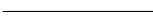
















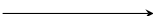
# TIKZ REFERENCE

Fall 2018. All drawings at scale 1. All code is included with TikZ package, no other packages required.

## LINE THICKNESS

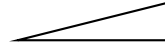
<code>\draw(0,0)--(2,0);</code>		<i>Default line</i>
<code>\draw[ultra thin](0,0)--(2,0);</code>		<i>0.1 pt line width</i>
<code>\draw[very thin](0,0)--(2,0);</code>		<i>0.2 pt line width</i>
<code>\draw[thin](0,0)--(2,0);</code>		<i>0.4 pt line width</i>
<code>\draw[semithick](0,0)--(2,0);</code>		<i>0.6 pt line width</i>
<code>\draw[thick](0,0)--(2,0);</code>		<i>0.8 pt line width</i>
<code>\draw[very thick](0,0)--(2,0);</code>		<i>1.2 pt line width</i>
<code>\draw[ultra thick](0,0)--(2,0);</code>		<i>1.6 pt line width</i>
<code>\draw[line width=3pt](0,0)--(2,0);</code>		<i>Custom line width</i>

## ARROWS

<code>\draw[-&gt;](0,0)--(2,0);</code>	
<code>\draw[-&gt;&gt;](0,0)--(2,0);</code>	
<code>\draw[&lt;-&gt;](0,0)--(2,0);</code>	
<code>\draw[ &gt;](0,0)--(2,0);</code>	
<code>\draw[&lt;-&gt;](0,0)--(1,0.3)--(2,0);</code>	
<code>\draw[-latex](0,0)--(2,0);</code>	
<code>\draw[-stealth](0,0)--(2,0);</code>	

## PATH SHAPES

```
\draw[thick] (0,0)--(2,0)--(2,0.5)--cycle;
```



*Closed path, can be filled*

```
\draw[thick] (0,0) rectangle (2,1);
```



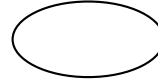
*(Lower left) and (upper right)*

```
\draw[thick] (0,0) circle (0.5);
```



*(center) and (radius)*

```
\draw[thick] (0,0) ellipse (1 and 0.5);
```



*(center) and (width height)*

```
\draw[thick] (0,0) arc (0:120:3);
```



*(start x, start y) arc  
(start:stop:rad)*

```
\draw[->,thick] (0,0) to [bend right=30] (2,0);
```



*Simple curve between nodes,  
right or left, specify angle*

```
\draw (0,0)..controls (0.5,1) and (1.5,-1)..(2,0);
```



*Bezier*

## LINE CAPS

```
\draw[line width=3pt, line cap=butt] (0,0)--(2,0);
```



```
\draw[line width=3pt, line cap=rect] (0,0)--(2,0);
```



```
\draw[line width=3pt, line cap=round] (0,0)--(2,0);
```

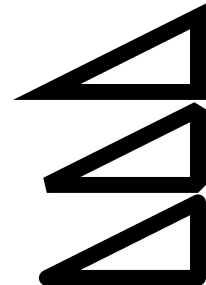


## LINE JOINS

```
\draw[line width=6pt, line join=miter] (0,0)--(2,0)--(2,1)--cycle;
```

```
\draw[line width=6pt, line join=bevel] (0,0)--(2,0)--(2,1)--cycle;
```

```
\draw[line width=6pt, line join=round] (0,0)--(2,0)--(2,1)--cycle;
```



## COLORS, SHADING, OPACITY

Predefined colors available: red, green, blue, cyan, magenta, yellow, black, gray, darkgray, lightgray, brown, lime, olive, orange, pink, purple, teal, violet, white

Define custom colors in preamble; rgb, RGB, HEX, CMYK

```
\definecolor{mugreen}{RGB}{15,89,78}
\definecolor{mublue}{RGB}{9,60,113}
\definecolor{customOrange}{rgb}{1,0.5,0}
\definecolor{customOrange}{HTML}{FF7F00}
\definecolor{customOrange}{cmymk}{0,0.5,1,0}
```

```
\draw[line width=3pt, teal] (0,0)--(2,0);
```



```
\draw[line width=3pt, teal!40!magenta] (0,0)--(2,0);
```



```
\draw[line width=3pt, mublue] (0,0)--(2,0);
```



```
\draw[thick, orange, fill=cyan] (0,0) rectangle (2,0.5);
```



```
\draw[thick] (0,0)--(2,0.5);
```

```
\draw[thick, black, fill=magenta, opacity=0.6] (0,0) rectangle (2,0.5);
```



```
\draw[thick] (0,0)--(2,0.5);
```

```
\draw[thick, black, fill=magenta, fill opacity=0.6] (0,0) rectangle (2,0.5);
```



```
\shade[left color=blue, right color=green] (0,0) rectangle (2,0.5);
```



```
\shade[draw=black, top color=blue, bottom color=yellow] (0,0) rectangle (2,0.5);
```



```
\shade[inner color=blue, outer color=red] (0,0) rectangle (2,0.5);
```



```
\draw[magenta, fill=magenta] (0,0) rectangle (2,0.5);
```

```
\draw[fill=black, very nearly transparent] (0.25,0) rectangle (2,0.25);
```



```
\draw[magenta, fill=magenta] (0,0) rectangle (2,0.5);
```

```
\draw[fill=black, nearly transparent] (0.25,0) rectangle (2,0.25);
```



```
\draw[magenta, fill=magenta] (0,0) rectangle (2,0.5);
```

```
\draw[fill=black, semitransparent] (0.25,0) rectangle (2,0.25);
```





```
\draw[magenta, fill=magenta] (0,0) rectangle (2,0.5);
```


```
\draw[fill=black, nearly opaque] (0.25,0) rectangle (2,0.25);
```

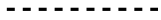



## LINE PATTERNS


`\draw[very thick, dotted] (0,0)--(2,0);` 


`\draw[very thick, densely dotted] (0,0)--(2,0);` 


`\draw[very thick, loosely dotted] (0,0)--(2,0);` 


`\draw[very thick, dashed] (0,0)--(2,0);` 


`\draw[very thick, densely dashed] (0,0)--(2,0);` 


`\draw[very thick, loosely dashed] (0,0)--(2,0);` 


`\draw[very thick, dashdotted] (0,0)--(2,0);` 


`\draw[very thick, densely dashdotted] (0,0)--(2,0);` 


`\draw[very thick, loosely dashdotted] (0,0)--(2,0);` 


`\draw[very thick, dashdotdotted] (0,0)--(2,0);` 


`\draw[very thick, densely dashdotdotted] (0,0)--(2,0);` 

`\draw[very thick, loosely dashdotdotted] (0,0)--(2,0);` 

`\draw[very thick, dash pattern=on 3 off 2] (0,0)--(2,0);` 

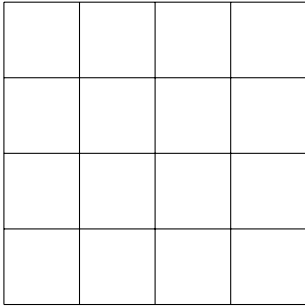
`\draw[very thick, double] (0,0)--(2,0);` 

`\draw[very thick, double distance=2pt] (0,0)--(2,0);` 

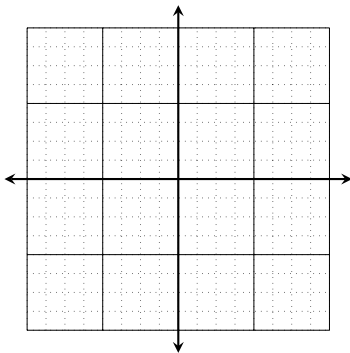
`\draw[blue, fill=blue] (0,0) rectangle (2,0.5);`  
`\draw[very thick, draw=white, double=green] (0,0.25)--(2,0.25);` 

## GRIDS AND PLOTTING

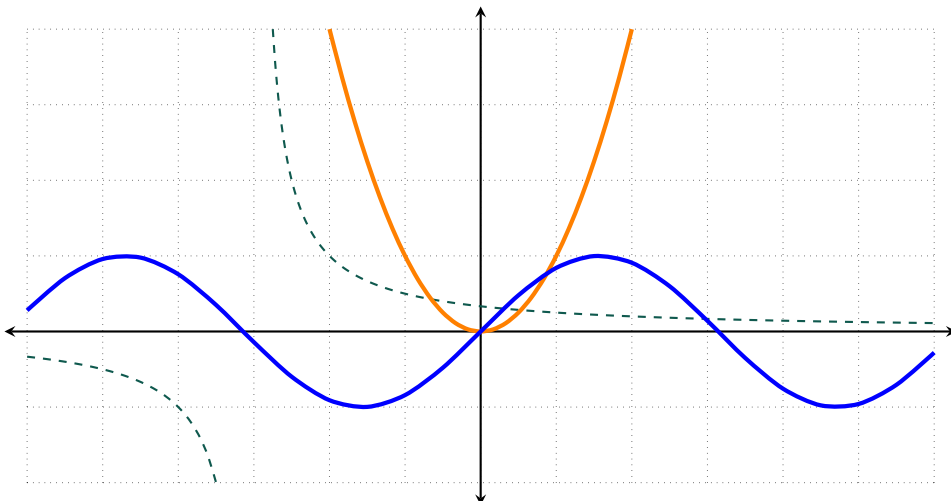
```
\draw (-2,-2) grid (2,2);
```



```
\draw[very thin, dotted, step=0.25] (-2,-2) grid (2,2);  
\draw[very thin, step=1] (-2,-2) grid (2,2);  
\draw[thick, stealth-stealth] (-2,0)--(2,0);  
\draw[thick, stealth-stealth] (0,-2)--(0,2);
```



```
\draw[very thin, dotted] (-6,-2) grid (6,4);  
\draw[thick, stealth-stealth] (-6.3,0)--(6.3,0);  
\draw[thick, stealth-stealth] (0,-2.3)--(0,4.3);  
% simple parabola  
\draw[domain=-2:2, smooth, variable=\x, ultra thick, orange] plot ({\x},{\x*\x});  
% rational function - avoid asymptotes, usually need extra smoothing (increase samples)  
\draw[domain=-6:-3.5, smooth, variable=\x, dashed, thick, mugreen] plot ({\x},{1/(\x+3)});  
\draw[domain=-2.75:6, smooth, variable=\x, dashed, thick, mugreen, samples=300] plot ({\x},{1/(\x+3)});  
% trig, expects degrees, so convert from radians  
\draw[domain=-6:6, smooth, variable=\x, ultra thick, blue] plot ({\x},{sin(deg(\x))});
```



# NODES

```
\node (A) at (0,0) {};
```

Position node called A at the point (0,0), no text

```
\node (B) at (2,0) {};
```

Position node called B at the point (2,0), no text

```
\node (C) at (45:2) {};
```

Polar positioning, (angle:radius from origin)

```
\draw (A) -- (B);
```

Draw path from node called A to node called B

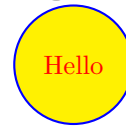
```
\node at (2,0) {Hello};
```

Text node at point (2,0), no reference name

```
\node[circle, draw] at (0,0) {Hello};
```



```
\node[circle, ultra thick, red, draw=blue, fill=yellow, inner sep=3pt] at (0,0) {Hello};
```



```
\node[circle, fill, inner sep=2pt] at (0,0) {};  
\node[above right] at (0,0) {$P = (0,0)$};
```

●  $P = (0,0)$

```
\node[circle, fill=blue, inner sep=2pt, label=right:{$Q = (0,0)$}] at (0,0) {};
```

●  $Q = (0,0)$

```
\node[draw, rectangle, rounded corners, text width=6cm] at (0,0) {To  
create a text node with multiple lines of  
text you need to set the text width. The  
text will then wrap at this width.};
```

To create a text node with multiple lines of text you need to set the text width. The text will then wrap at this width.

```
\node[draw, rectangle, rounded corners, text width=6cm, align=center] at (0,0)  
{Text can be aligned as {\tt left},  
\tt flush left}, {\tt right}, {\tt flush  
right}, {\tt center}, {\tt flush center},  
\tt justify}, and {\tt none}};
```

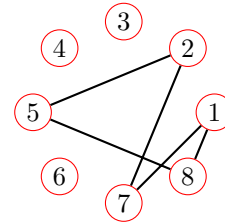
Text can be aligned by left, flush left, right, flush right, center, flush center, justify, and none

## FOREACH

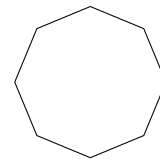
```
\foreach \i in {0,1,2,3} {
  \draw (\i, 0) circle (0.2);
}
```



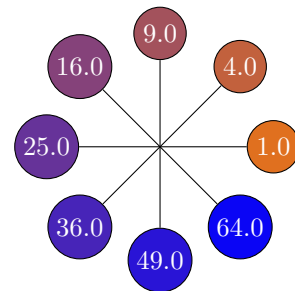
```
% label nodes for reference later; count starts at 1
\foreach \angle [count=\n] in {0,45,...,315} {
  \node[circle,draw=red,inner sep=2pt] at (\angle:1.2) {\n};
}
```



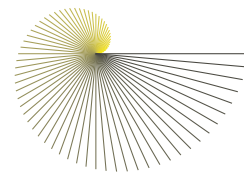
```
% loop within a path:
\draw (0:1) \foreach \x in {45,90,...,359} {
  -- (\x:1)
} -- cycle (90:1);
```



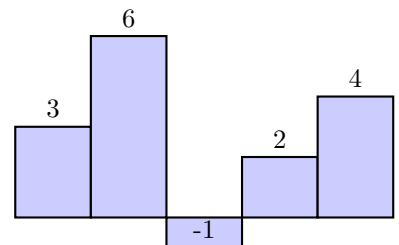
```
% use pgfmath to calculate values for colors, text, etc
\foreach \angle [count=\n] in {0,45,...,315} {
  \pgfmathsetmacro\shade{\n*12}
  \pgfmathsetmacro\lab{\n*\n}
  \node[circle, white, draw=black, fill=blue!\shade!orange,
    inner sep=2pt] (\n) at (\angle:1.5) {\lab};
  \draw (0,0) -- (\n);
}
```



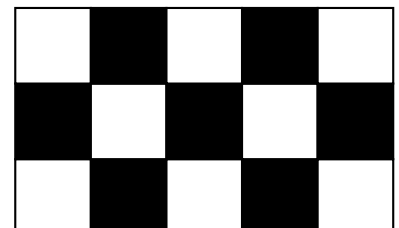
```
\foreach \angle [count=\n] in {0,5,...,360} {
  \pgfmathsetmacro\shade{\n*1.2}
  \pgfmathsetmacro\r{10*\n/360}
  \draw[black!\shade!yellow] (0,0) -- (\angle:\r);
}
```



```
% TikZ bar chart, loop over values to be charted
\foreach \b [count=\n] in {3,6,-1,2,4} {
  \draw[thick, black, fill=blue!20!white]
    (\n-1,0) rectangle (\n,0.4*\b);
  \node[above] at (\n-0.5,0.4*\b){\b};
}
```

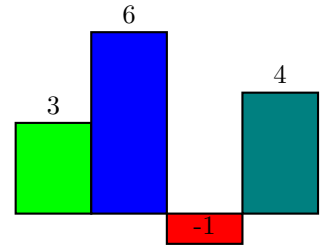


```
% if else:
\foreach \r in {0,1,2} {
  \foreach \c in {0,1,...,4} {
    \pgfmathsetmacro\n{\r+\c}
    \ifodd\n
      \draw[thick, fill=black] (\c-1,\r-1) rectangle (\c,\r);
    \else
      \draw[thick, fill=white] (\c-1,\r-1) rectangle (\c,\r);
    \fi
  }
}
```

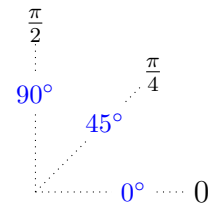


## FOREACH, CONTINUED

```
% define multiple variables for each loop
\foreach \b/\c [count=\n] in {3/green,6/blue,-1/red,4/teal} {
  \draw[thick, black, fill=\c]
    (\n-1,0) rectangle (\n,0.4*\b);
  \node[above] at (\n-0.5,0.4*\b){\b};
}
```

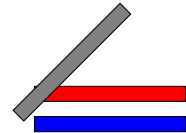


```
\foreach \ang/\label in {0/$0$,45/$\frac{\pi}{4}$,90/$\frac{\pi}{2}$} {
  \draw[dotted] (0,0) -- (\ang:2);
  \node at (\ang:2.2) {\large \label};
  \node[blue, fill=white] at (\ang:1.3) {\ang$^\circ$};
}
```

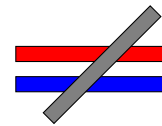


## ROTATE

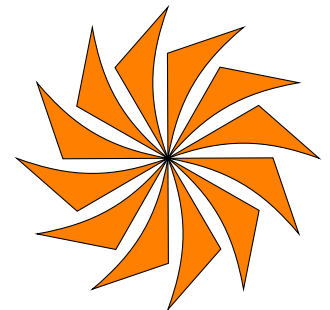
```
% rotate by any angle around the origin
\draw[fill=blue] (0,0) rectangle (2,0.2);
\draw[fill=red] (0,0.4) rectangle (2,0.6);
\draw[fill=gray, rotate=45] (0,0.2) rectangle (2,0.4);
```



```
% rotate by any angle around any point
\draw[fill=blue] (0,0) rectangle (2,0.2);
\draw[fill=red] (0,0.4) rectangle (2,0.6);
\draw[fill=gray, rotate around={45:(1,0.5)}] (0,0.2) rectangle (2,0.4);
```



```
% rotate in loop
\foreach \a in {0,30,60,...,330} {
  \draw[fill=orange, rotate=\a] (0,0) to [bend left=20] (2,0)
    --(1.2,0.7)--cycle;
}
```



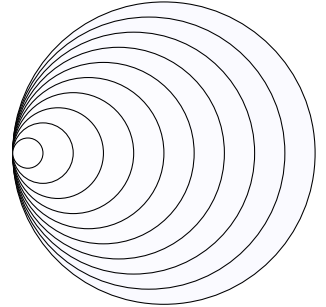


## SHIFT AND SCALE

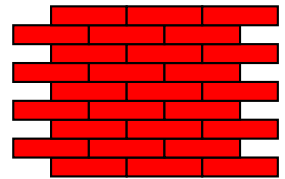
```
% shift always requires units, even cm:  
\draw[fill=blue] (0,0) rectangle (2,0.25);  
\draw[fill=red, xshift=1cm, yshift=0.25cm] (0,0) rectangle (2,0.25);
```



```
\foreach \i in {2,1.8,1.6,...,0.2} {  
  \draw[fill=blue!\i!white, xshift=\i cm] (0,0) circle (\i);  
}
```



```
% shift within loop  
\foreach \r [count=\row] in {0,0.25,...,2} {  
  \foreach \c in {0,1,2} {  
    \pgfmathsetmacro{\shiftval}{Mod(\row,2)}  
    \draw[thick, fill=red, xshift=\shiftval*0.5cm]  
      (\c,\r) rectangle (\c+1,\r+0.25);  
  }  
}
```



```
% shift within scope, will apply to anything defined in scope  
\draw[fill=blue] (0,0) rectangle (2,0.2);  
\draw[fill=red] (0,0.4) rectangle (2,0.6);  
\begin{scope}[xshift=1cm]  
  \draw[fill=gray] (0,0.2) rectangle (2,0.4);  
  \draw[fill=orange] (0,0.6) rectangle (2,0.8);  
\end{scope}
```

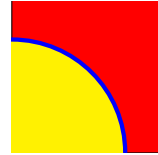


```
% shift and scale within scope  
\draw[fill=blue] (0,0) rectangle (2,0.2);  
\draw[fill=red] (0,0.4) rectangle (2,0.6);  
\begin{scope}[yshift=-0.5cm, xscale=2]  
  \draw[fill=gray] (0,0.2) rectangle (2,0.4);  
  \draw[fill=orange] (0,0.6) rectangle (2,0.8);  
\end{scope}
```

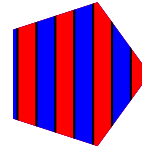


## CLIP

```
% only show what's inside clip region, applies  
% to anything defined AFTER clip statement only  
\clip (0,0) rectangle (2,2);  
\draw[fill=red] (0,0) rectangle (4,4);  
\draw[ultra thick, blue, fill=yellow] (0,0) circle (2);
```



```
% clip can be any shape or path  
\clip (0:1) \foreach \x in {72,144,...,359} {  
  -- (\x:1)  
} -- cycle (90:1);  
\foreach \i [count=\n] in {-1.5,-1.25,...,1.75} {  
  \ifodd\n  
    \draw[thick, fill=blue] (\i-1,-3) rectangle (\i,3);  
  \else  
    \draw[thick, fill=red] (\i-1,-3) rectangle (\i,3);  
  \fi  
}
```



```
% clip inside scope if only certain parts are to be clipped  
\draw[fill=yellow] (0,0) circle (1);  
\begin{scope}  
\clip (-1,0) circle (1);  
\draw[fill=green] (0,0) circle (1);  
\end{scope}
```

