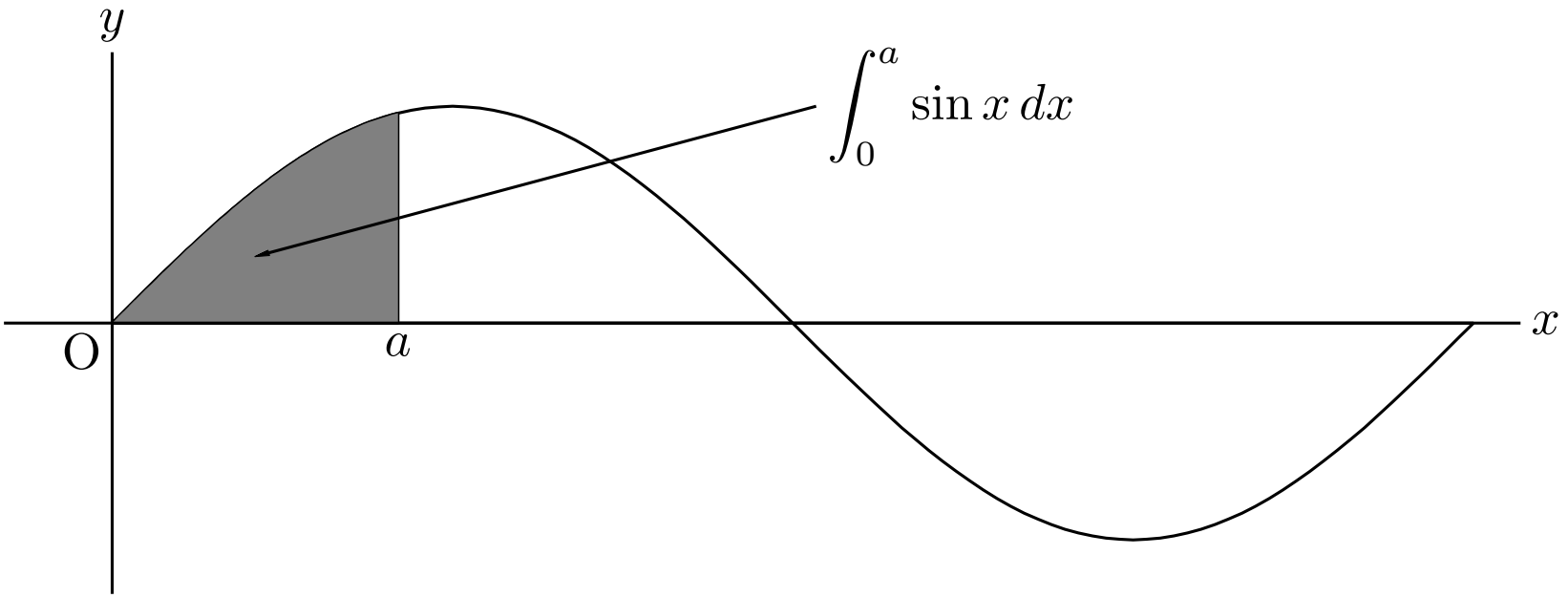
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

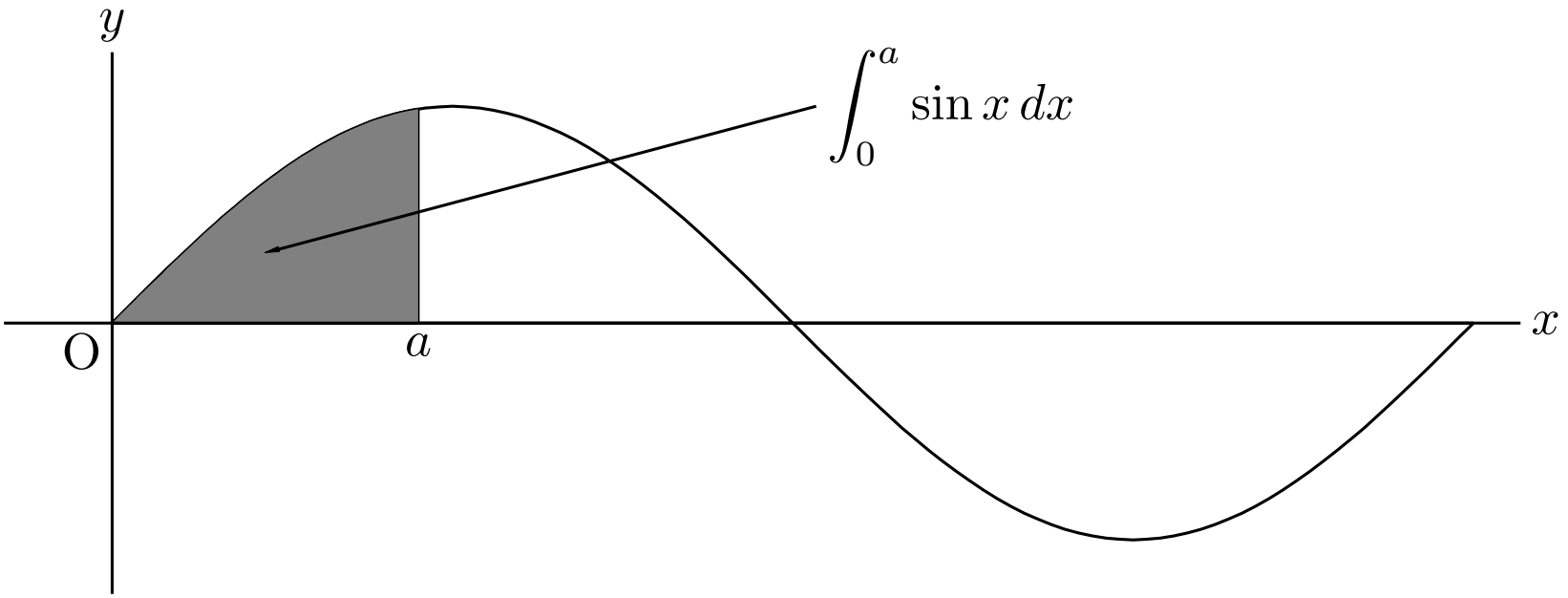
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

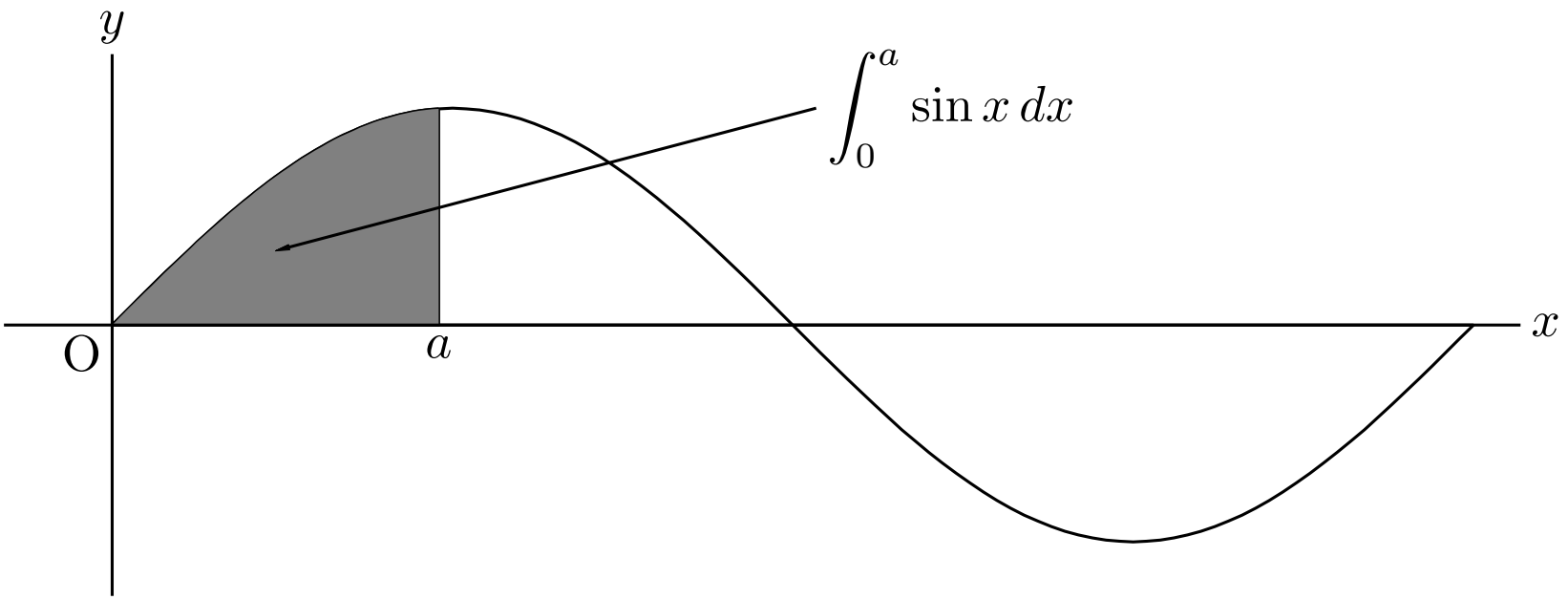
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

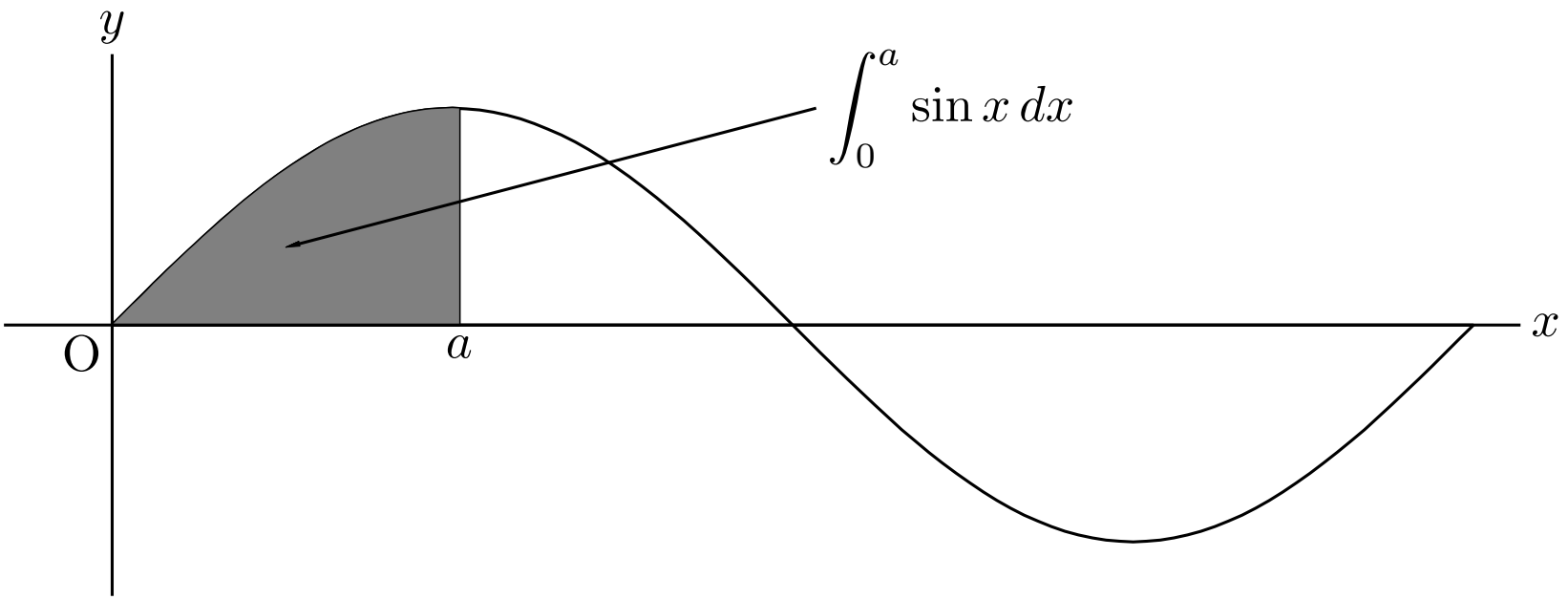
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

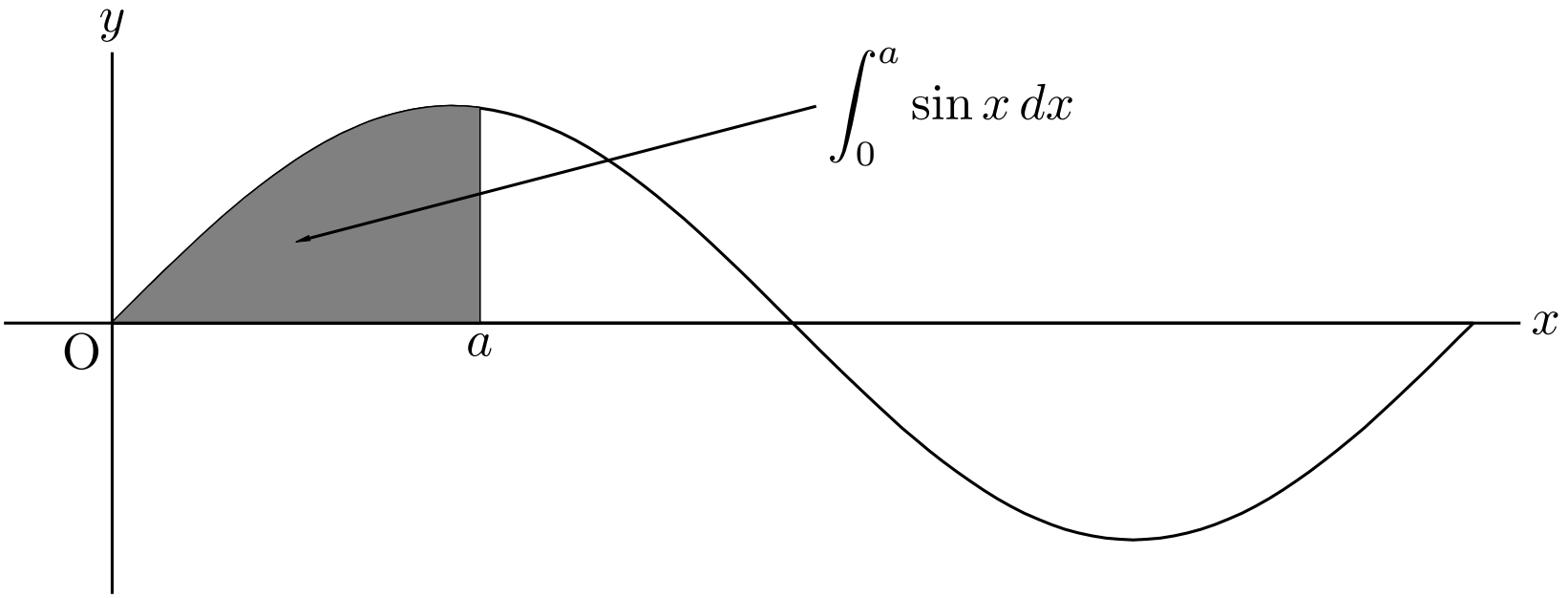
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

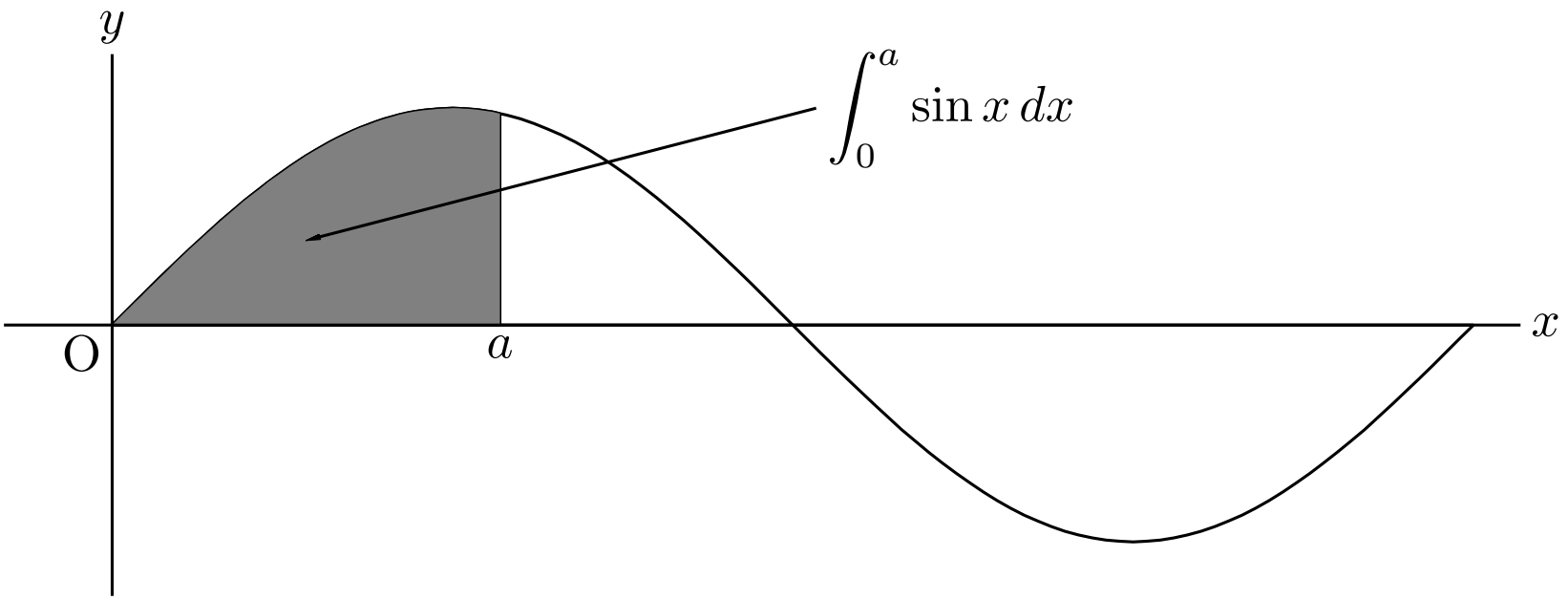
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

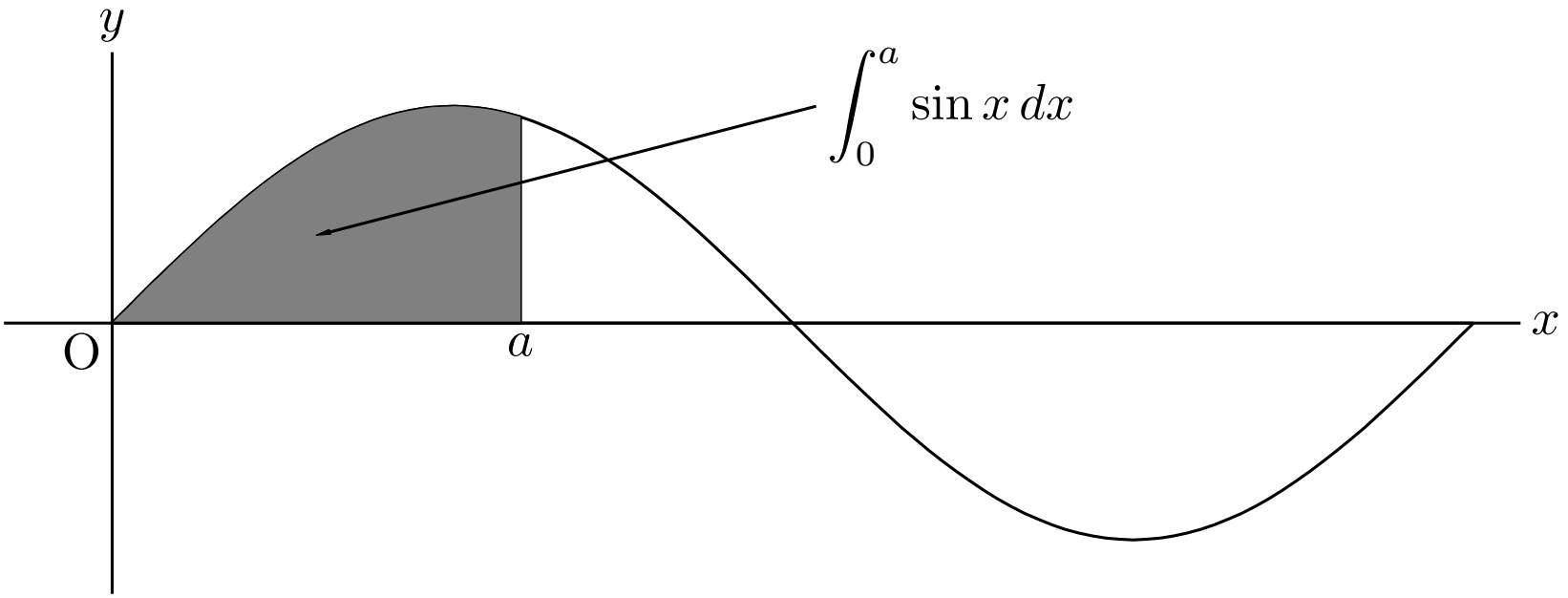
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

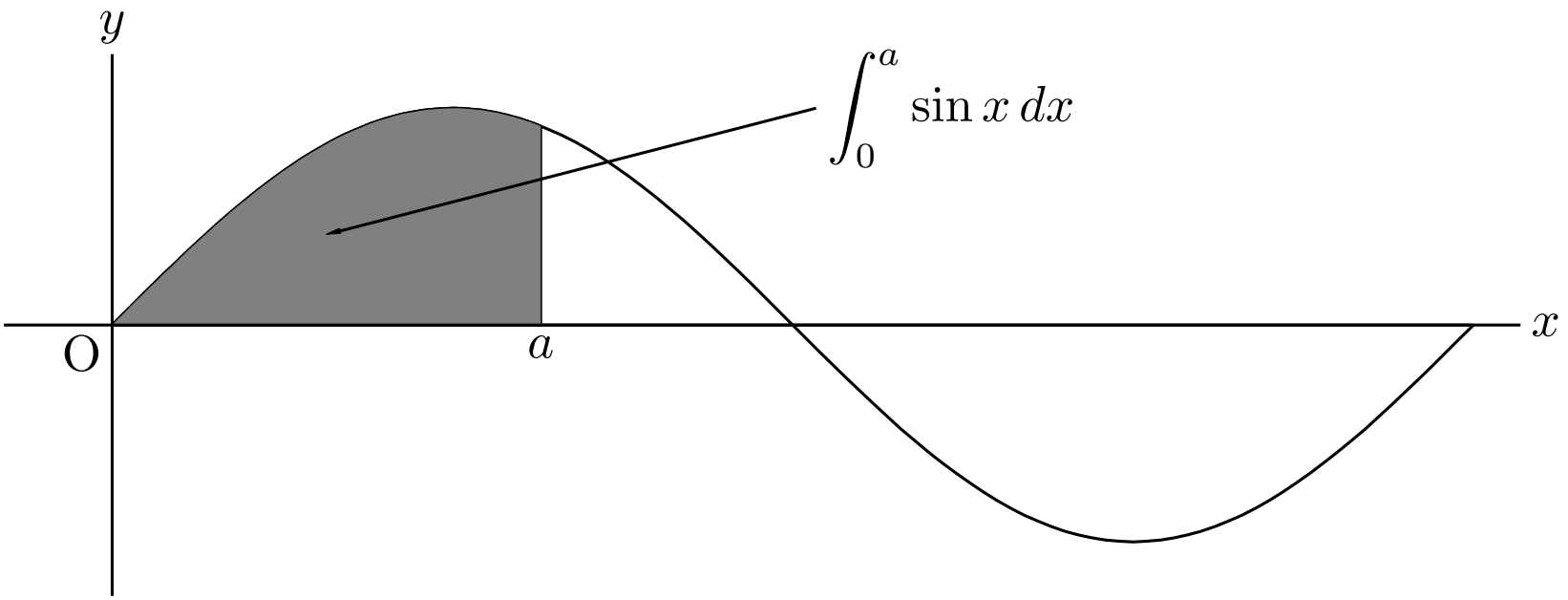
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

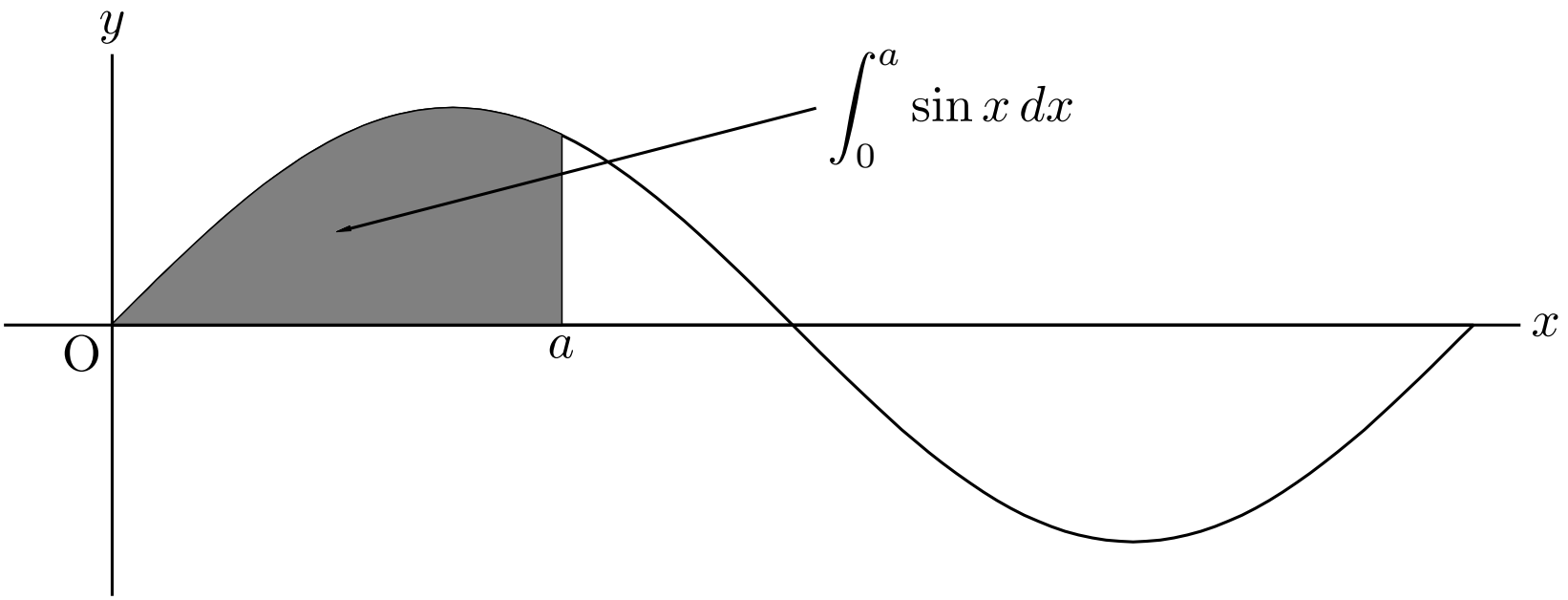
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

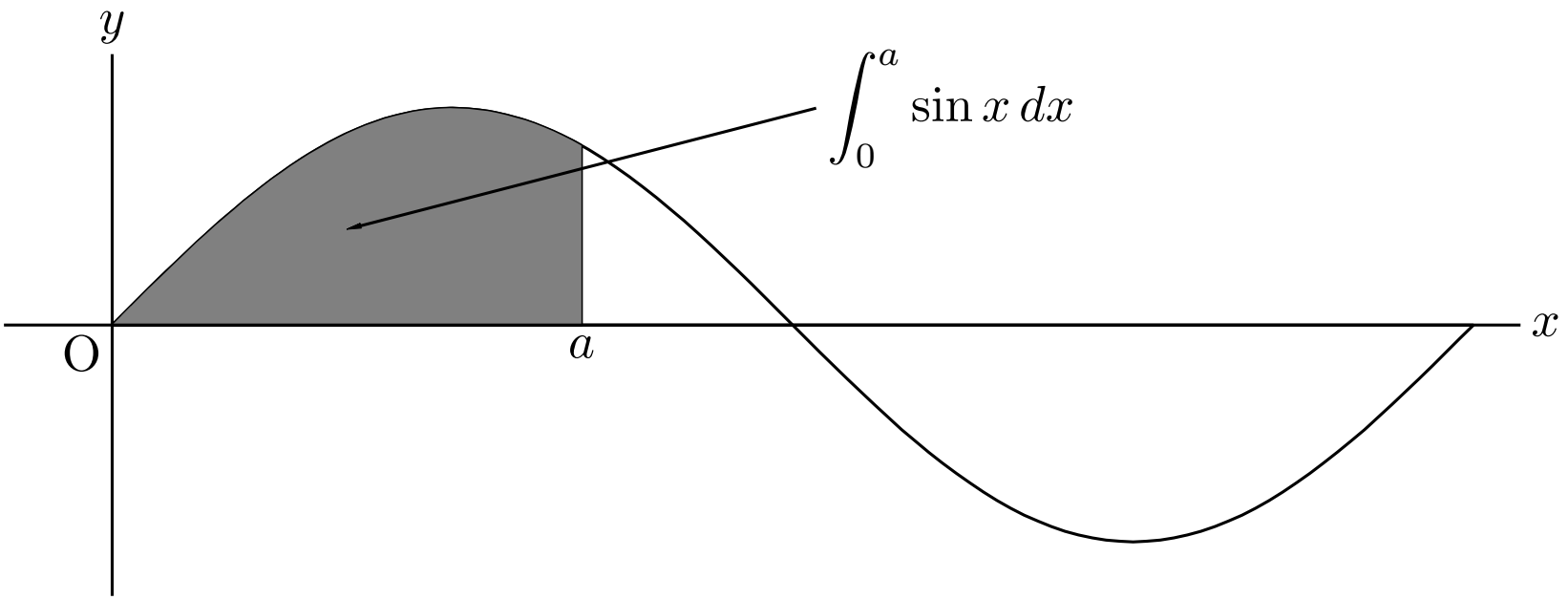
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

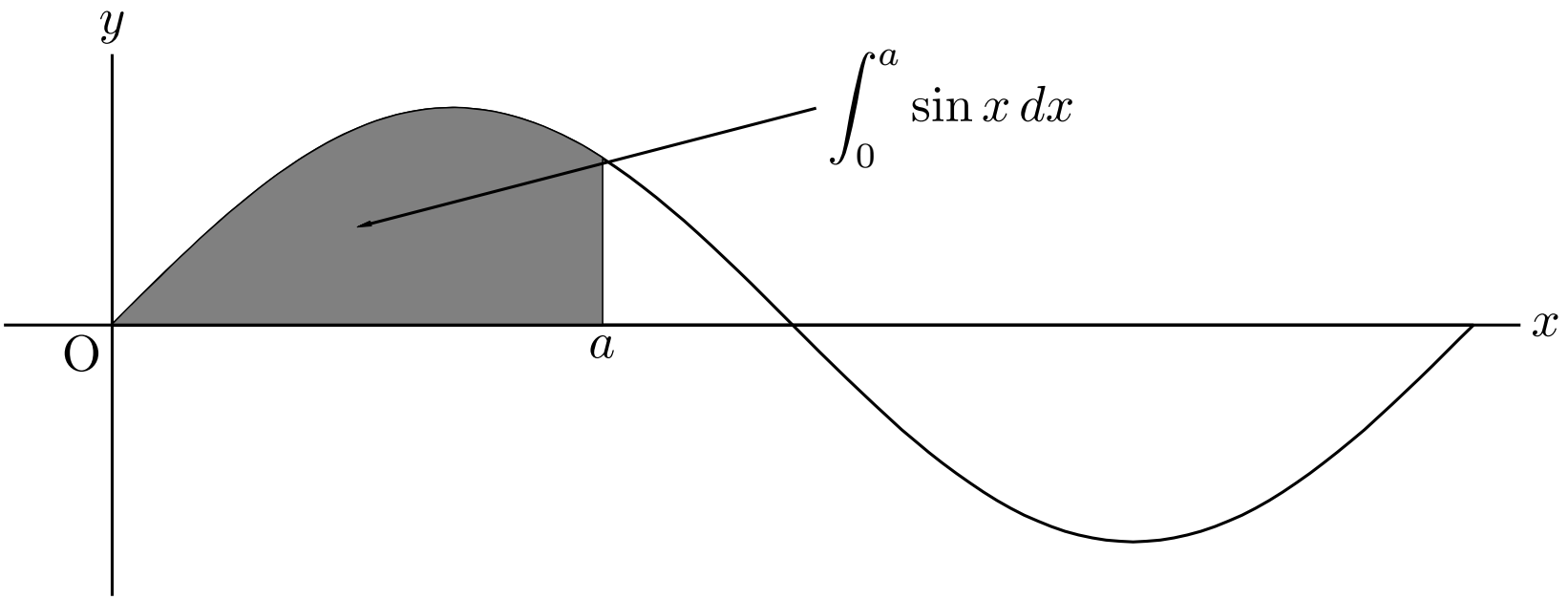
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

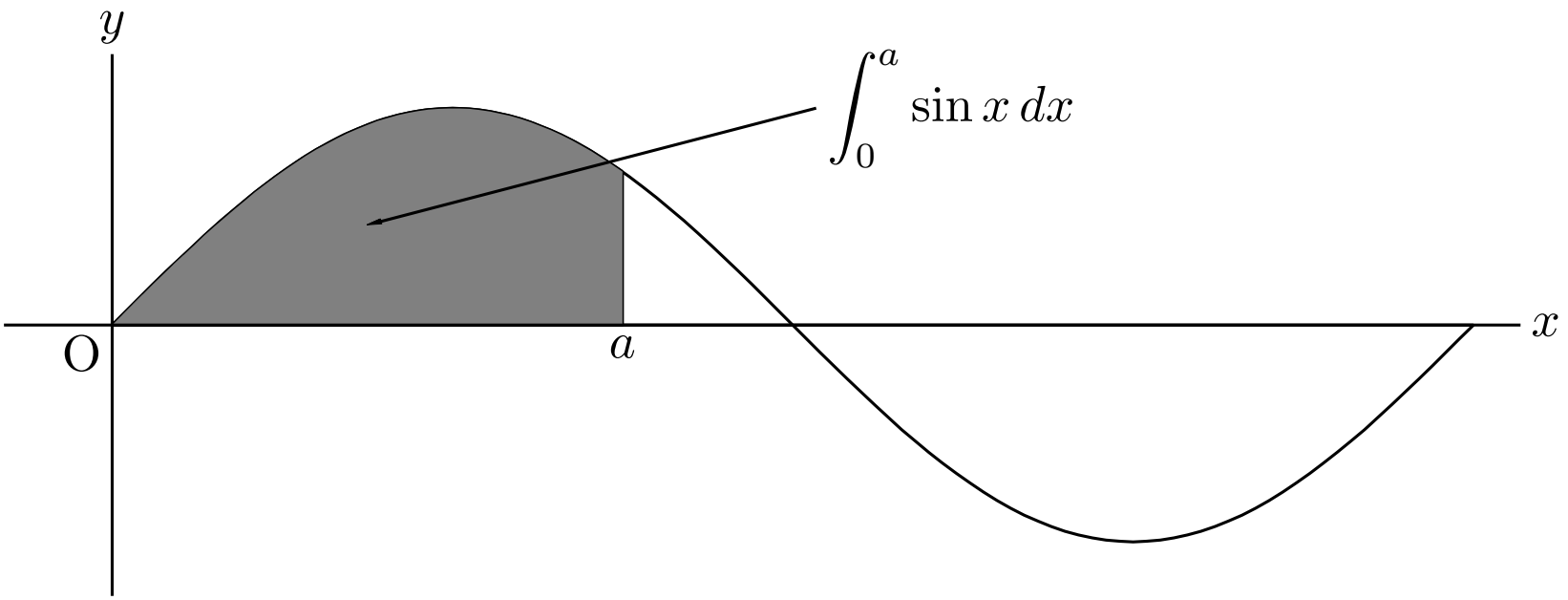
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

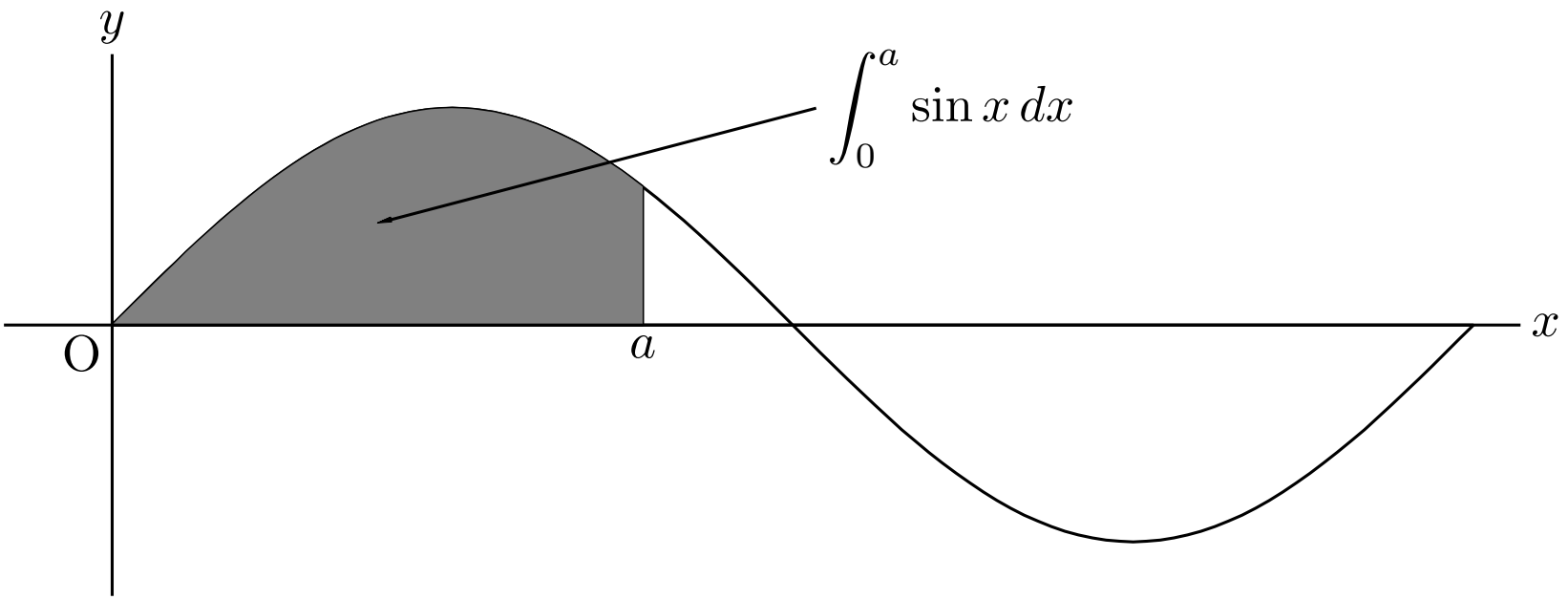
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

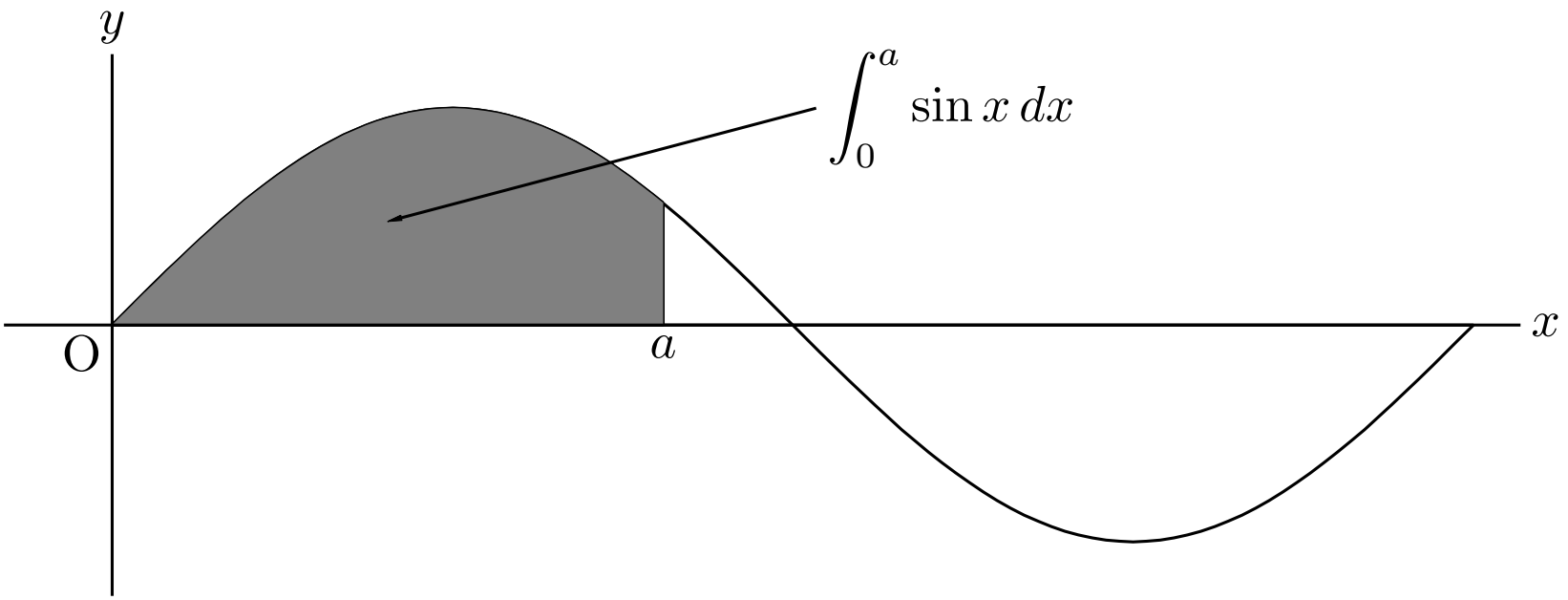
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

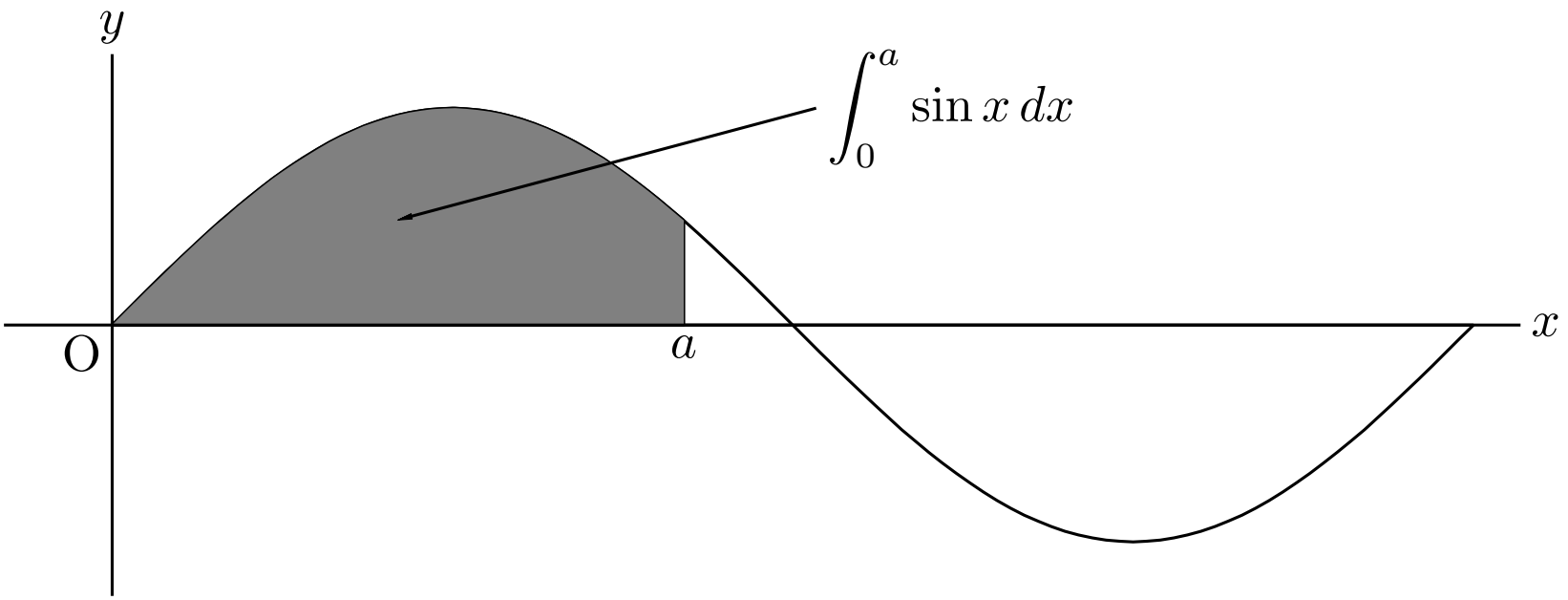
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

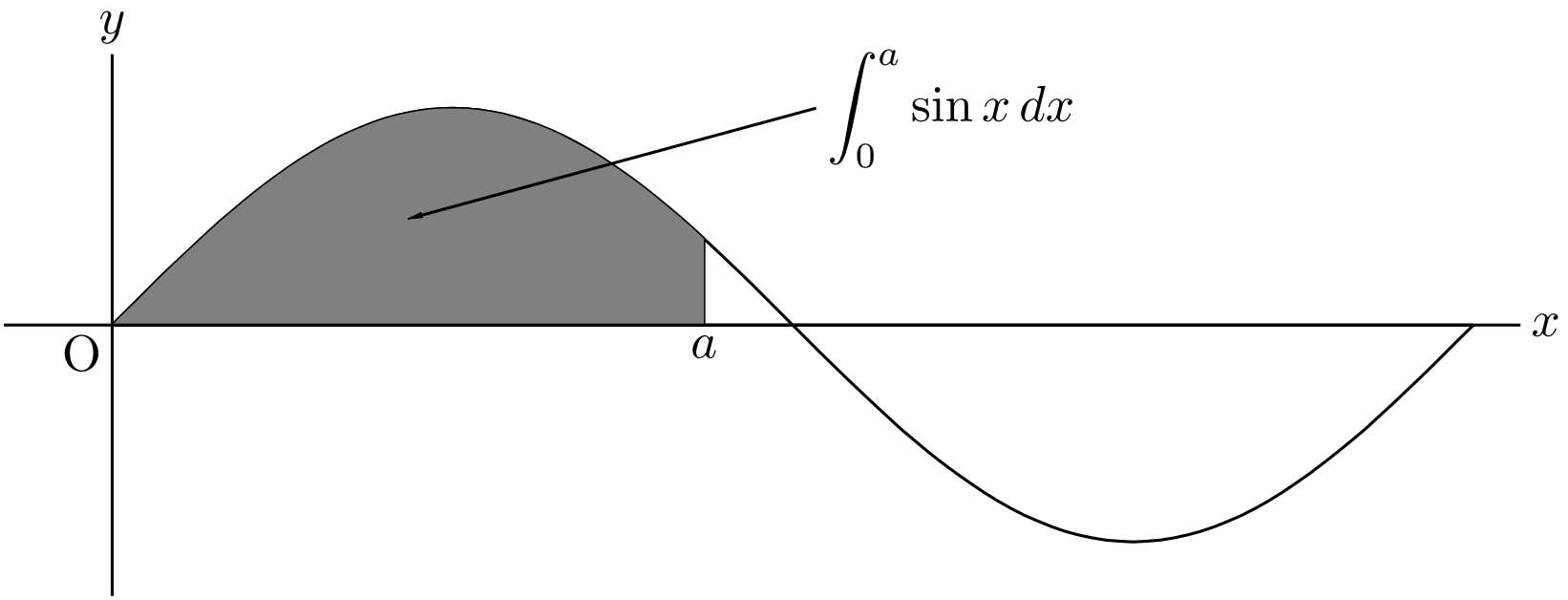
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

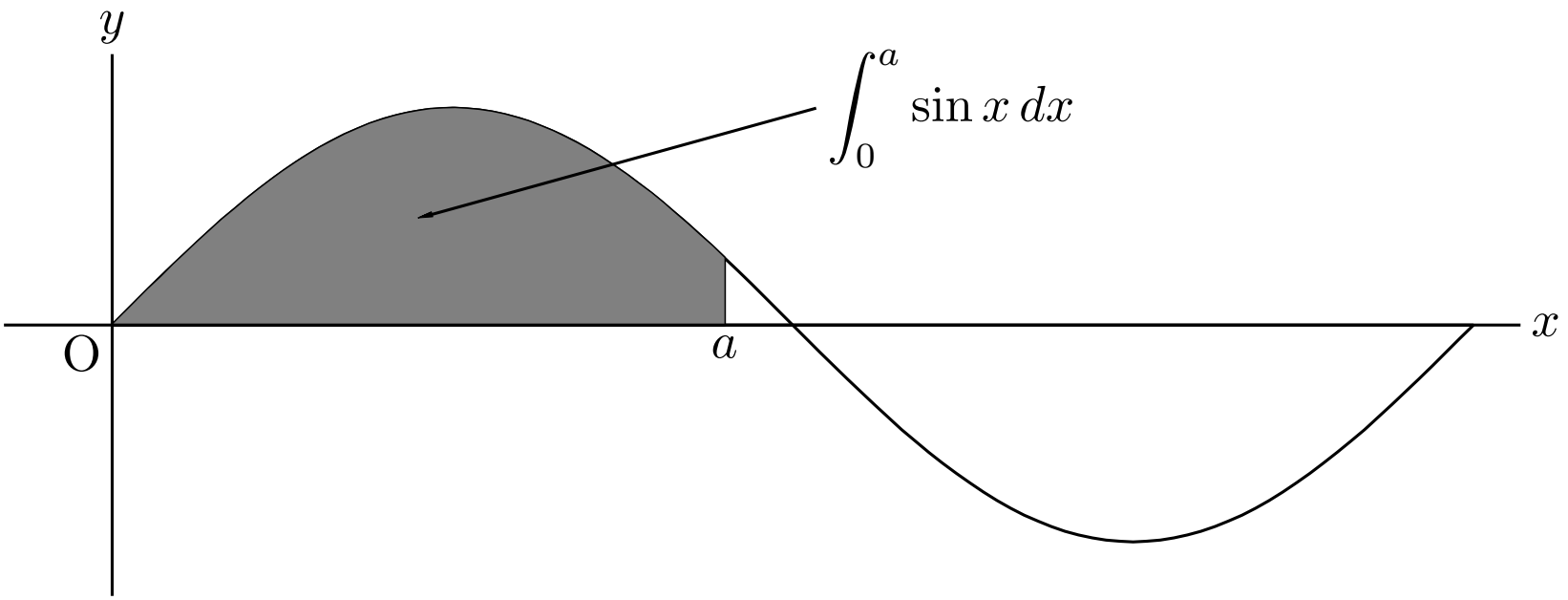
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

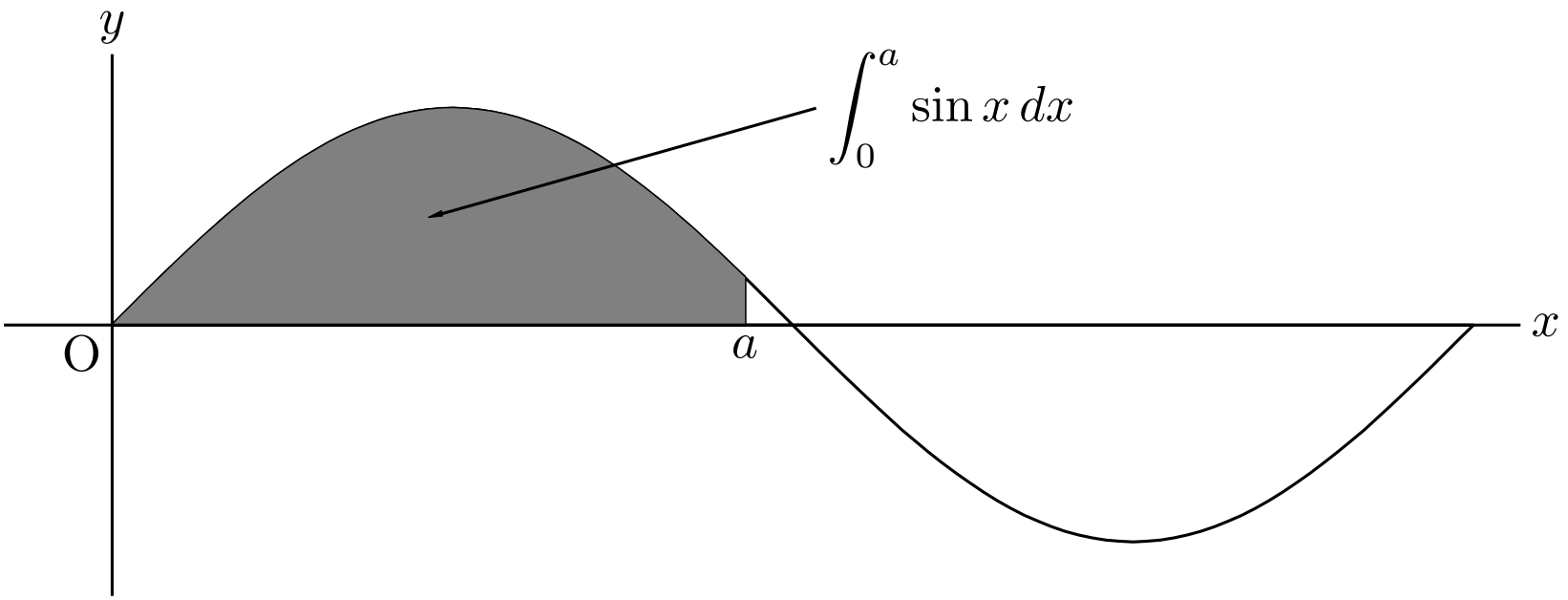
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

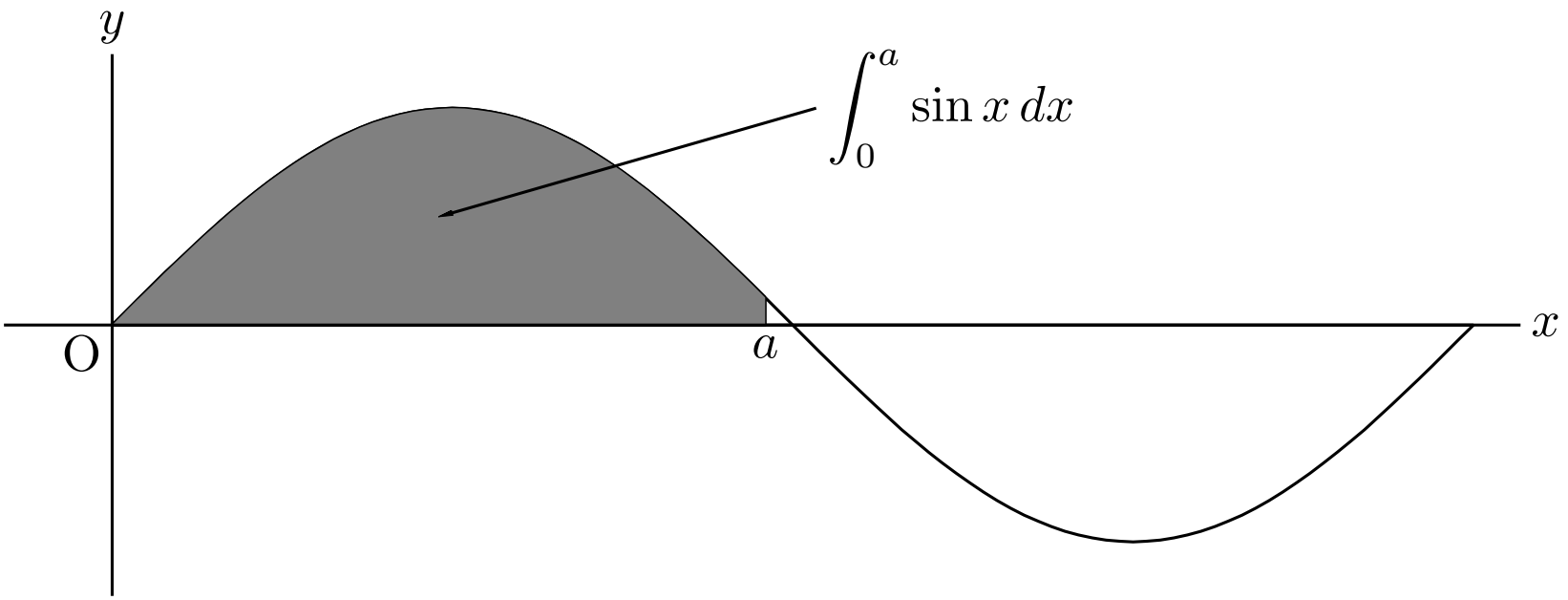
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

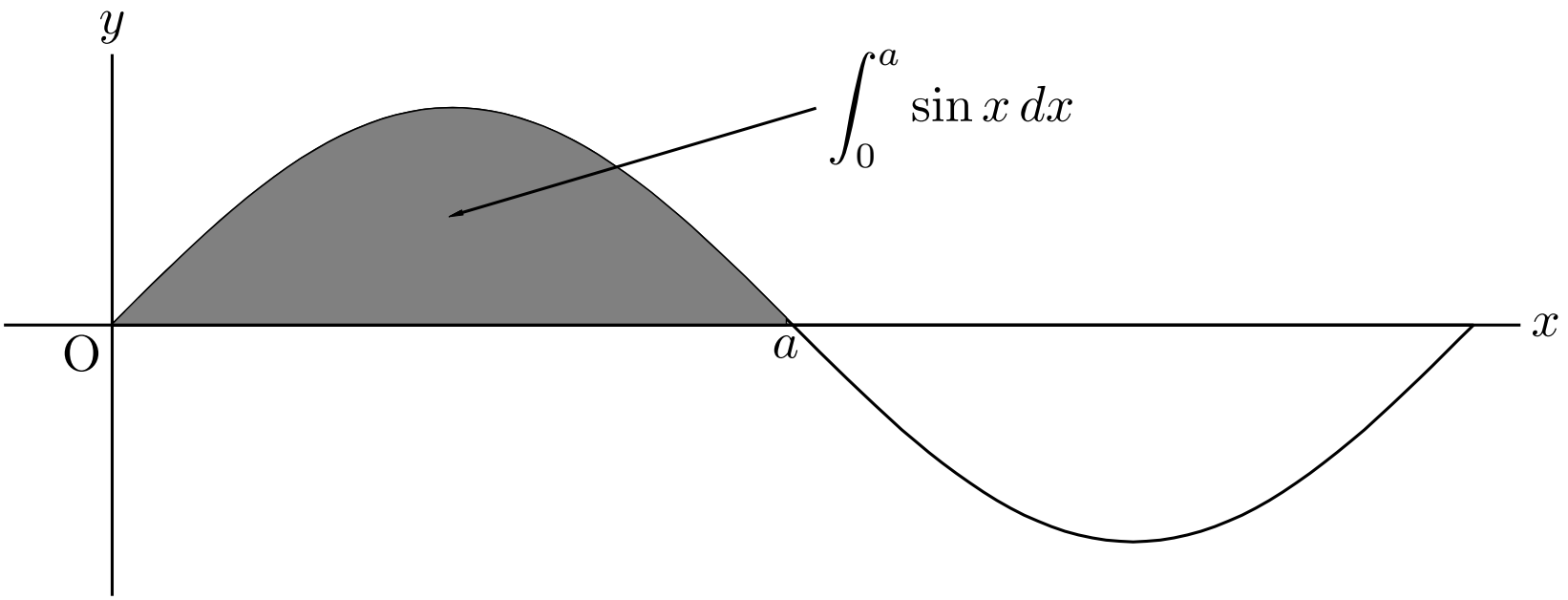
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

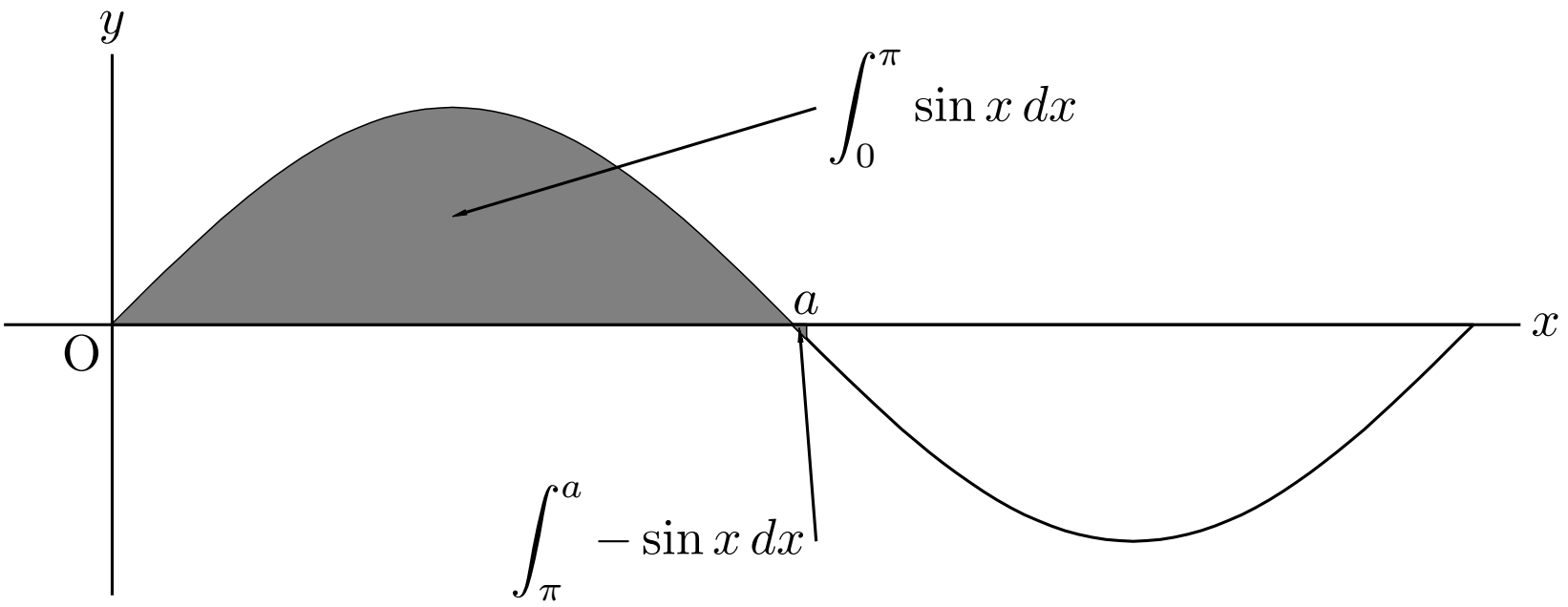
Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

2. Sample case of KETCindy use

Flexibly formatted TEX output

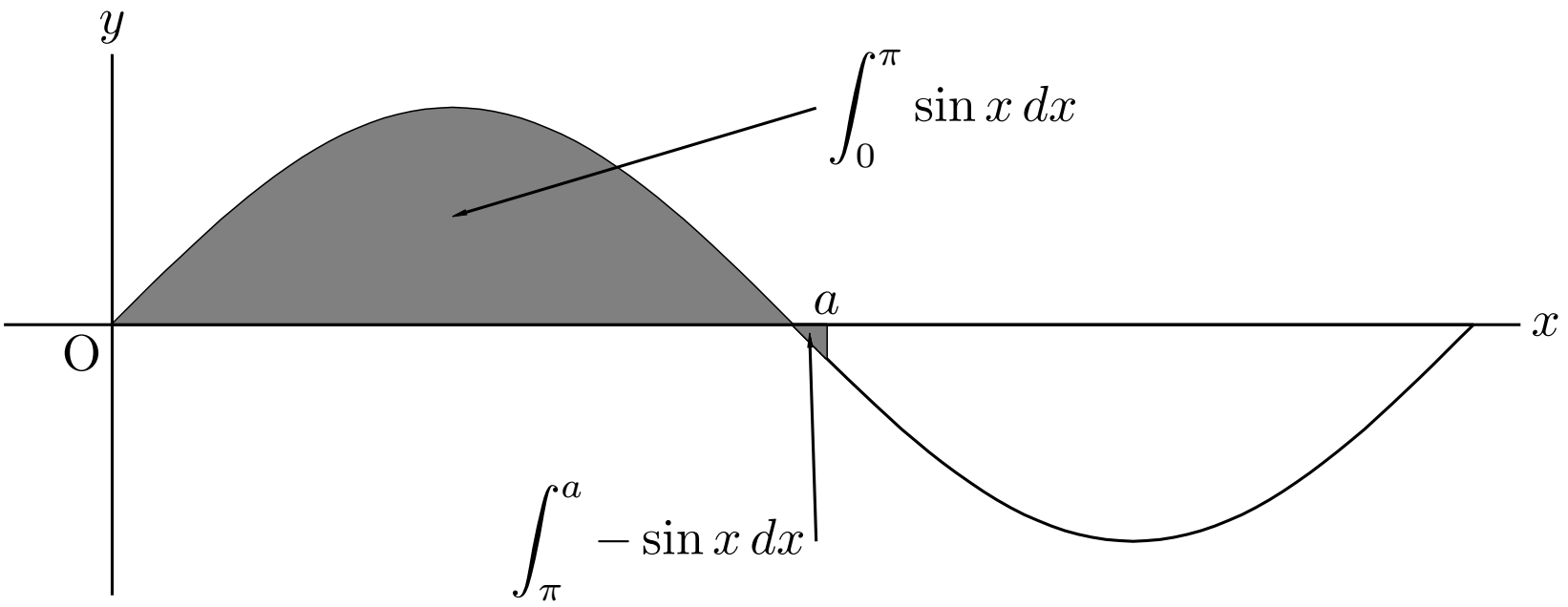


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

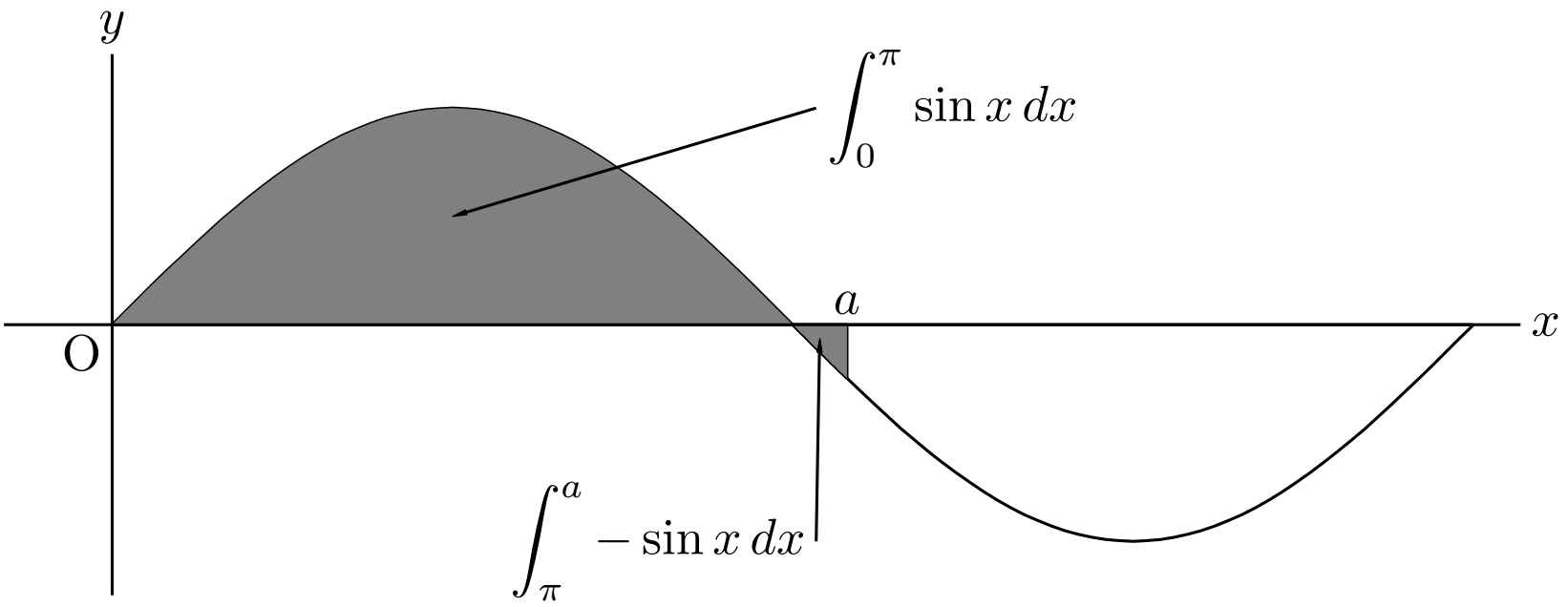


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

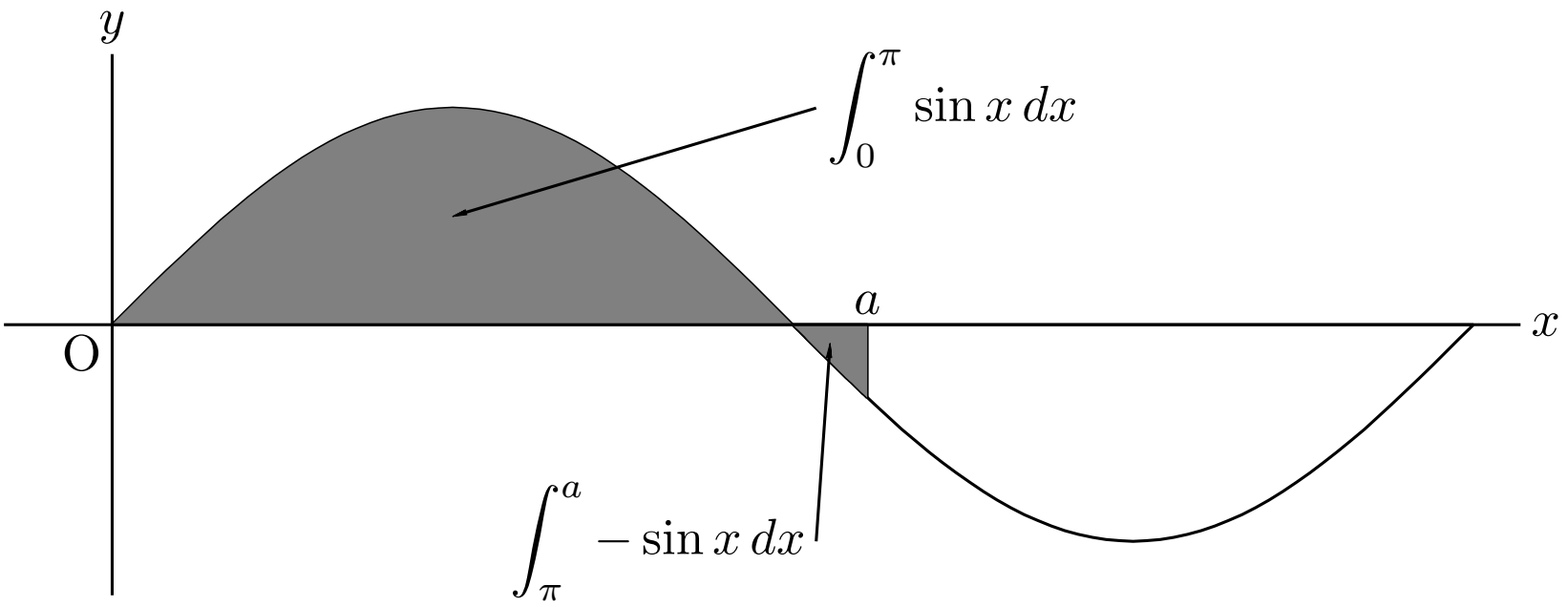


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

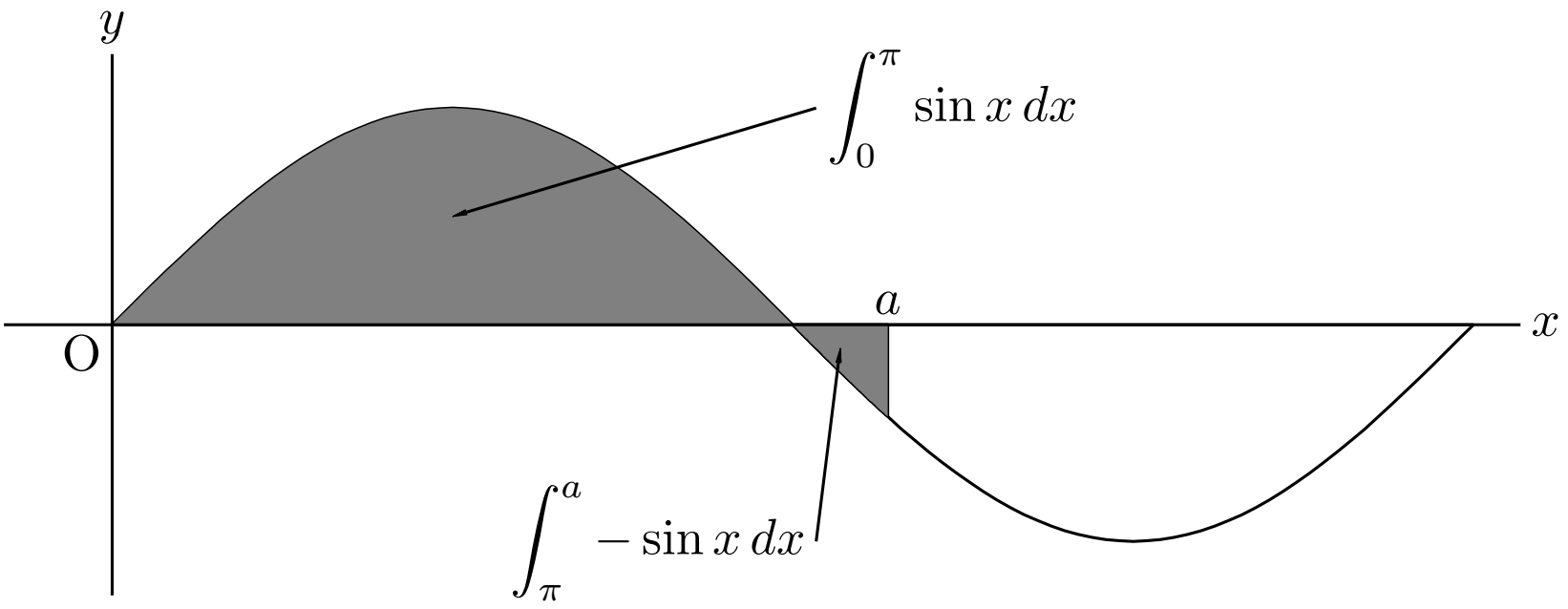


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

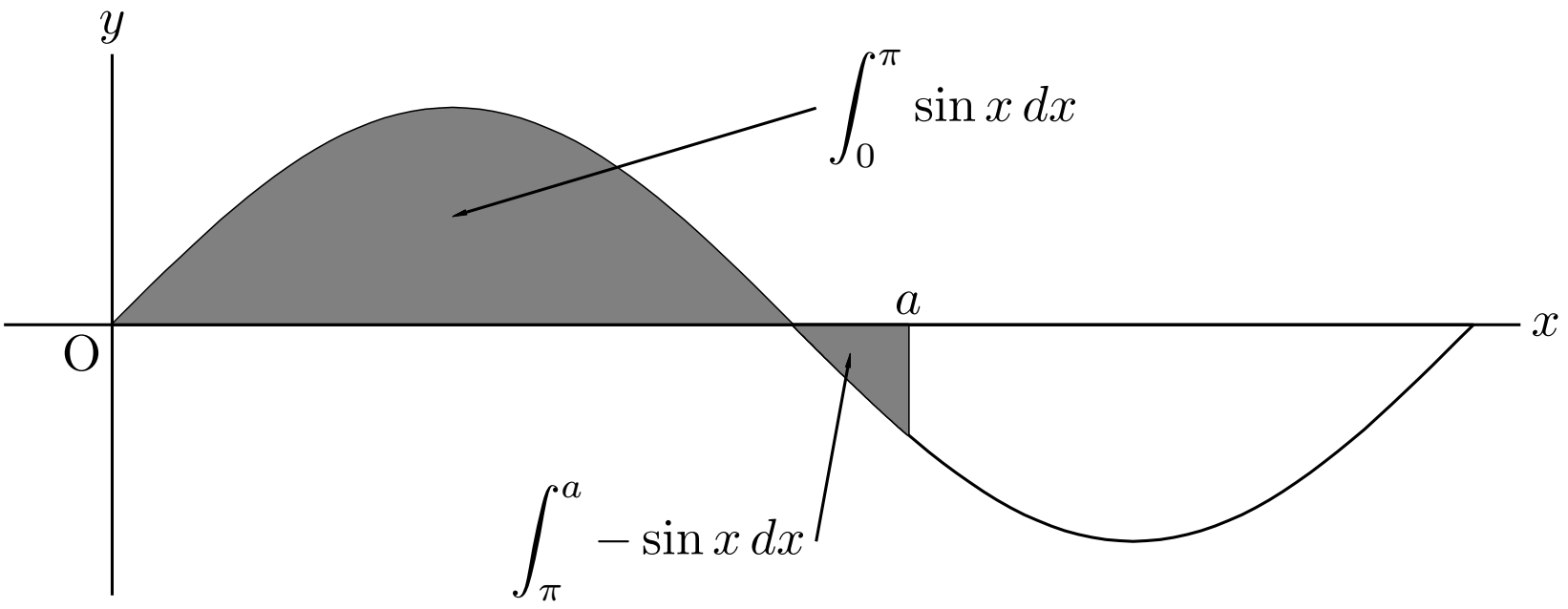


$$\int_0^a \sin x\,dx = \int_0^\pi \sin x\,dx - \int_\pi^a (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

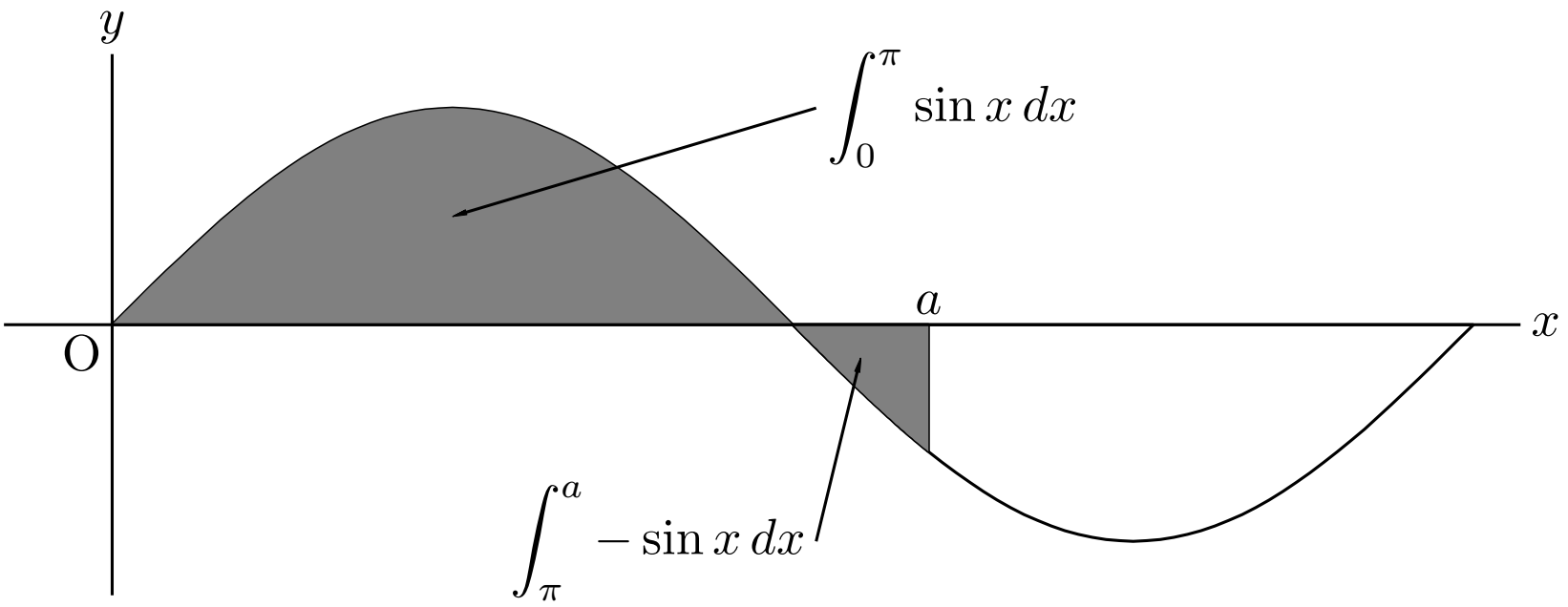


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

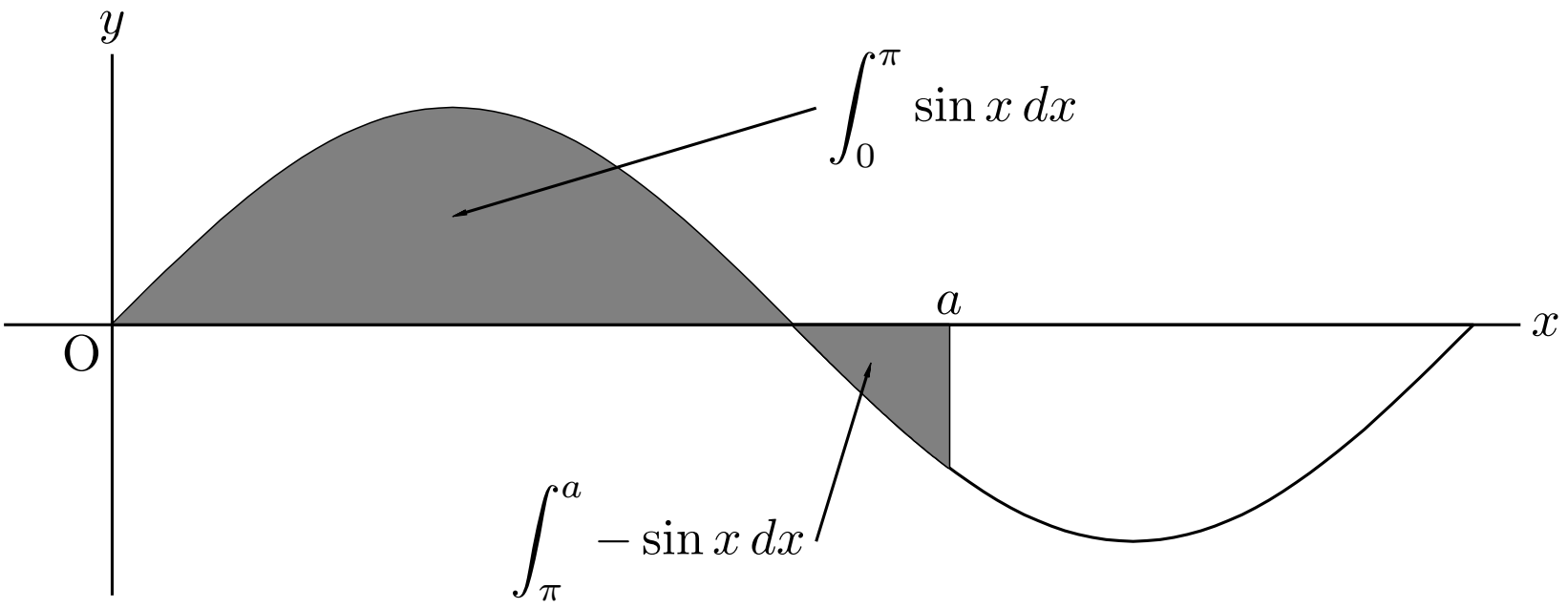


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

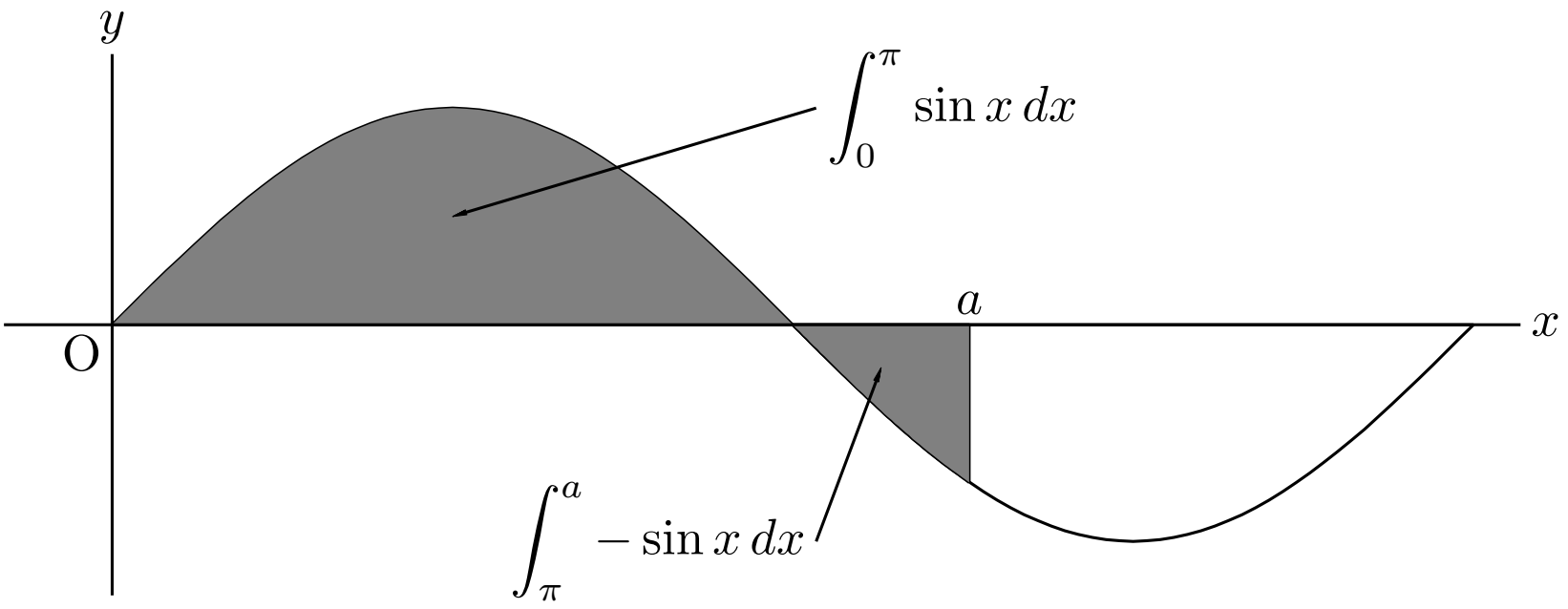


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

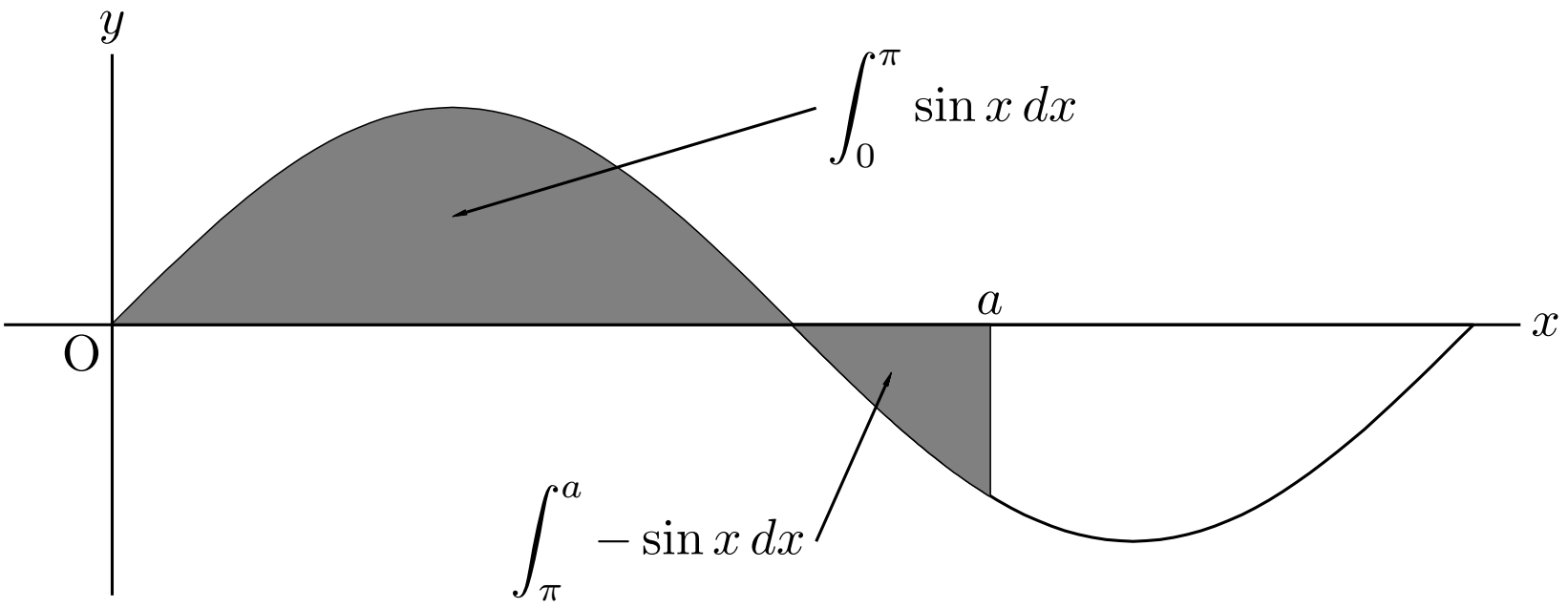


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

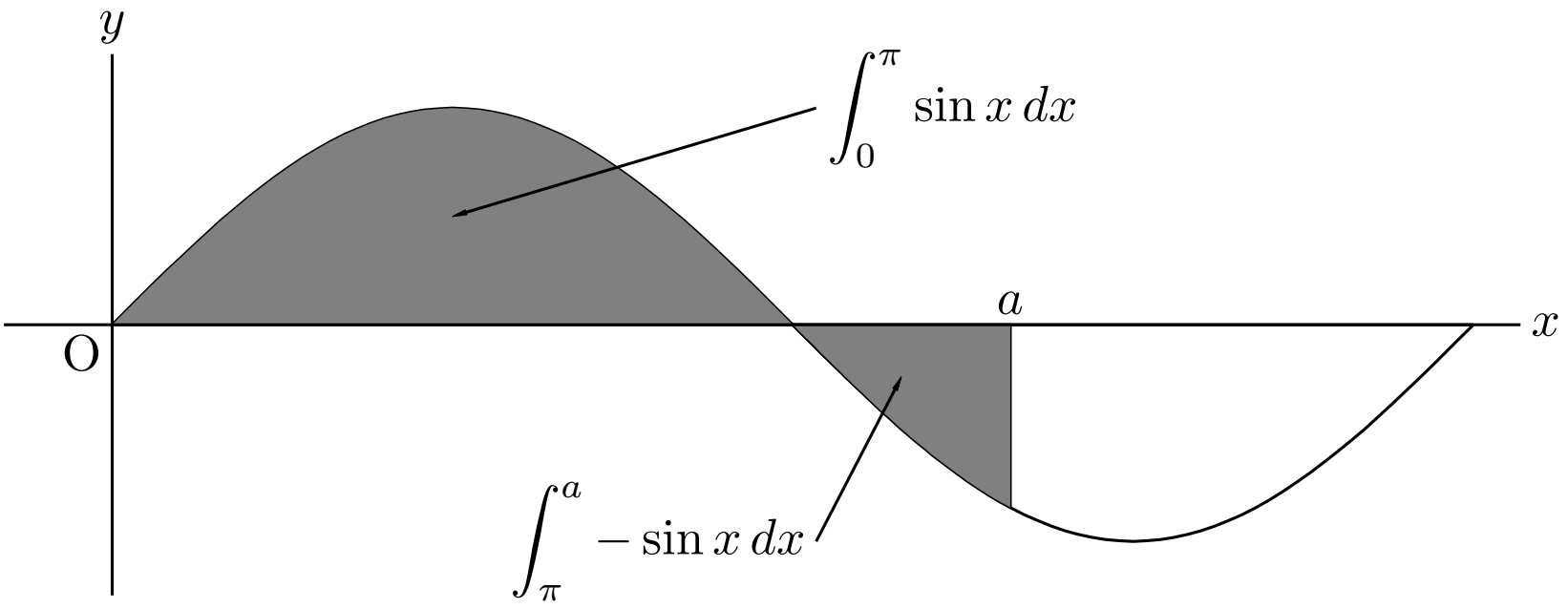


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

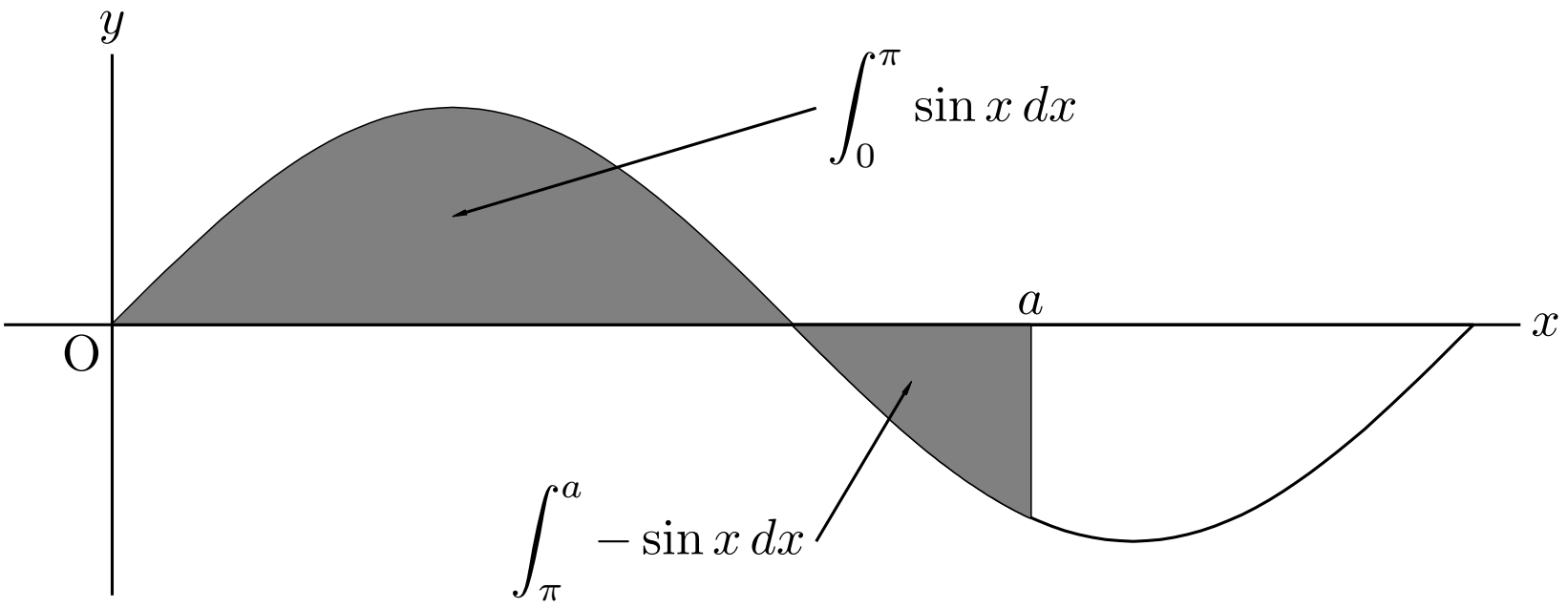


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

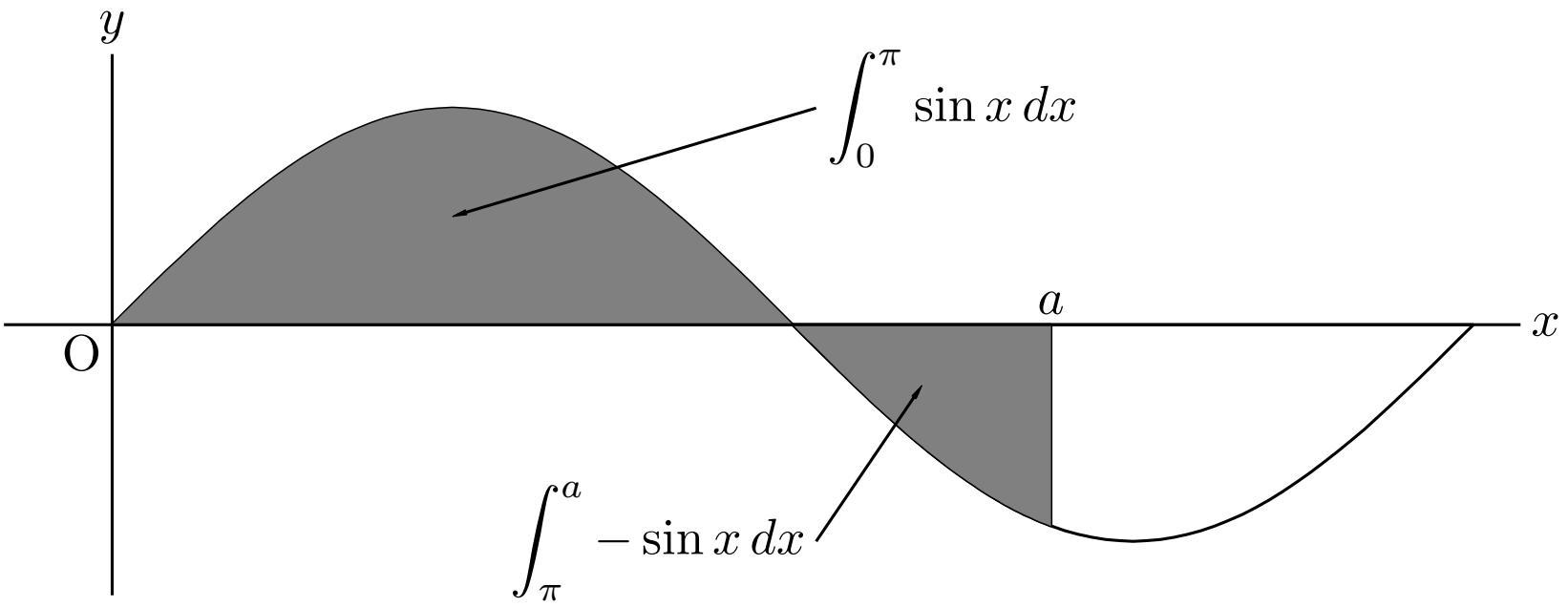


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

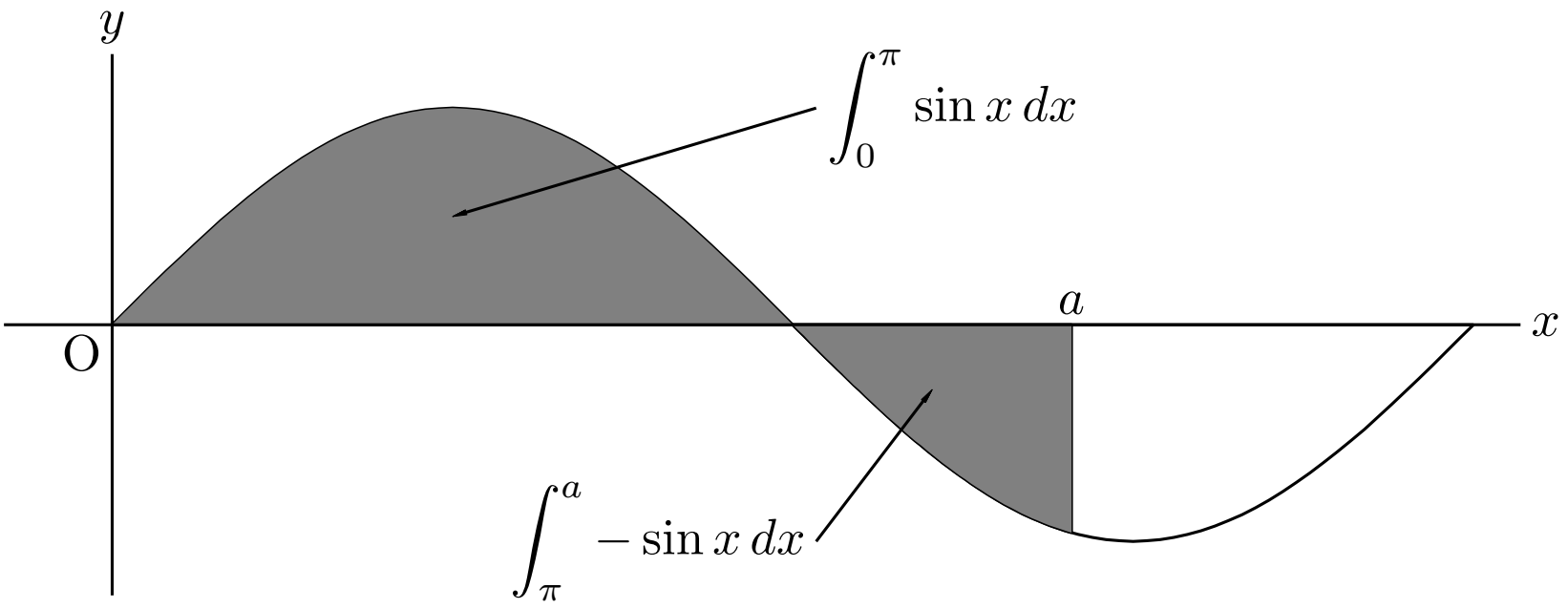


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

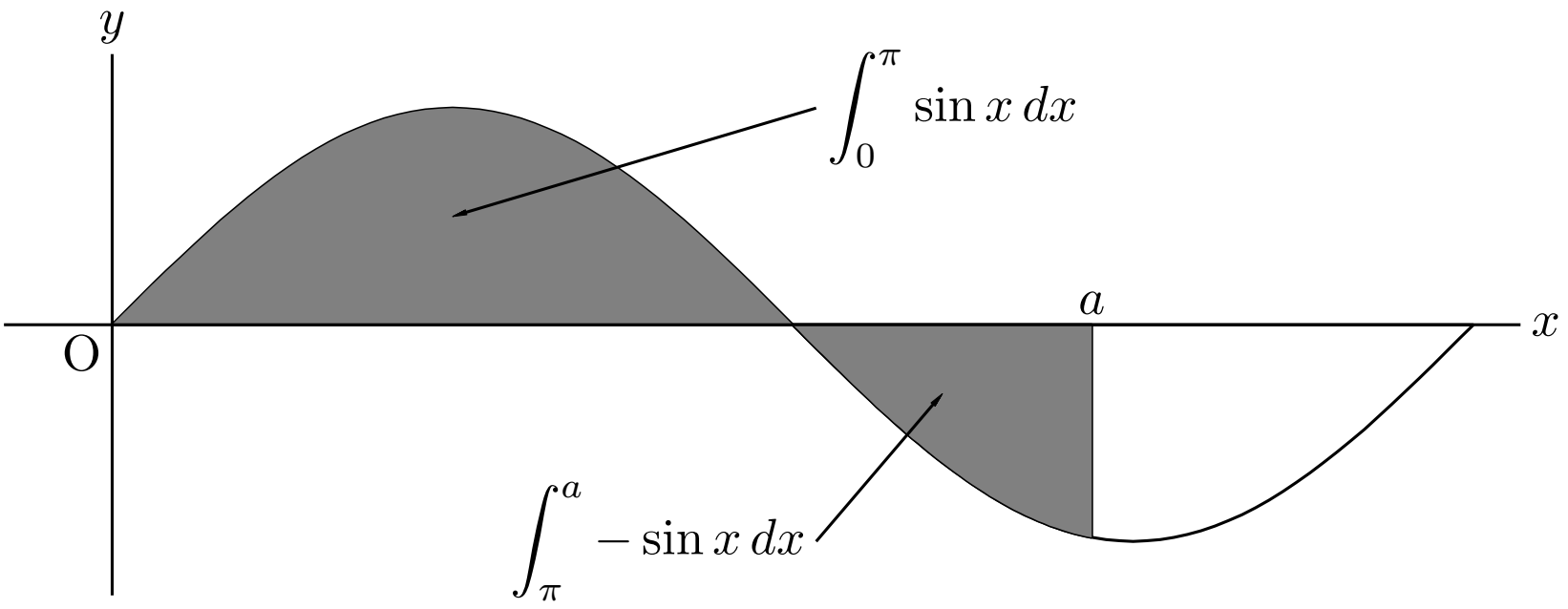


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

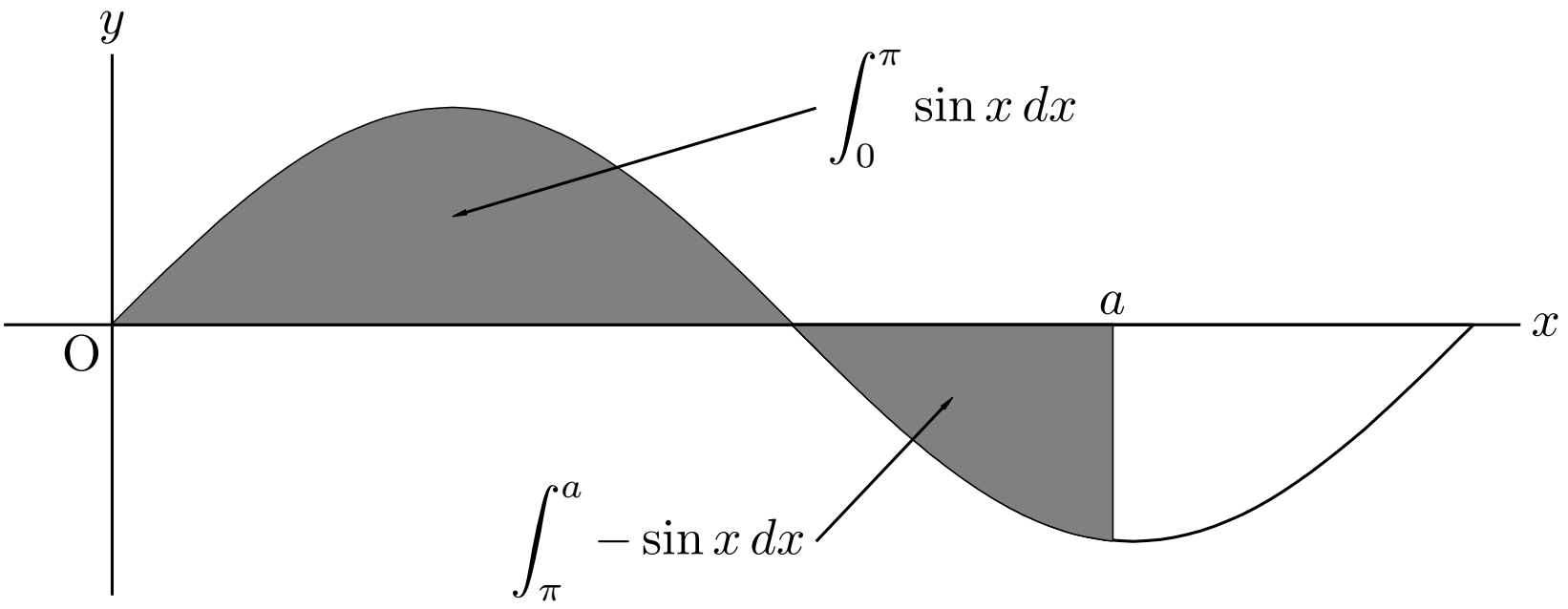


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output

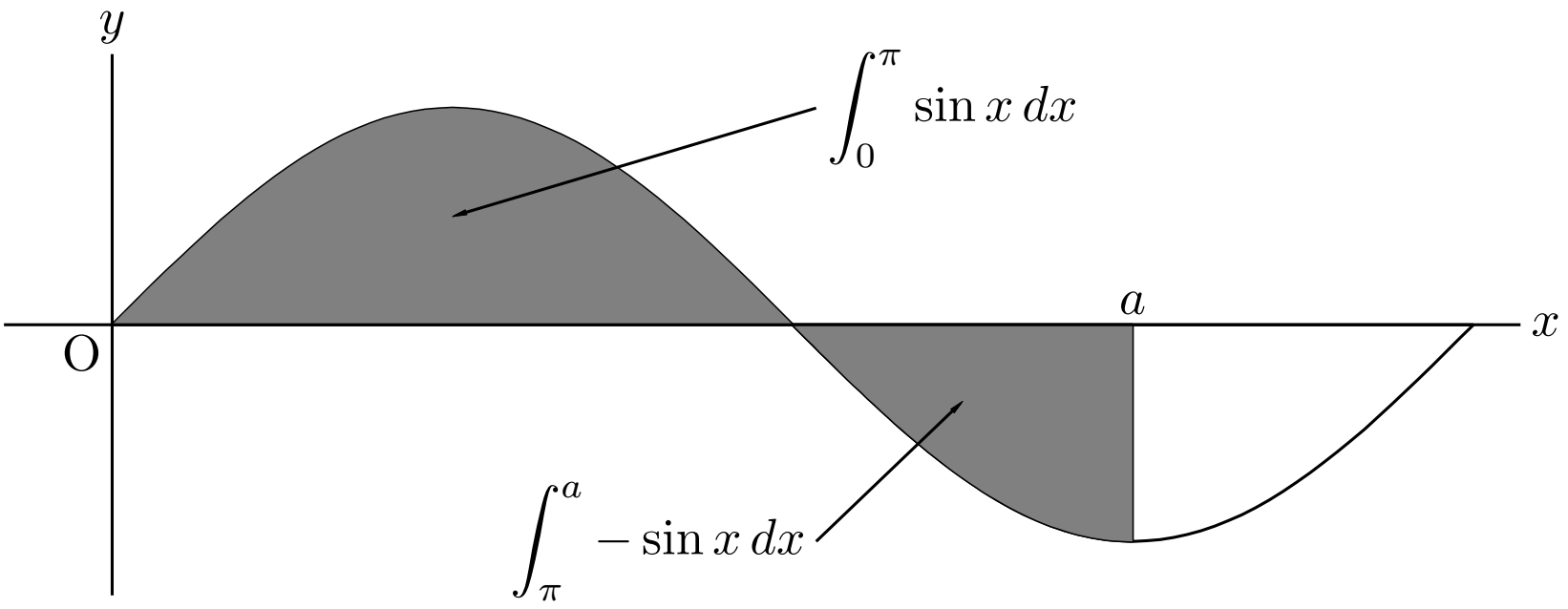


$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST LAST

2. Sample case of KETCindy use

Flexibly formatted TEX output



$$\int_0^a \sin x\,dx = \int_0^{\pi} \sin x\,dx - \int_{\pi}^{a} (-\sin x)\,dx \qquad (a > \pi)$$

FIRST

LAST

3. Collaborative use with Maxima

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

3. Collaborative use with Maxima

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

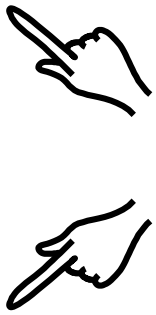
+

Symbolically computed results which must be transformed for DGS and TEX use

3. Collaborative use with Maxima

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

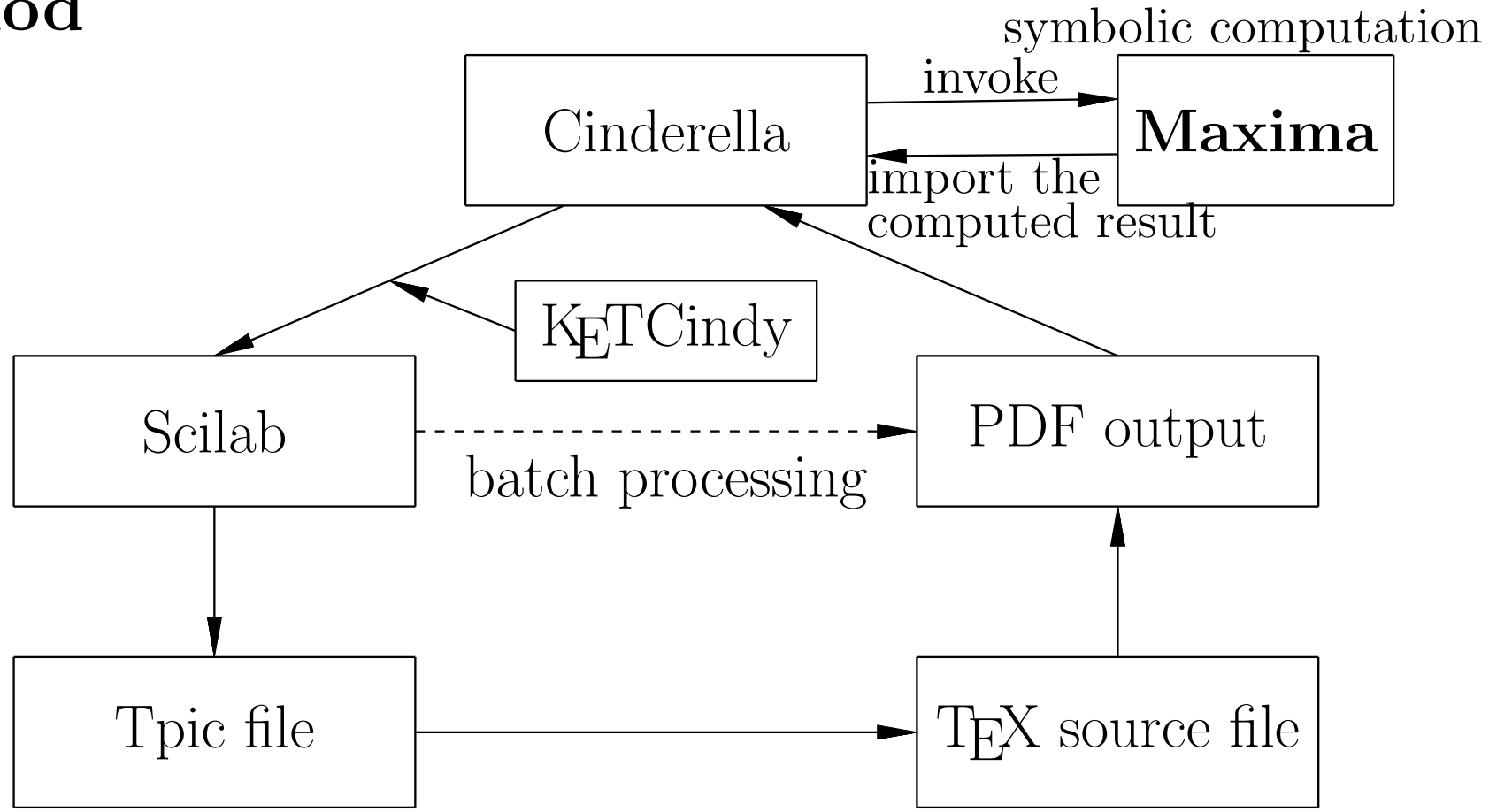


\+ How to synchronize?

Symbolically computed results which must be transformed for DGS and TEX use

3. Collaborative use with Maxima

Method



3. Collaborative use with Maxima

Example

In GeoGebra, points A, B, C, and D are chosen.
Construct a cubic polynomial through those points.
Draw a tangent line in arbitrary point $(x,\ p(x))$.

3. Collaborative use with Maxima

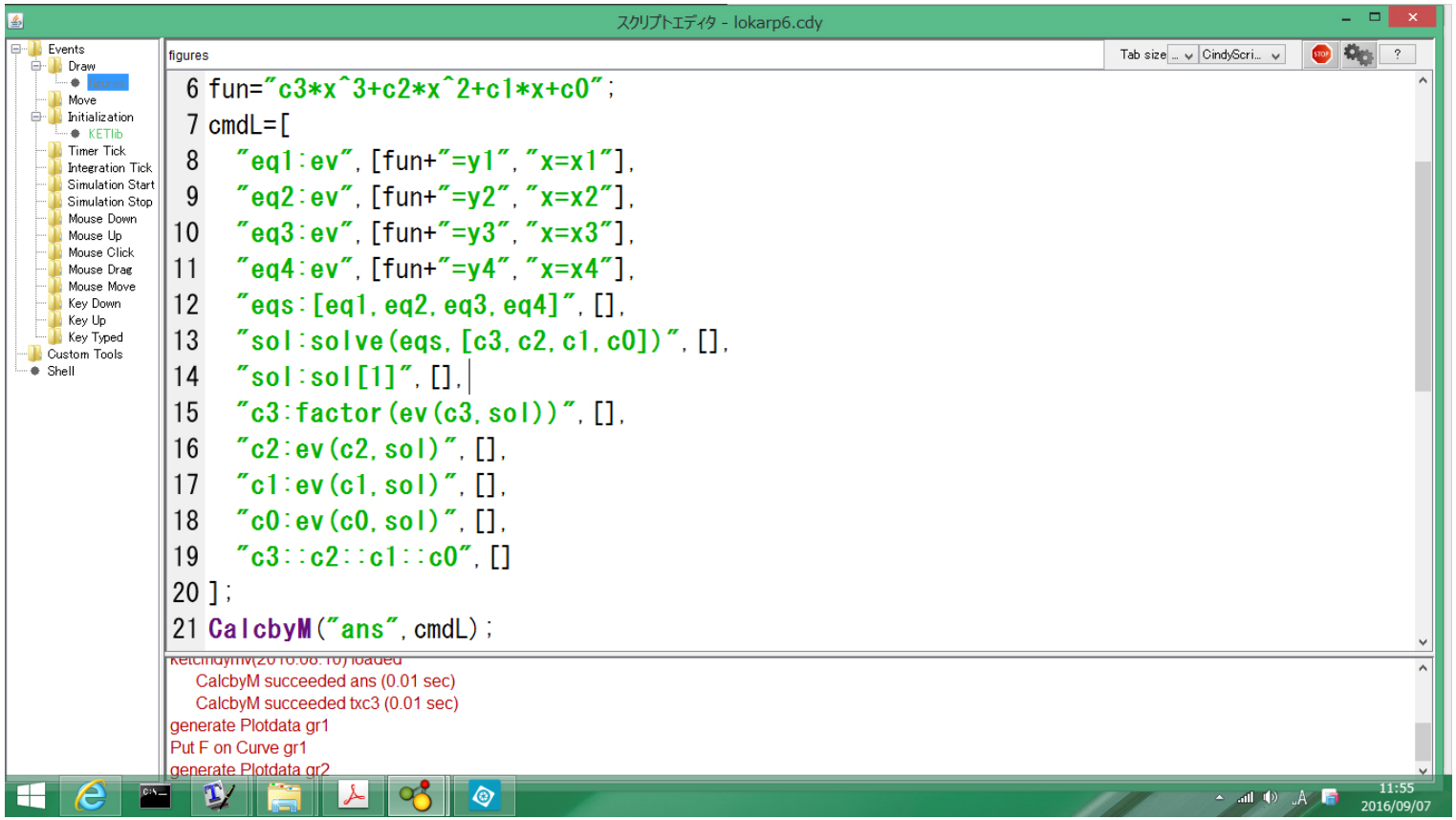
Example

In GeoGebra, points A, B, C, and D are chosen. Construct a cubic polynomial through those points. Draw a tangent line in arbitrary point $(x,\ p(x))$.

- This problem is also solvable by the collabortive use of Cinderella/KETCindy and Maxima
- The KETCindy command "Mxtex" converts the result computed by Maxima into TEX readable form

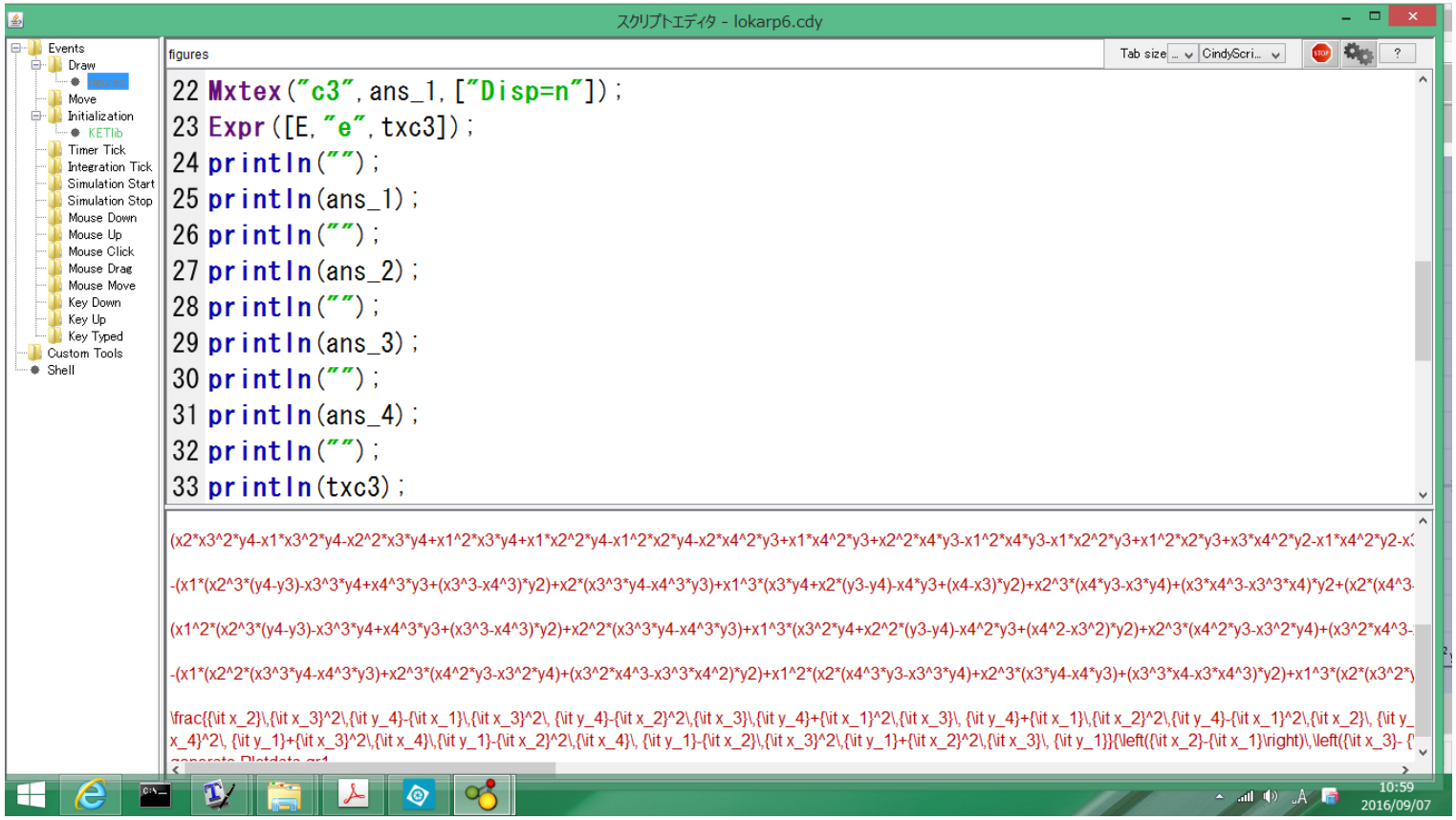
3. Collaborative use with Maxima

Cindyscript screen (invoking Maxima)



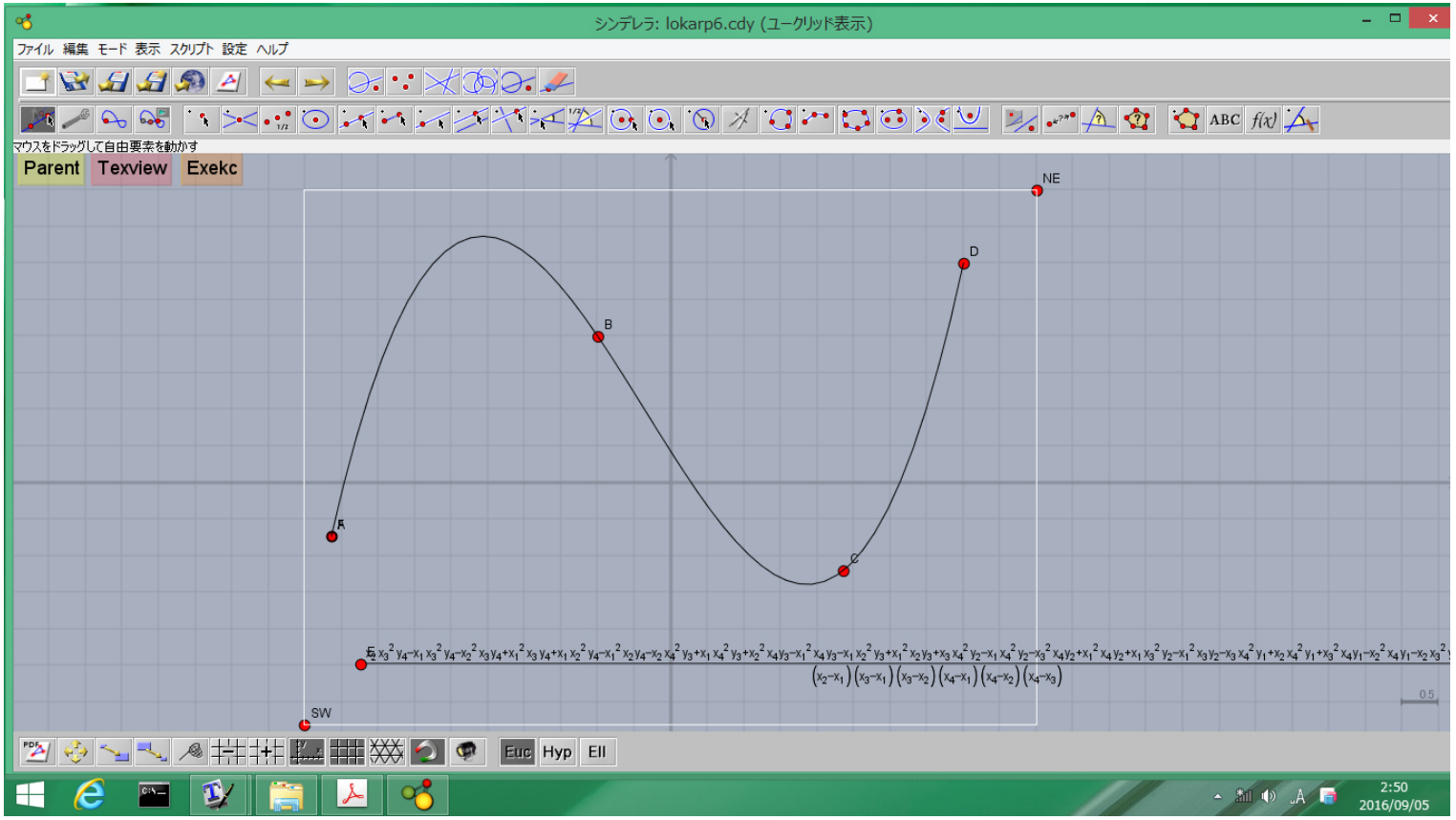
3. Collaborative use with Maxima

Cindyscript screen (Outputs and conversion)



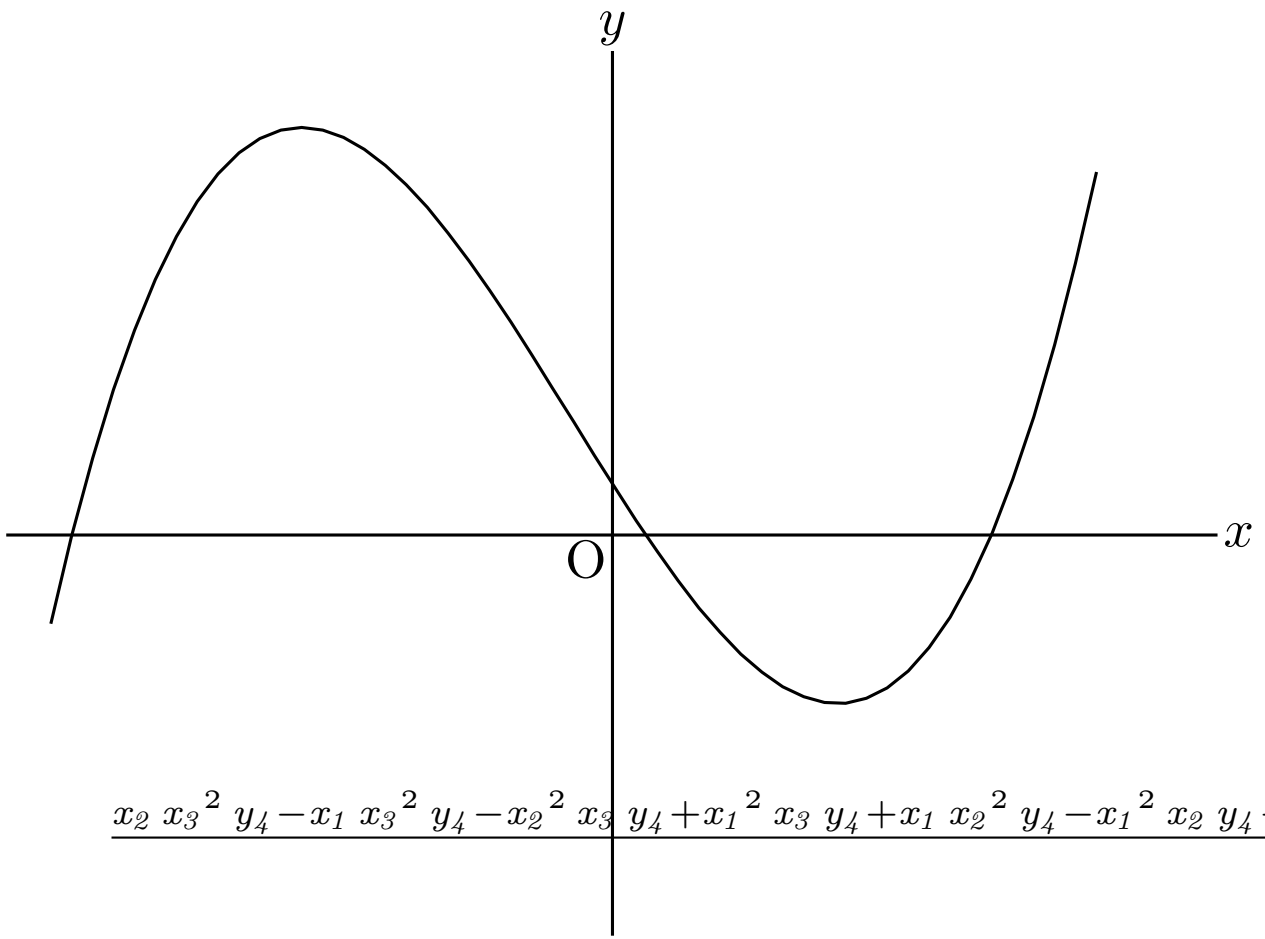
3. Collaborative use with Maxima

Cinderella screen



3. Collaborative use with Maxima

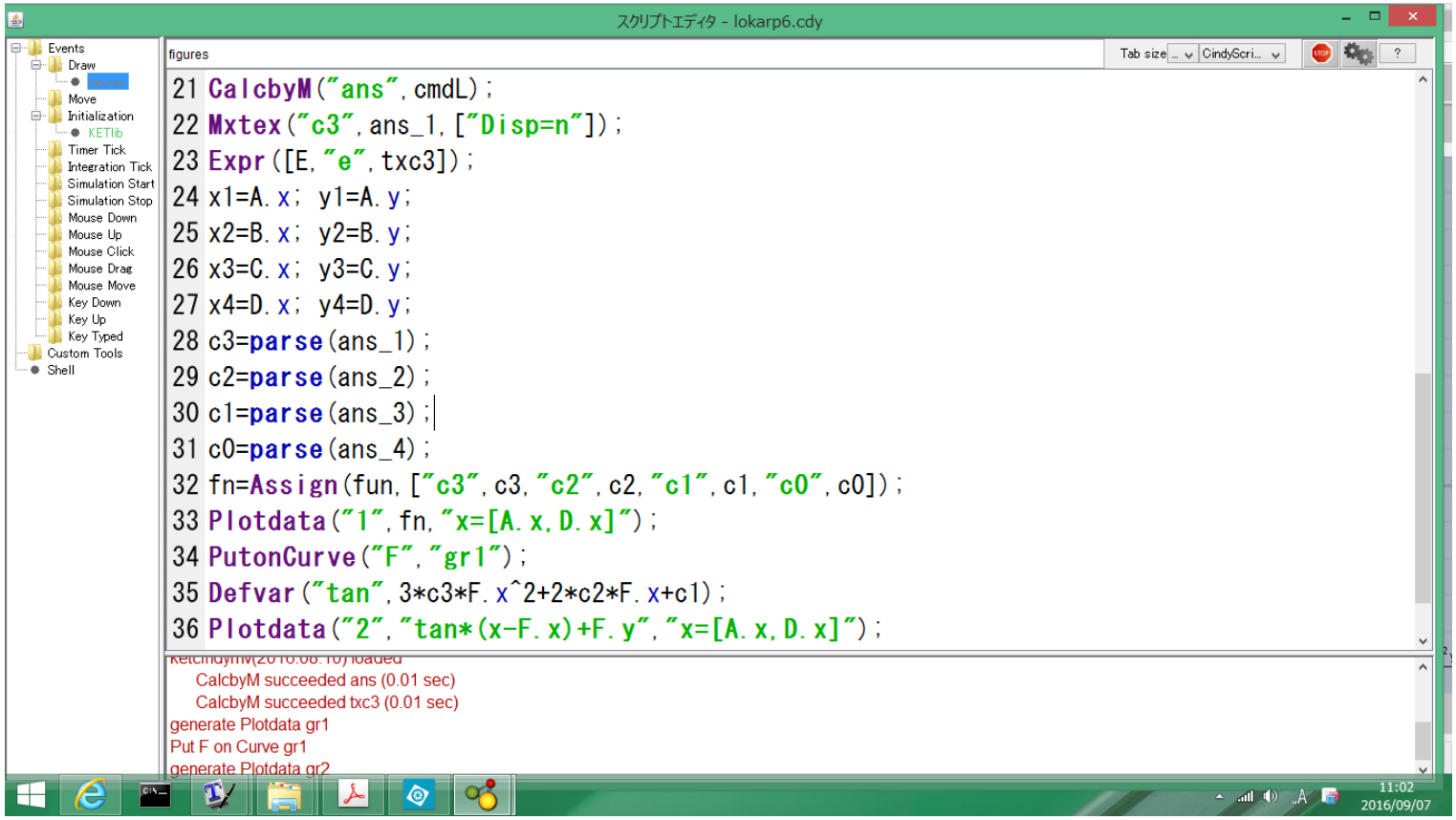
TEX outpout



$$x_2\ {x_3}^2\ y_4 - x_1\ {x_3}^2\ y_4 - {x_2}^2\ x_3\ y_4 + {x_1}^2\ x_3\ y_4 + x_1\ {x_2}^2\ y_4 - {x_1}^2\ x_2\ y_4 - x_2\ {x_4}^2\ y_3 + x_1\ {x_4}^2\ y_3 + x_2$$

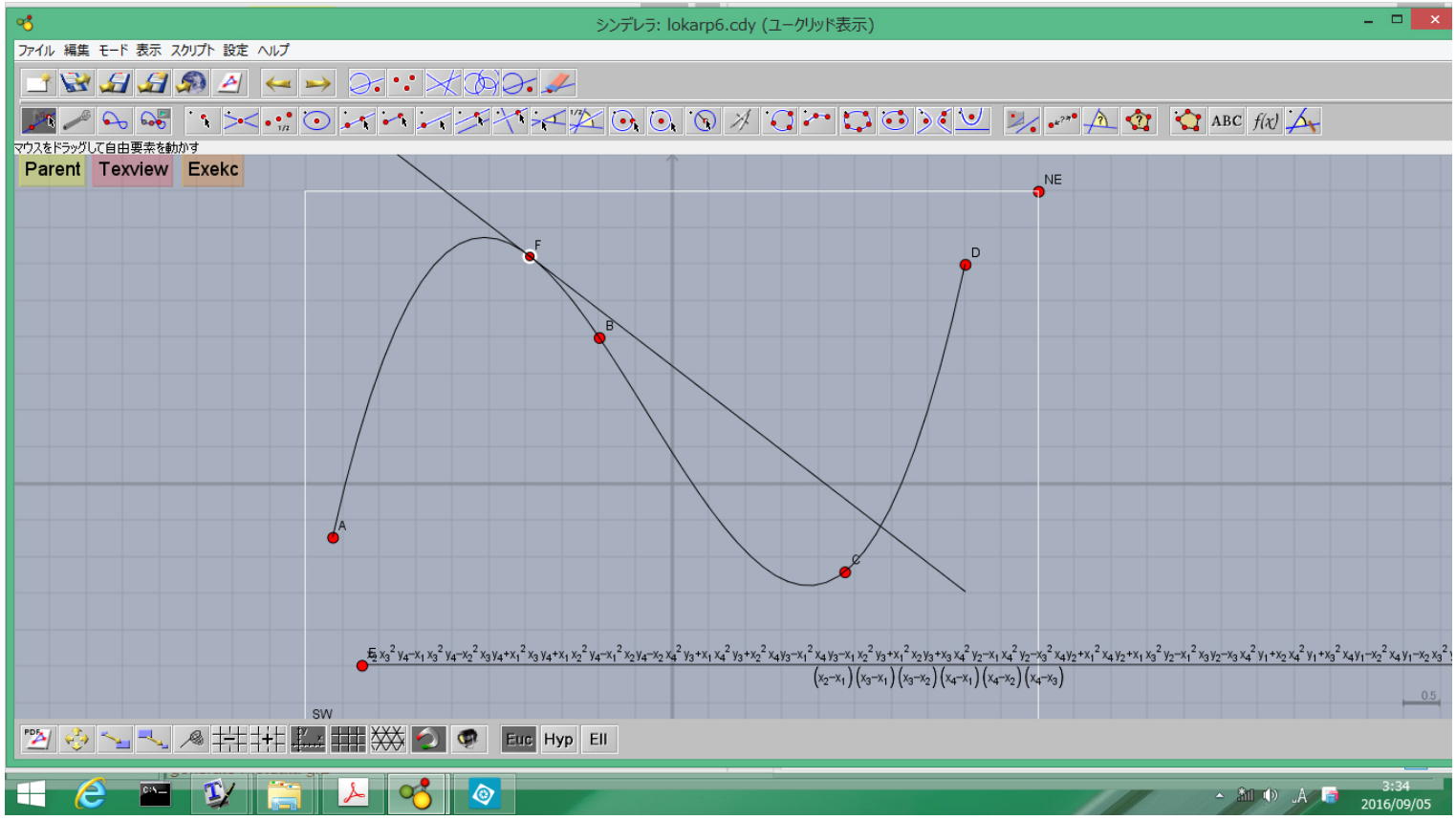
3. Collaborative use with Maxima

Cindyscript screen (Utilizing output)



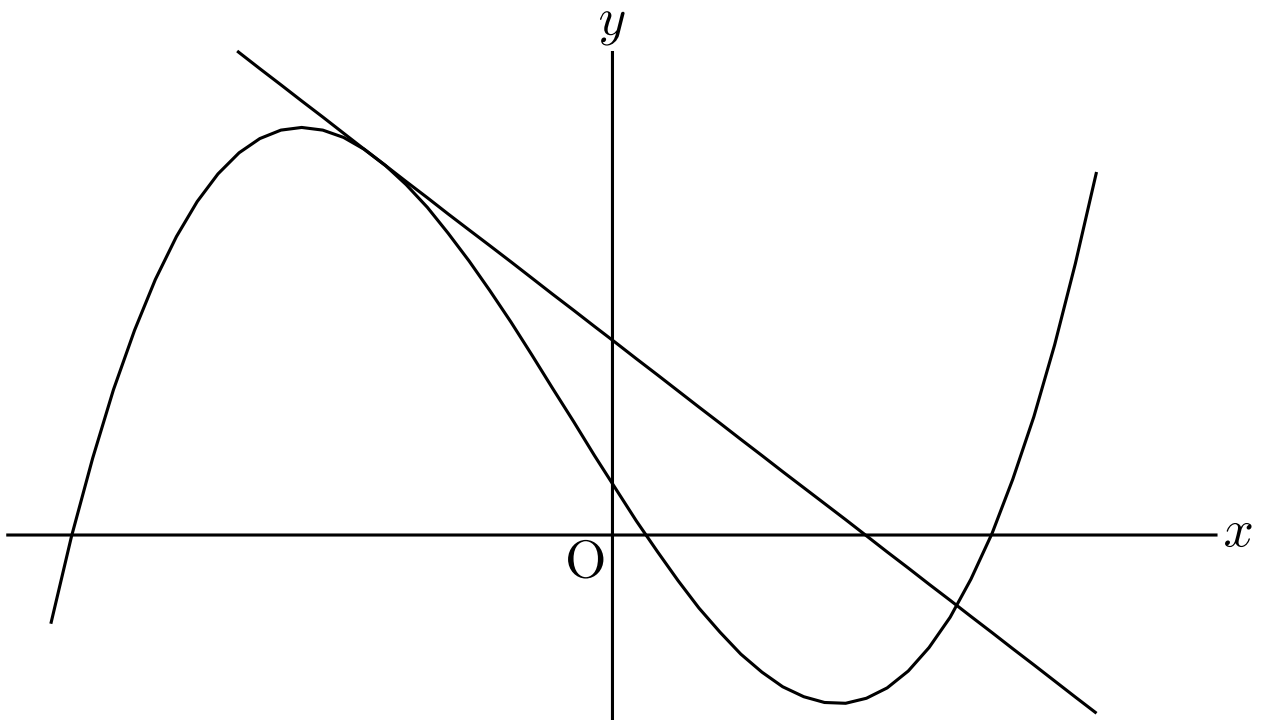
3. Collaborative use with Maxima

Cinderella screen



3. Collaborative use with Maxima

TEX outpout



$$x_2\,{x_3}^2\,y_4-x_1\,{x_3}^2\,y_4-{x_2}^2\,x_3\,y_4+{x_1}^2\,x_3\,y_4+x_1\,{x_2}^2\,y_4-{x_1}^2\,x_2\,y_4-x_2\,{x_4}^2\,y_3+x_1\,{x_4}^2\,y_3+x_2$$

4. Collaborative use with R

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

4. Collaborative use with R

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

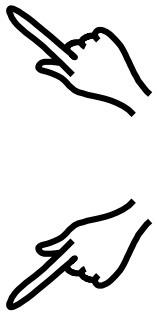
+

Tables in Excel which cannot be copied to DGS and TEX and statistical analysis of it

4. Collaborative use with R

Purpose

Interactive operation onto mathematical objects with high-quality TEX outputs

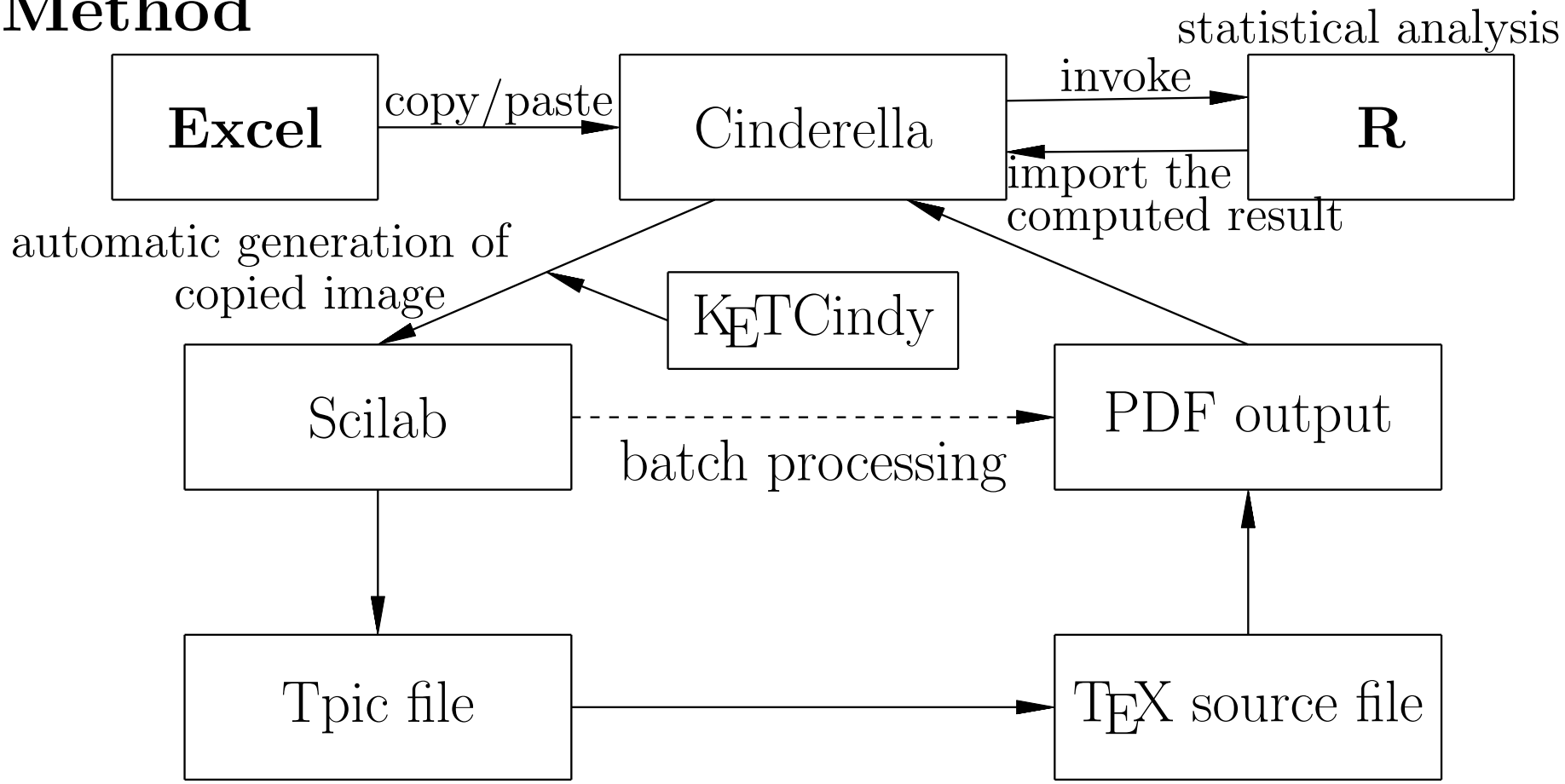


\+ How to synchronize?

Tables in Excel which cannot be copied to DGS and TEX and statistical analysis of it

4. Collaborative use with R

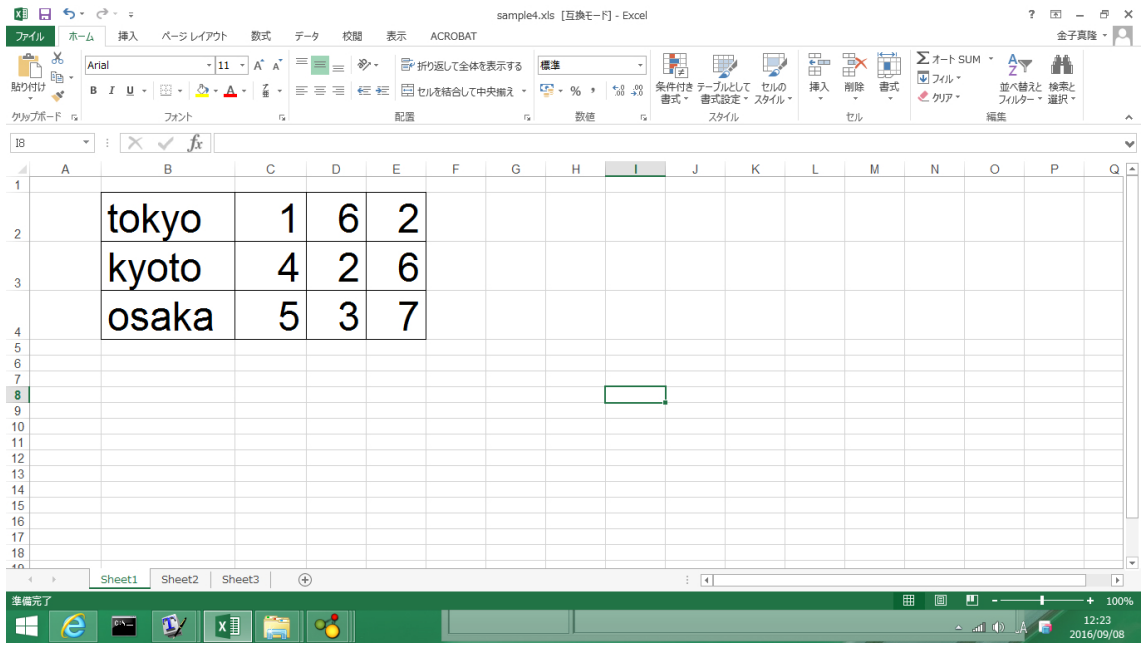
Method



4. Collaborative use with R

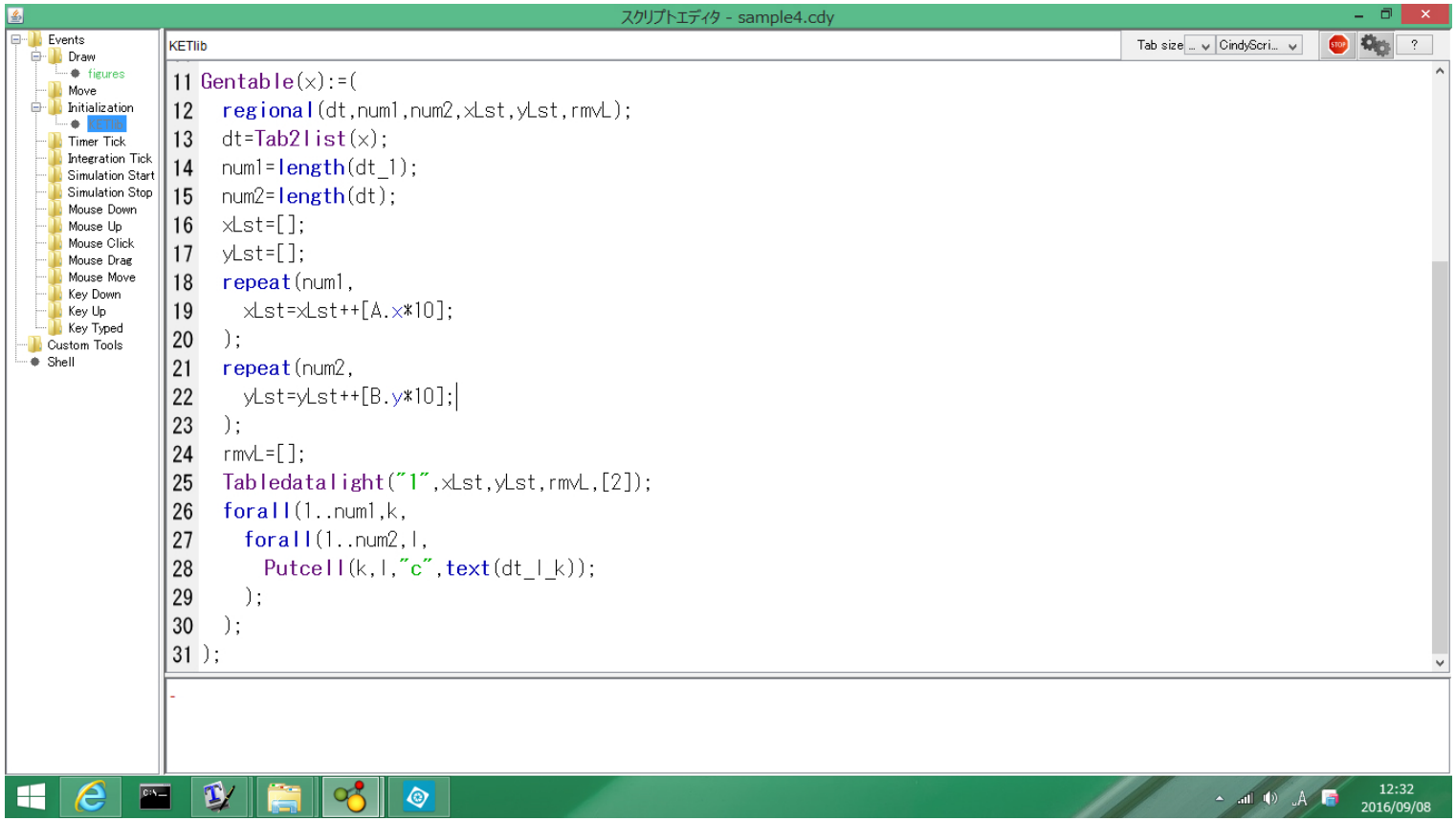
Example

Generate the copied image of the following table in spreadsheet onto TEX output. Moreover execute χ^2 test via R.



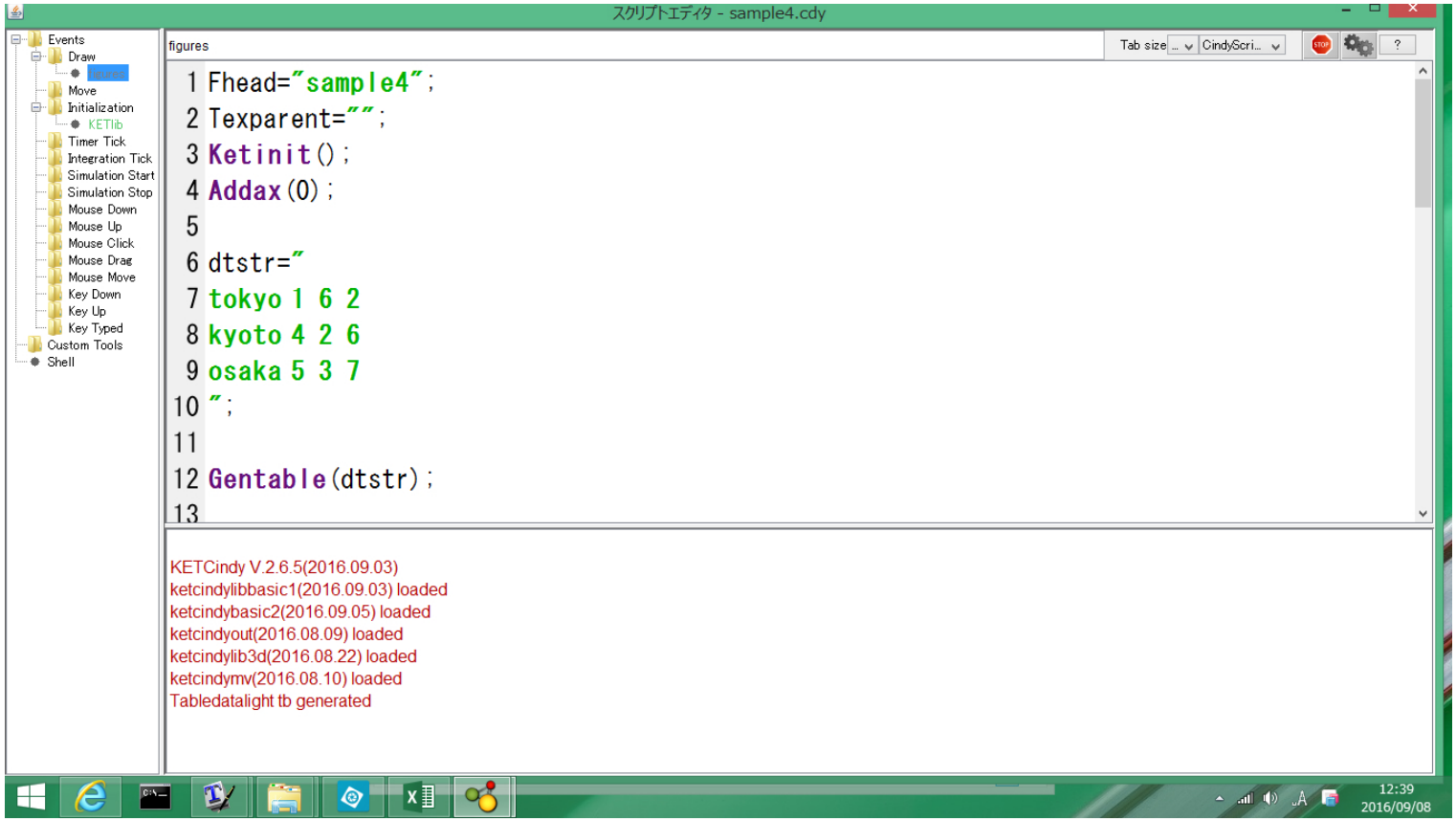
4. Collaborative use with R

Cindyscript screen (Definition of "Gentable")



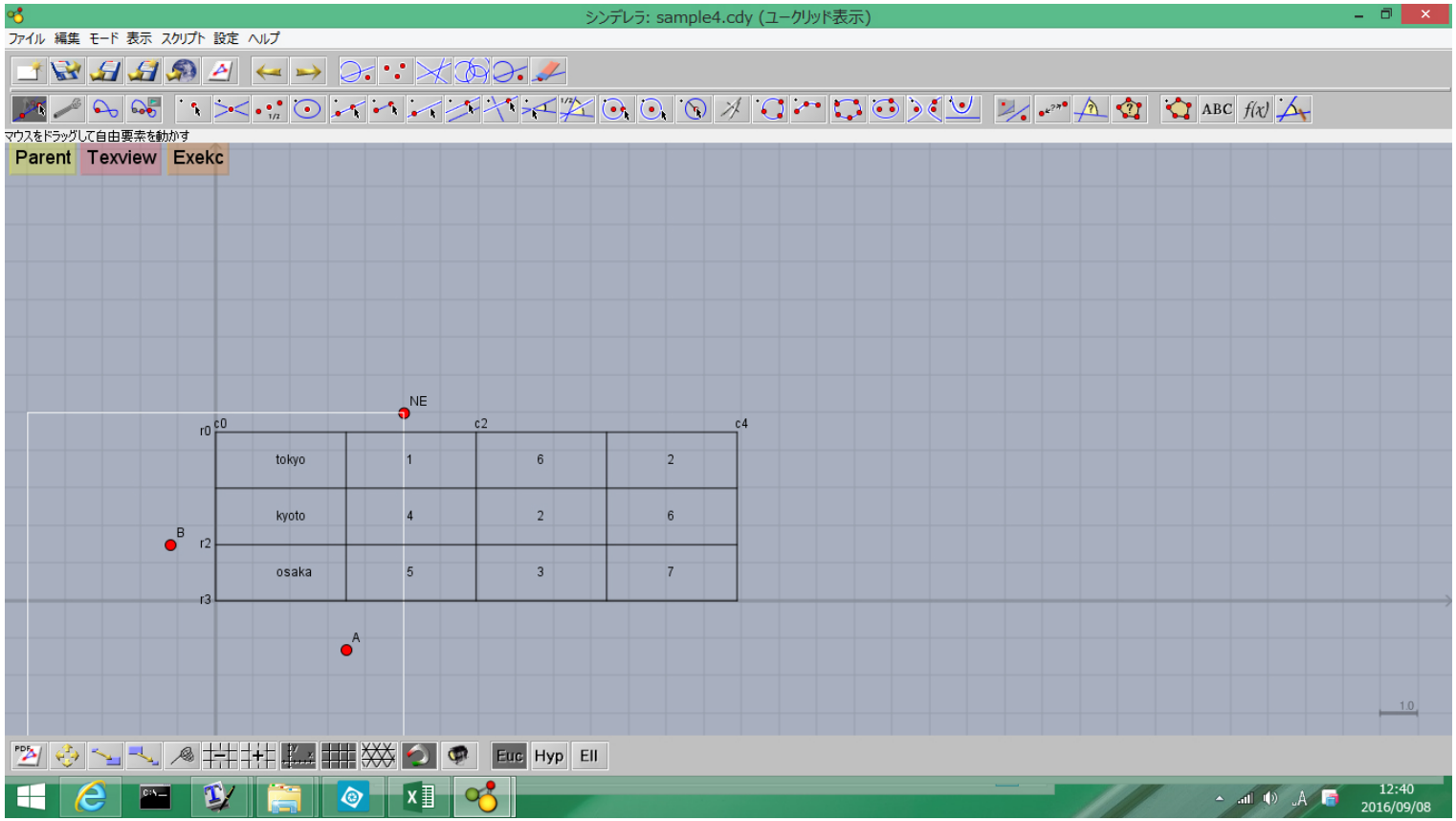
4. Collaborative use with R

Cindyscript screen (Execution of “copy/paste”)



4. Collaborative use with R

Cinderella screen (“interactive” table)



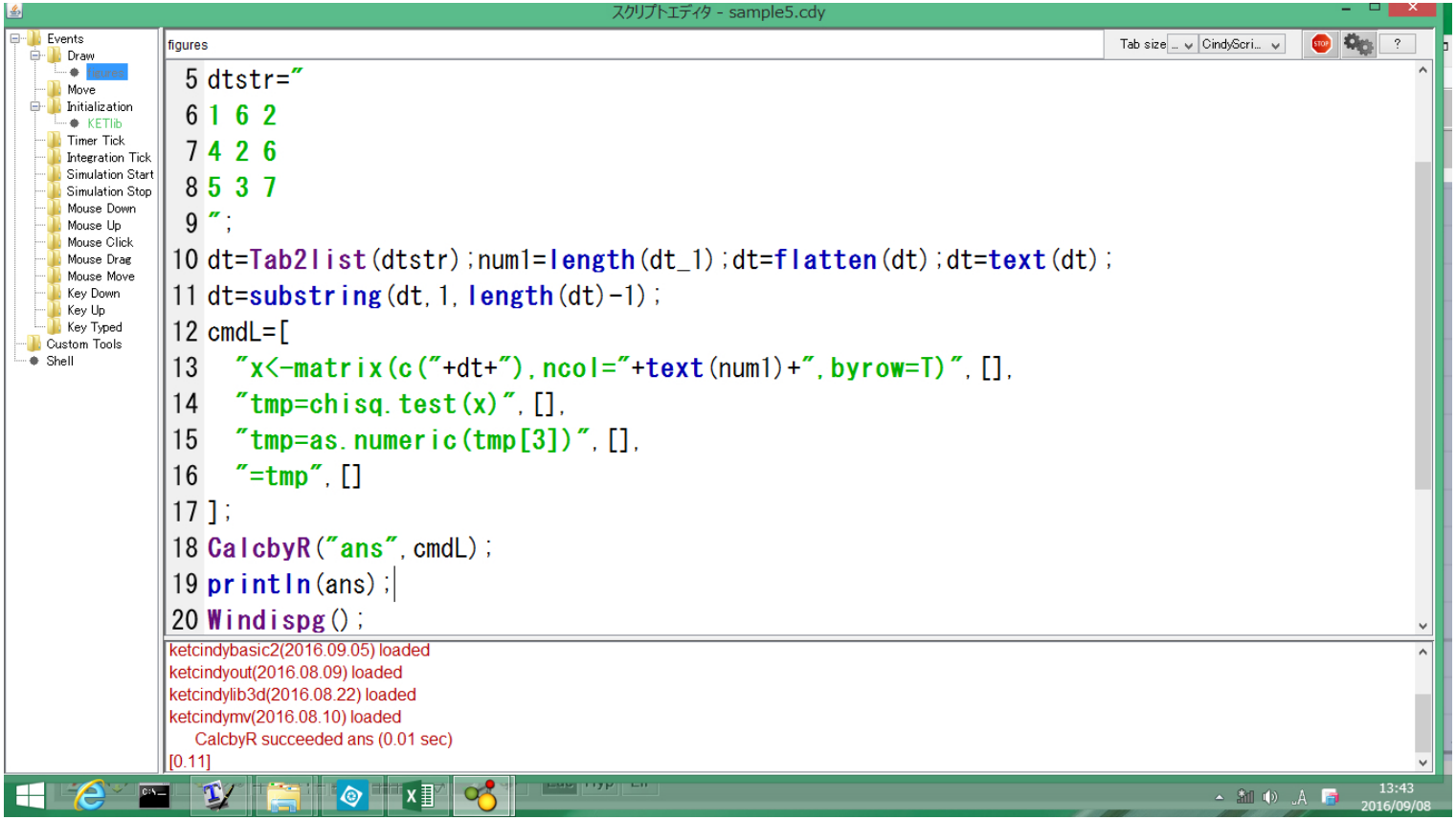
4. Collaborative use with R

TEX outpout

tokyo	1	6	2
kyoto	4	2	6
osaka	5	3	7

4. Collaborative use with R

Cindyscript screen (Execution of χ^2 test)



5. Concluding remarks

What is the value of this collaborative system?

5. Concluding remarks

What is the value of this collaborative system?

Collective use of small tools should be effective and indispensable in some situations.

5. Concluding remarks

What is the role of Cinderella?

5. Concluding remarks

What is the role of Cinderella?

It can play as the controller and translator between many small tools via its scripting language (Cindyscript)

Please visit our workshop!!

Sep. 9th 14:00 – 16:00

Room 231

Tnank you very much
for your attentions!!