

# Introdução ao TikZ

## Primeiros passos

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July 29, 2025

# O que é TikZ?

- **TikZ** = "TikZ ist *kein* Zeichenprogramm" (Alemão para "TikZ não é um programa de desenho")
- Pacote  $\text{\LaTeX}$  para criar gráficos vetoriais **programaticamente**
- Usa comandos simples para desenhar formas, diagramas e ilustrações complexas
- Características principais:
  - Gráficos independentes de resolução
  - Integração nativa com  $\text{\LaTeX}$
  - Sistema de coordenadas com suporte a matemática
  - Sistema de camadas para desenho

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- **Formação:**
  - Doutorado em Ciência da Computação
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- **Contribuições:**
  - Criador do pacote TikZ (2005)
  - Desenvolvedor do Beamer (classe para apresentações)
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- **Atuação:**
  - Professor de Algoritmos e Complexidade
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# Por que Usar TikZ?

- **Integração perfeita** com documentos
- Fontes e estilo consistentes
- Ideal para diagramas científicos
- Numeração/legendas automáticas
- Cria gráficos complexos a partir de comandos simples
- Melhor que imagens externas para:
  - Fluxogramas
  - Gráficos/Diagramas
  - Esquemas técnicos
  - Visualizações matemáticas

Comando para carregar o pacote

```
\usepackage{tikz}
```

Linhas

```
\begin{tikzpicture}[scale=0.5]  
  \draw (0,0) -- (2,0);  
\end{tikzpicture}
```



```
\begin{tikzpicture}[scale=0.5]  
  \draw[red] (0,0) -- (2,0) -- (2,2) -- (0,2) -- cycle;  
\end{tikzpicture}
```



```
\begin{tikzpicture}[scale=0.5]  
  \draw[->,thick,dashed] (0,0) -- (2,0);  
\end{tikzpicture}
```



Círculo com centro em  $(0,0)$  e raio 1cm

```
\begin{tikzpicture}[scale=0.5]  
\draw (0,0) circle (1cm);  
\end{tikzpicture}
```



Retângulo com cantos  $(3,0)$  e  $(5,2)$

```
\begin{tikzpicture}[scale=0.5]  
\draw[fill=blue!20] (3,0) rectangle (5,2);  
\end{tikzpicture}
```



Elipse com centro em  $(1, 1.5)$ , raio maior 1cm e menor 0.5 cm

```
\begin{tikzpicture}[scale=0.5]  
\draw[red] (1,1.5) ellipse (1cm and 0.5cm);  
\end{tikzpicture}
```



Triângulo com vértices  $(7, 0)$ ,  $(8, 2)$  e  $(9, 0)$

```
\begin{tikzpicture}[scale=0.5]  
\draw[fill=green] (7,0) -- (8,2) -- (9,0) -- cycle;  
\end{tikzpicture}
```



## Posicionando texto em figuras

```
\begin{tikzpicture}[scale=0.5]  
\draw (0,0) circle (1cm);  
\node at (0,2) {Um círculo};  
\end{tikzpicture}
```

Um círculo



## Nó com caixa

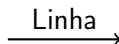
```
\begin{tikzpicture}[scale=0.5]  
\node[draw] at (2,2) {Texto};  
\end{tikzpicture}
```





## Texto ao longo de setas

```
\begin{tikzpicture}[scale=0.5]  
\draw[->, thick] (0.5,0.5)  
-- node[above] {Linha} (3.5,0.5);  
\end{tikzpicture}
```



## Mais um exemplo de node

```
\begin{tikzpicture}[scale=0.5]  
\draw (1,2) circle (0.5)  
node[below=0.7cm] {Legenda};  
\end{tikzpicture}
```



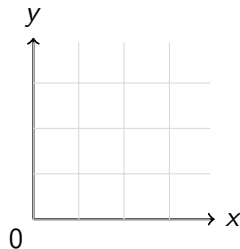
Texto

# Exemplo - Sistema de Coordenadas

```
\begin{tikzpicture}[scale=0.8]
  % Eixos coordenados
  \draw[thick, ->] (0,0) -- (4,0) node[right] {$x$};
  \draw[thick, ->] (0,0) -- (0,4) node[above] {$y$};

  % Grades
  \draw[gray!30] (0,0) grid (3.9,3.9);

  % Origem
  \node[below left] at (0,0) {0};
\end{tikzpicture}
```



# Pré-definições

```
\begin{tikzpicture}[node distance=1.5cm,  
  estilo1/.style={rectangle, rounded corners, fill=red!30, draw},  
  estilo2/.style={rectangle, fill=blue!30, draw}]  
  
  % Cria nós com os estilos pré-definidos  
  \node[estilo1] at (0,0) {Texto};  
  \node[estilo2] at (1,1) {Texto};  
  
\end{tikzpicture}
```



ou podemos definir no cabeçalho do arquivo com

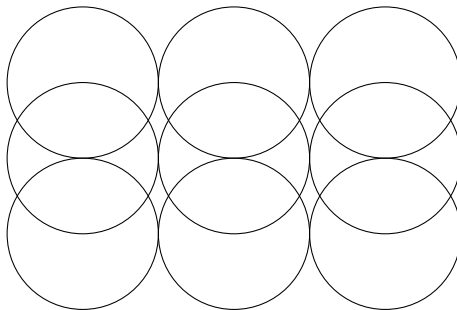
```
\tikzset{estilo1/.style={rectangle, rounded corners, fill=red!30, draw}}  
\tikzset{estilo2/.style={rectangle, fill=blue!30, draw}}
```

ou com

```
\tikzstyle{estilo1} = [rectangle, rounded corners, fill=red!30, draw]
```

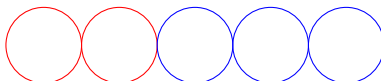
# Iteradores

```
\begin{tikzpicture}  
  \foreach \x in {1,3,5}  
  {  
    \foreach \y in {1,...,3}  
    {  
      \draw (\x,\y) circle (1 cm);  
    }  
  }  
\end{tikzpicture}
```



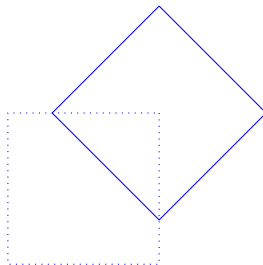
# Condicional

```
\usepackage{tikz,ifthen}
\begin{tikzpicture}
  \foreach \i in {1, ..., 5}{
    \ifthenelse{\i < 3}{\draw[red] (\i, 0) circle (0.5cm);}
                      {\draw[blue] (\i, 0) circle (0.5cm);}
  }
\end{tikzpicture}
```



# Translação e rotação

```
\begin{tikzpicture}  
\draw[blue,dotted] (1,1) -- (1,-1) -- (-1,-1) -- (-1,1) -- (1,1);  
\draw[blue,shift={ (3 cm,5 cm) },rotate=45]  
(1,1) -- (1,-1) -- (-1,-1) -- (-1,1) -- (1,1);  
\end{tikzpicture}
```

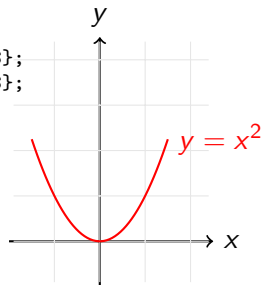


# Plotando Funções

```
\begin{tikzpicture}[scale=0.8]
  % Sistema de coordenadas
  \draw[thick, ->] (-2,0) -- (2.5,0) node[right] {$x$};
  \draw[thick, ->] (0,-1) -- (0,4.5) node[above] {$y$};

  % Grade
  \draw[gray!20] (-1.9,-0.9) grid (2.4,4.4);

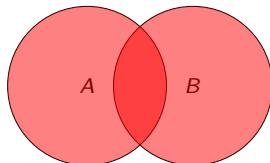
  % Função quadrática
  \draw[red, thick, domain=-1.5:1.5, samples=50]
    plot (\x, {\x*\x}) node[right] {$y = x^2$};
\end{tikzpicture}
```



# Exemplo - Diagramas de Venn

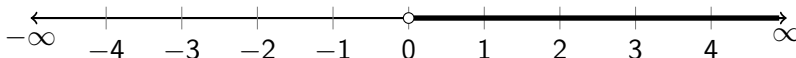
```
\def\firstcircle{(0,0) circle (1.5cm)}  
\def\secondcircle{(0:2cm) circle (1.5cm)}  
\begin{tikzpicture}[scale=0.5]  
  \draw \firstcircle node {$A$};  
  \draw \secondcircle node {$B$};  
  \begin{scope}[fill opacity=0.5]  
    \fill[red] \firstcircle;  
    \fill[red] \secondcircle;  
  \end{scope}  
\end{tikzpicture}
```

$$A \cup B = \{x : x \in A \vee x \in B\}$$





# Exemplo - Reta dos reais positivos



```
% Linha <->
\draw[<->, thick] (-5,0) -- (5,0);

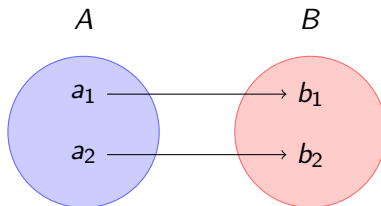
% Desenha linhas verticais de 0.3 pts
\foreach \i in {-4,-3,...,4}
  \draw[gray] (\i,0.15) -- ++ (0,-0.3) node[below,text=black] {$\i$};

% Coloca os \infty
\node[below] at (-5,0) {$-\infty$};
\node[below] at (5,0) {$\infty$};

% Círculo em zero
\draw[black,fill=white] (0,0) circle (2pt);

% Linha mais grossa de (0,\infty)
\draw[line width = 2pt] (2pt,0) -- (4.9,0);
```

# Exemplo - Mapeamento



% Desenha os conjuntos

```
\draw[fill=blue!20, draw=blue!60] (-1.5,0) circle (1cm);
```

```
\draw[fill=red!20, draw=red!60] (1.5,0) circle (1cm);
```

% Textos

```
\node at (-1.5,1.5) {$A$}; \node at (1.5,1.5) {$B$};
```

% Cria os nós

```
\node (x1) at (-1.5,0.5) {$a_1$}; \node (x2) at (-1.5,-0.3) {$a_2$};
```

```
\node (y1) at (1.5,0.5) {$b_1$}; \node (y2) at (1.5,-0.3) {$b_2$};
```

% Liga com as setas

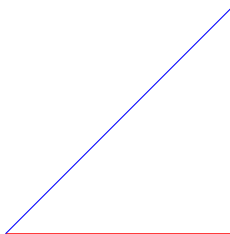
```
\draw[->] (x1) -- (y1);
```

```
\draw[->] (x2) -- (y2);
```

# Cálculos simples

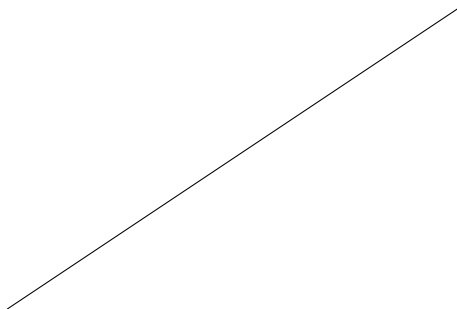
```
% soma (2,1) com (1,-1)  
\draw[red] (0,0) -- ($(2,1) + (1,-1)$);
```

```
% Multiplica (1,1) por 3  
\draw[blue] (0,0) -- ($3*(1,1)$);
```



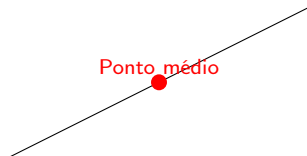
# Constantes

```
\begin{tikzpicture}  
  % Define duas variáveis  
  \def\x{3}  
  \def\y{2}  
  % Faz uma linha  
  \draw (-\x,-\y) -- (\x,\y);  
\end{tikzpicture}
```



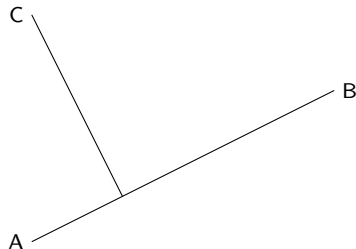
# Ponto médio

```
\coordinate (A) at (0,0);  
\coordinate (B) at (4,2);  
\draw (A) -- (B);  
\fill[red] ($(A)!0.5!(B)$) circle (3pt) node[above] {Ponto médio};
```



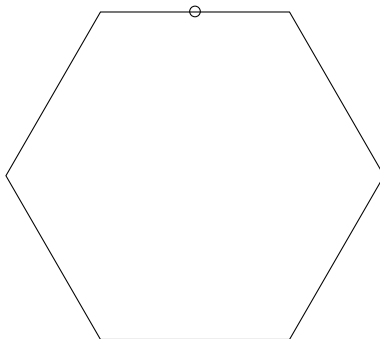
# Projeção ortogonal

```
\coordinate (A) at (0,0) ;  
\coordinate (B) at (4,2);  
\coordinate (C) at (1,3);  
\draw (A) -- (B);  
\draw (C) -- ($(A)!(C)!(B)$)  
\node[left] at (A) {A};  
\node[right] at (B) {B};  
\node[left] at (C) {C};
```



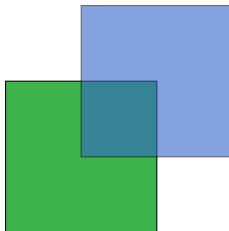
# Polígonos e mais contas

```
\usetikzlibrary{shapes.geometric}  
\begin{tikzpicture}  
\node[regular polygon, regular polygon sides=6, draw,minimum size=5cm]  
(hex) at (0,0) {};  
\draw ($(hex.corner 1)!0.5!(hex.corner 2)$) circle (2pt);  
\end{tikzpicture}
```



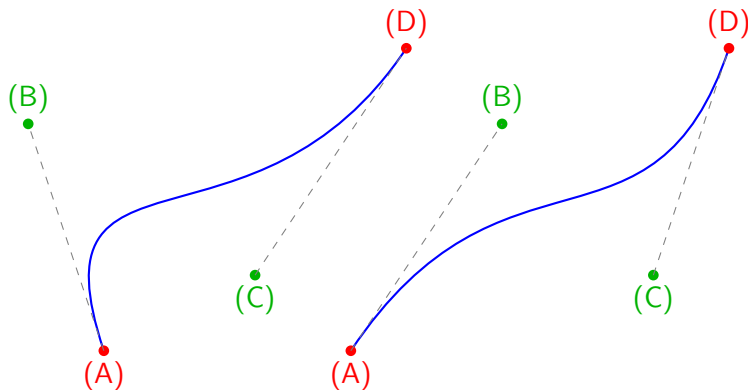
# Definição de cores

```
\definecolor{azul}{RGB}{50,100,200}  
\definecolor{verde}{RGB}{60,180,75}  
\definecolor{vermelho}{RGB}{180,60,75}  
\draw[fill=verde] (0,0) rectangle (2,2);  
\draw[fill=azul,opacity=0.6] (1,1) rectangle (3,3);
```





# Bezier (cúbica)



```
\begin{tikzpicture}
  % Pontos: inicio, controle 1, controle 2 e final
  \coordinate (A) at (0,0);
  \coordinate (B) at (2,3);
  \coordinate (C) at (4,1);
  \coordinate (D) at (5,4);

  % Desenha a curva
  \draw[blue, thick] (A) .. controls (B) and (C) .. (D);

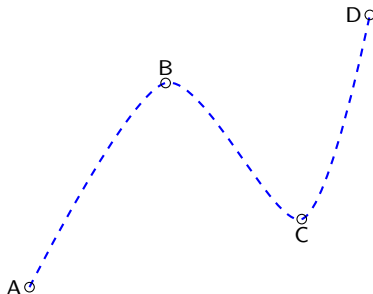
  % Coloca os pontos
  \fill[red] (A) circle (2pt) node[below]{(A)};
  \fill[red] (D) circle (2pt) node[above]{(D)};
  \fill[green!70!black] (B) circle (2pt) node[above]{(B)};
  \fill[green!70!black] (C) circle (2pt) node[below]{(C)};

  % Linhas de controle (só para visualização)
  \draw[dashed, gray] (A) -- (B);
  \draw[dashed, gray] (C) -- (D);

\end{tikzpicture}
```

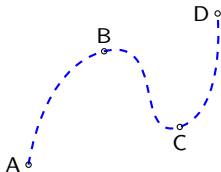
# Interpolar pontos

```
\begin{tikzpicture}
\coordinate (A) at (0,0);
\coordinate (B) at (2,3);
\coordinate (C) at (4,1);
\coordinate (D) at (5,4);
\draw[blue,thick, smooth, dashed] plot coordinates {(A) (B) (C) (D)};
\draw (A) circle (2pt) node [left] {A};
\draw (B) circle (2pt) node [above] {B};
\draw (C) circle (2pt) node [below] {C};
\draw (D) circle (2pt) node [left] {D};
\end{tikzpicture}
```

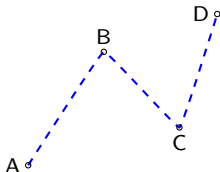


# Interpolar pontos - tensão

```
\draw[blue,thick, smooth, dashed, tension=1.5] plot coordinates {(A) (B) (C) (D)};
```



```
\draw[blue,thick, smooth, dashed, tension=0.1] plot coordinates {(A) (B) (C) (D)};
```



# Fluxogramas

```
\tikzstyle{startstop} = [rectangle, rounded corners,  
    minimum width=3cm,  
    minimum height=1cm,  
    text centered,  
    draw=black,  
    fill=red!30]
```

```
\tikzstyle{io} = [trapezium,  
    trapezium stretches=true,  
    trapezium left angle=70,  
    trapezium right angle=110,  
    minimum width=3cm,  
    minimum height=1cm, text centered,  
    draw=black, fill=blue!30]
```

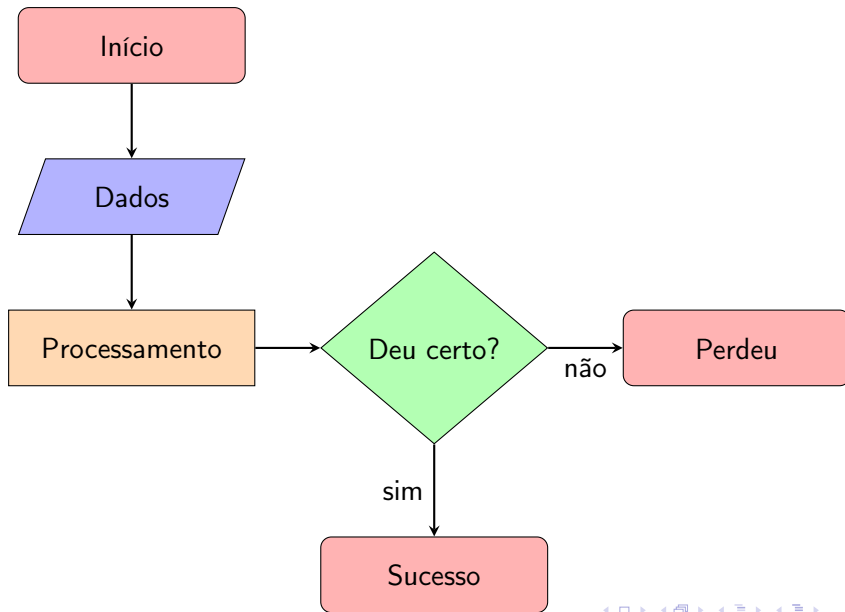
```
\tikzstyle{process} = [rectangle,  
    minimum width=3cm,  
    minimum height=1cm,  
    text centered,  
    text width=3cm,  
    draw=black,  
    fill=orange!30]
```

```
\tikzstyle{decision} = [diamond,  
    minimum width=3cm,  
    minimum height=1cm,  
    text centered,  
    draw=black,  
    fill=green!30]  
  
\tikzstyle{arrow} = [thick,->,>=stealth]  
  
\begin{tikzpicture}[node distance=2cm]  
Fluxograma  
\end{tikzpicture}
```

# Exemplo de fluxograma

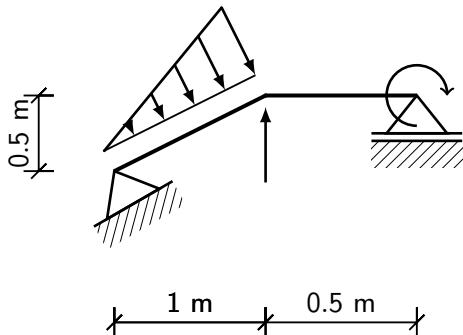
```
\begin{tikzpicture}[node distance=2cm]
% Primeiro nó
\node (inicio) [startstop] {Início};
% io
\node (entrada) [io, below of=inicio] {Dados};
% Etapa 1
\node (etapa1) [process, below of=entrada] {Processamento};
% Decisão
\node (pergunta1) [decision, right of=etapa1, xshift=2cm] {Deu certo?};
% Etapa 2
\node (errado) [startstop, right of = pergunta1, xshift=2cm] {Perdeu};
% Fim
\node (certo) [startstop, below of = pergunta1, yshift=-1cm] {Sucesso};
% Linhas
\draw [arrow] (inicio) -- (entrada);
\draw [arrow] (entrada) -- (etapa1);
\draw [arrow] (etapa1) -- (pergunta1);
\draw [arrow] (pergunta1) -- node[anchor=east] {sim} (certo);
\draw [arrow] (pergunta1) -- node[anchor=north] {não} (errado);
\end{tikzpicture}
```

# Exemplo de fluxograma





```
% Define os pontos
\point{A}{0}{0};
\point{B}{2}{1};
\point{C}{4}{1};
% Define as vigas
\beam{2}{A}{B}[0][1];
\beam{2}{B}{C}[1];
% Força distribuída
\lineload{1}{A}{B}[0];
% Força e momento
\load{1}{B}[-90];
\load{2}{C};
% Apoios
\support{1}{A}[30];
\support{2}{C}[0];
% Cotas
\dimensioning{1}{B}{C}{-2}[$0.5$ m]
\dimensioning{1}{A}{B}{-2}[$1$ m]
\dimensioning{2}{A}{C}{-1}[$0.5$ m]
```



# Animações

```
\begin{center}
% 5 frames por segundo
\begin{animateinline}[controls,loop]{5}
% 20 frames, variável ii começa em 0 e incrementa em 1
% variável ij começa em 20 e decrementa em 1
\multiframe{20}{ii=0+1,ij=20+-1}{
% Imagem a ser gerada
\begin{tikzpicture}[scale=1.2]
% Mantém a área de animação igual
\useasboundingbox (-0.2,-0.2) rectangle (2.2, 2.2);
\fill[blue] (\ij/10,\ii/10) circle (0.2);
\fill[red] (\ii/10,\ij/10) circle (0.2);
\end{tikzpicture}
}
\end{animateinline}
\end{center}
```

```
\begin{center}  
\begin{animateinline}[controls,loop]{10}  
  \multiframe{20}{ii=0+15}{  
    \begin{tikzpicture}[scale=0.7]  
      \draw[blue,rotate=\ii] (0,0) rectangle (2,2)  
    \end{tikzpicture}  
  }  
\end{animateinline}  
\end{center}
```



## Recursos de Aprendizado

- Manual oficial: `texdoc tikz` (3500+ páginas!)
- <https://tikz.dev>
- Tutoriais do Overleaf

## Ideias para Praticar

- Desenhe formas geométricas simples
- Adicione complexidade
- Recrie diagramas de livros