



# Week 3

parameters, return, math, graphics

Special thanks to Scott Shawcroft, Ryan Tucker, and Paul Beck for their work on these slides.

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# Parameters

```
def name (parameter, parameter, ..., parameter) :  
    statements
```

- Parameters are declared by writing their names (no types)

```
>>> def print_many(word, n) :  
...     for i in range(n):  
...         print word  
  
>>> print_many("hello", 4)  
hello  
hello  
hello  
hello
```

# Exercise

- Recreate the lines/boxes of stars example from lecture:

```
*****
```

```
*****
```

```
*****
```

```
*****
```

```
*           *
```

```
*****
```

```
*****
```

```
*       *
```

```
*       *
```

```
*****
```

# Exercise Solution

## stars.py

```
1  # Draws a box of stars with the given width and height.
2  def box(width, height):
3      print width * "*"
4      for i in range(height - 2):
5          print "*" + (width - 2) * " " + "*"
6      print width * "*"
7
8  # main
9  print 13 * "*"
10 print 7 * "*"
11 print 35 * "*"
12 box(10, 3)
13 box(5, 4)
```

# Default Parameter Values

```
def name (parameter=value, ..., parameter=value) :  
    statements
```

- Can make parameter(s) optional by specifying a default value

```
>>> def print_many(word, n=1):  
...     for i in range(n):  
...         print word  
  
>>> print_many("shrubbery")  
shrubbery  
>>> print_many("shrubbery", 4)  
shrubbery  
shrubbery  
shrubbery  
shrubbery
```

- **Exercise:** Modify `stars.py` to add an optional parameter for the character to use for the outline of the box (default `"*"`).

# Parameter Keywords

**name (parameter=value, ..., parameter=value)**

- Can specify the names of parameters as you call a function
- This allows you to pass the parameters in any order

```
>>> def print_many(word, n):  
...     for i in range(n):  
...         print word  
  
>>> print_many(str="shrubbery", n=4)  
shrubbery  
shrubbery  
shrubbery  
shrubbery  
  
>>> print_many(n=3, str="Ni!")  
Ni!  
Ni!  
Ni!
```

# Math commands

```
from math import *
```

Function name	Description
<code>ceil(value)</code>	rounds up
<code>cos(value)</code>	cosine, in radians
<code>degrees(value)</code>	convert radians to degrees
<code>floor(value)</code>	rounds down
<code>log(value, base)</code>	logarithm in any base
<code>log10(value)</code>	logarithm, base 10
<code>max(value1, value2, ...)</code>	largest of two (or more) values
<code>min(value1, value2, ...)</code>	smallest of two (or more) values
<code>radians(value)</code>	convert degrees to radians
<code>round(value)</code>	nearest whole number
<code>sin(value)</code>	sine, in radians
<code>sqrt(value)</code>	square root
<code>tan(value)</code>	tangent

Constant	Description
<code>e</code>	2.7182818...
<code>pi</code>	3.1415926...

# Returning Values

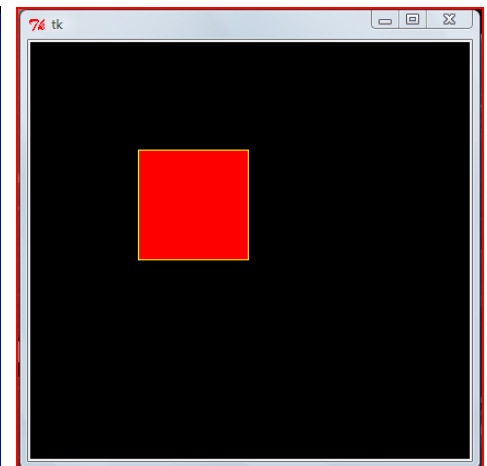
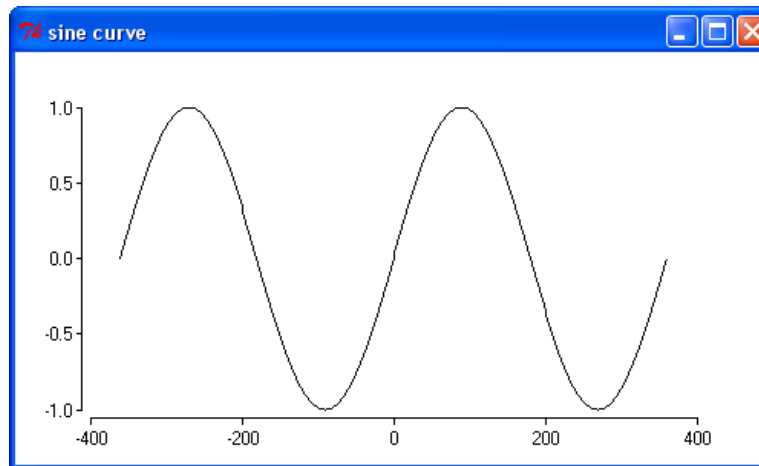
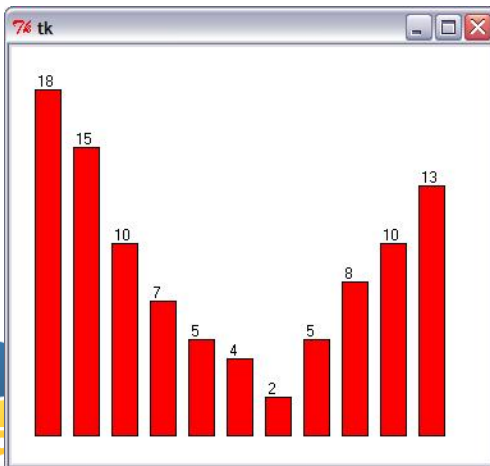
```
def name (parameters) :  
    statements  
    ...  
    return value
```

```
>>> def ftoc(temp):  
...     tempc = 5.0 / 9.0 * (temp - 32)  
...     return tempc  
  
>>> ftoc(98.6)  
37.0
```



# DrawingPanel

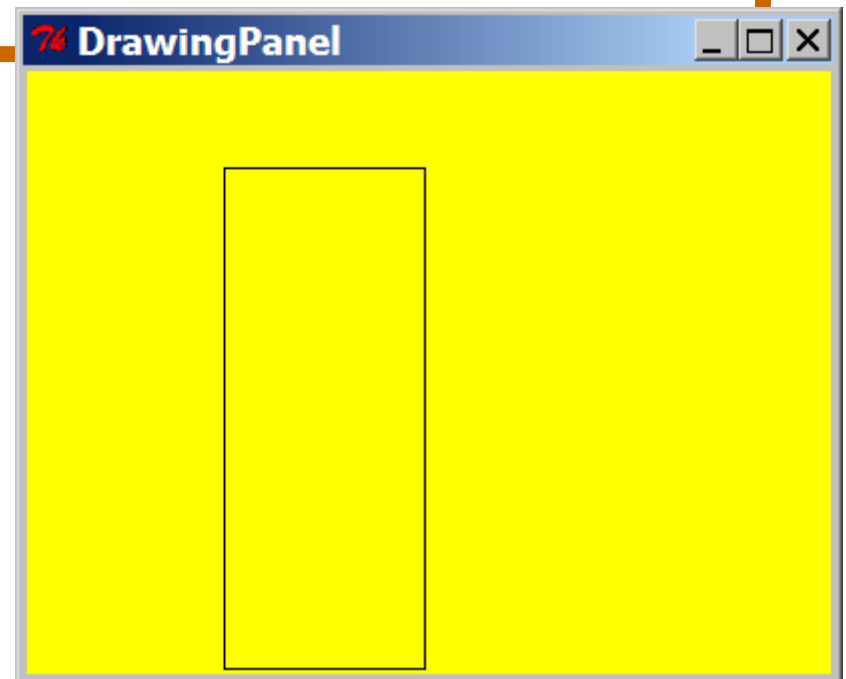
- Instructor-provided `drawingpanel.py` file must be in the same folder as your Python program
- At the top of your program, write:
  - `from drawingpanel import *`
- Panel's `canvas` field behaves like `Graphics g` in Java



# DrawingPanel Example

## draw1.py

```
1 from drawingpanel import *
2
3 panel = DrawingPanel(400, 300)
4 panel.set_background("yellow")
5 panel.canvas.create_rectangle(100, 50, 200, 300)
6
```



# Drawing Methods

Java	Python
drawLine	<code>panel.canvas.create_line(x1, y1, x2, y2)</code>
drawRect, fillRect	<code>panel.canvas.create_rectangle(x1, y1, x2, y2)</code>
drawOval, fillOval	<code>panel.canvas.create_oval(x1, y1, x2, y2)</code>
drawString	<code>panel.canvas.create_text(x, y, text="text")</code>
setColor	<i>(see next slide)</i>
setBackground	<code>panel.set_background(color)</code>

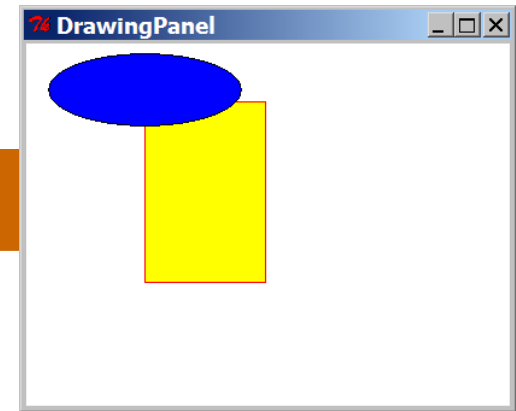
- Notice, methods take x2/y2 parameters, not width/height

# Colors and Fill

- Python doesn't have `fillRect`, `fillOval`, or `setColor`.
  - Instead, pass outline and fill colors when drawing a shape.
  - List of all color names: <http://wiki.tcl.tk/16166>
  - [Visual display of all colors](#)

## drawcolors.py

```
1 from drawingpanel import *
2
3 panel = DrawingPanel(400, 300)
4 panel.canvas.create_rectangle(100, 50, 200, 200,
5                               outline="red", fill="yellow")
6 panel.canvas.create_oval(20, 10, 180, 70, fill="blue")
```

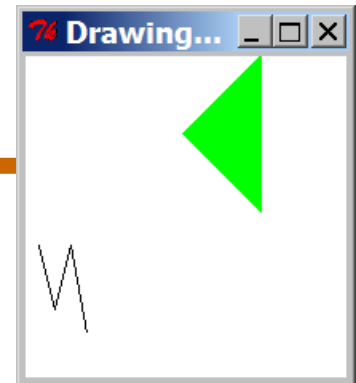


# Polygons

- Draw arbitrary polygons with `create_polygon`
- Draw line groups by passing more params to `create_line`

## drawpoly.py

```
1 from drawingpanel import *
2
3 panel = DrawingPanel(200, 200)
4 panel.canvas.create_polygon(100, 50, 150, 0,
                             150, 100, fill="green")
5 panel.canvas.create_line(10, 120, 20, 160,
                           30, 120, 40, 175)
6
```



# Exercise

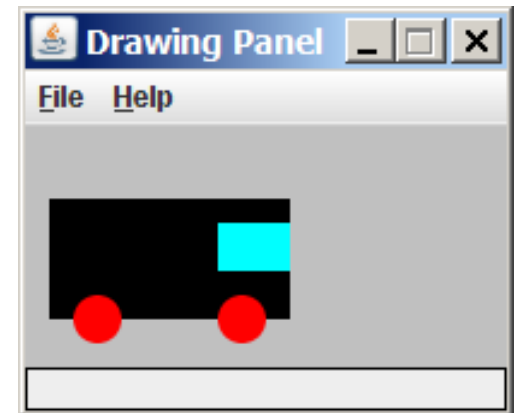
Let's create a car in Python:

```
import java.awt.*;
public class DrawCar {
    public static void main(String[] args) {
        DrawingPanel panel = new DrawingPanel(200, 100);
        panel.setBackground(Color.LIGHT_GRAY);
        Graphics g = panel.getGraphics();

        g.setColor(Color.BLACK);
        g.fillRect(10, 30, 100, 50);

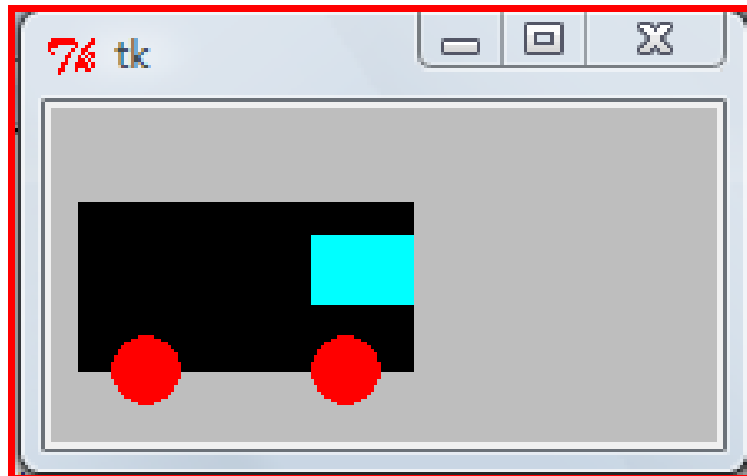
        g.setColor(Color.RED);
        g.fillOval(20, 70, 20, 20);
        g.fillOval(80, 70, 20, 20);

        g.setColor(Color.CYAN);
        g.fillRect(80, 40, 30, 20);
    }
}
```



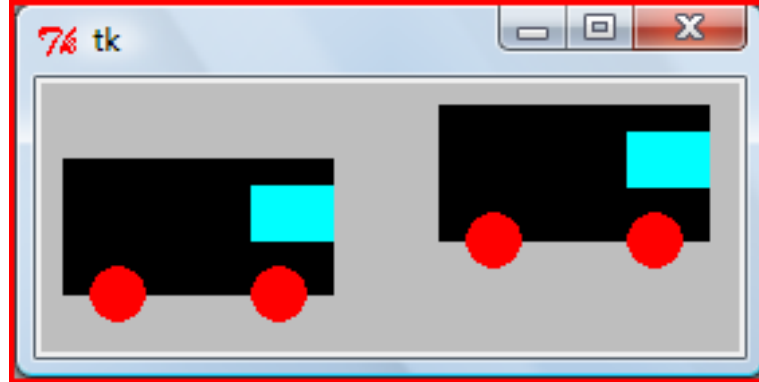
# Exercise

## Draw a car in Python



# Exercise

Now, let's use parameters so that we can place the cars all over the DrawingPanel.





# Exercise

Animate it using `panel.sleep()`

