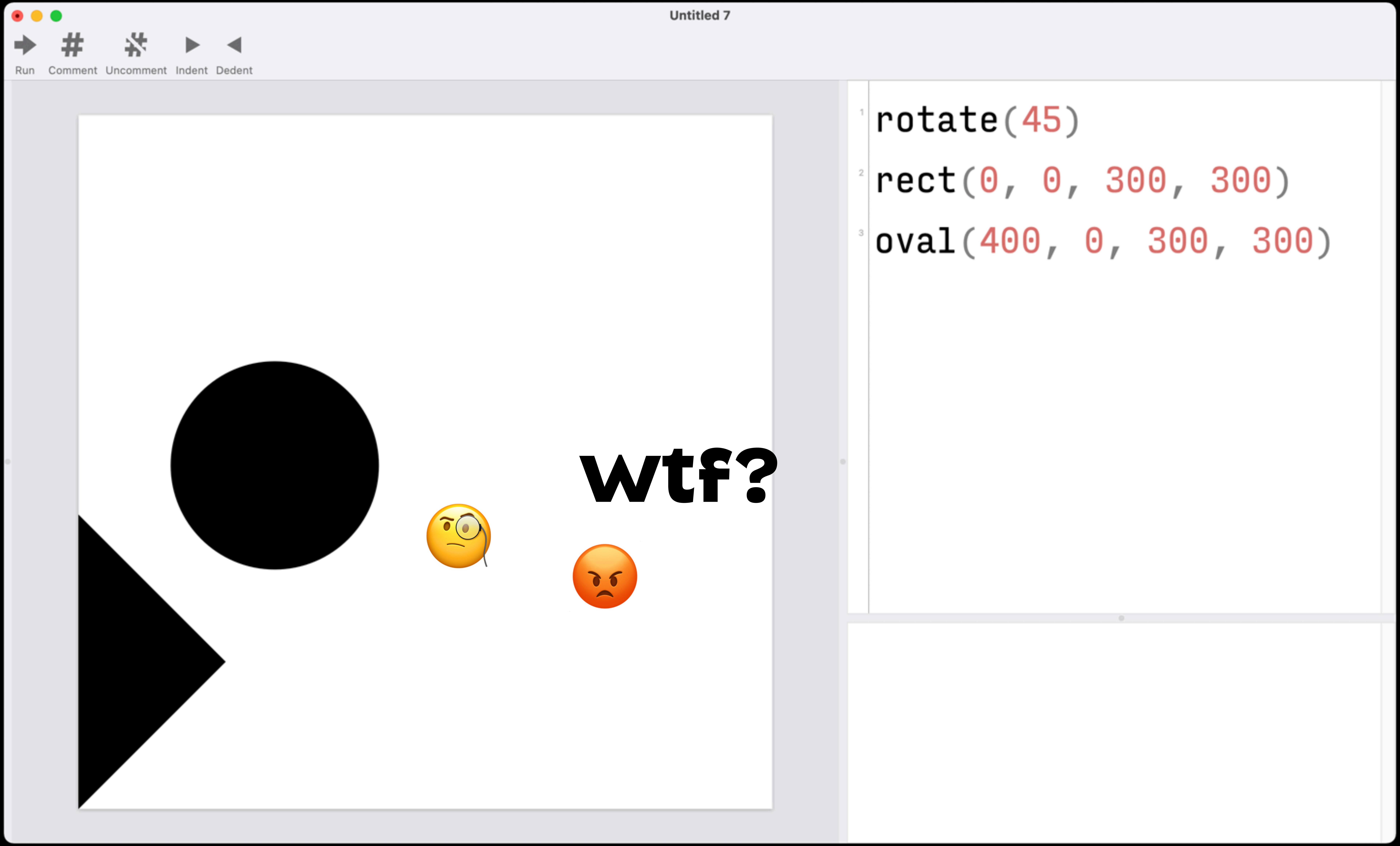
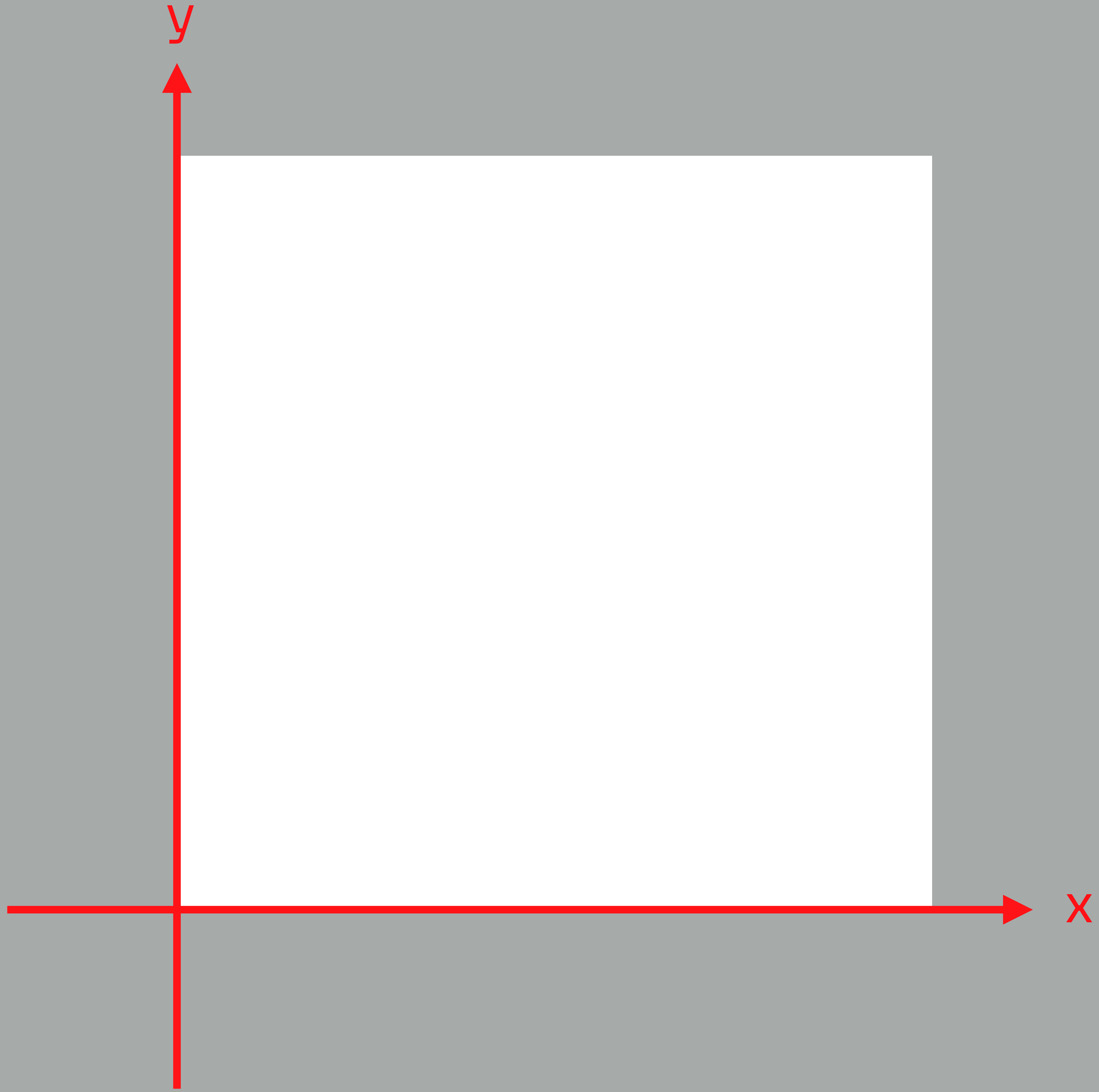
Translate & Rotate



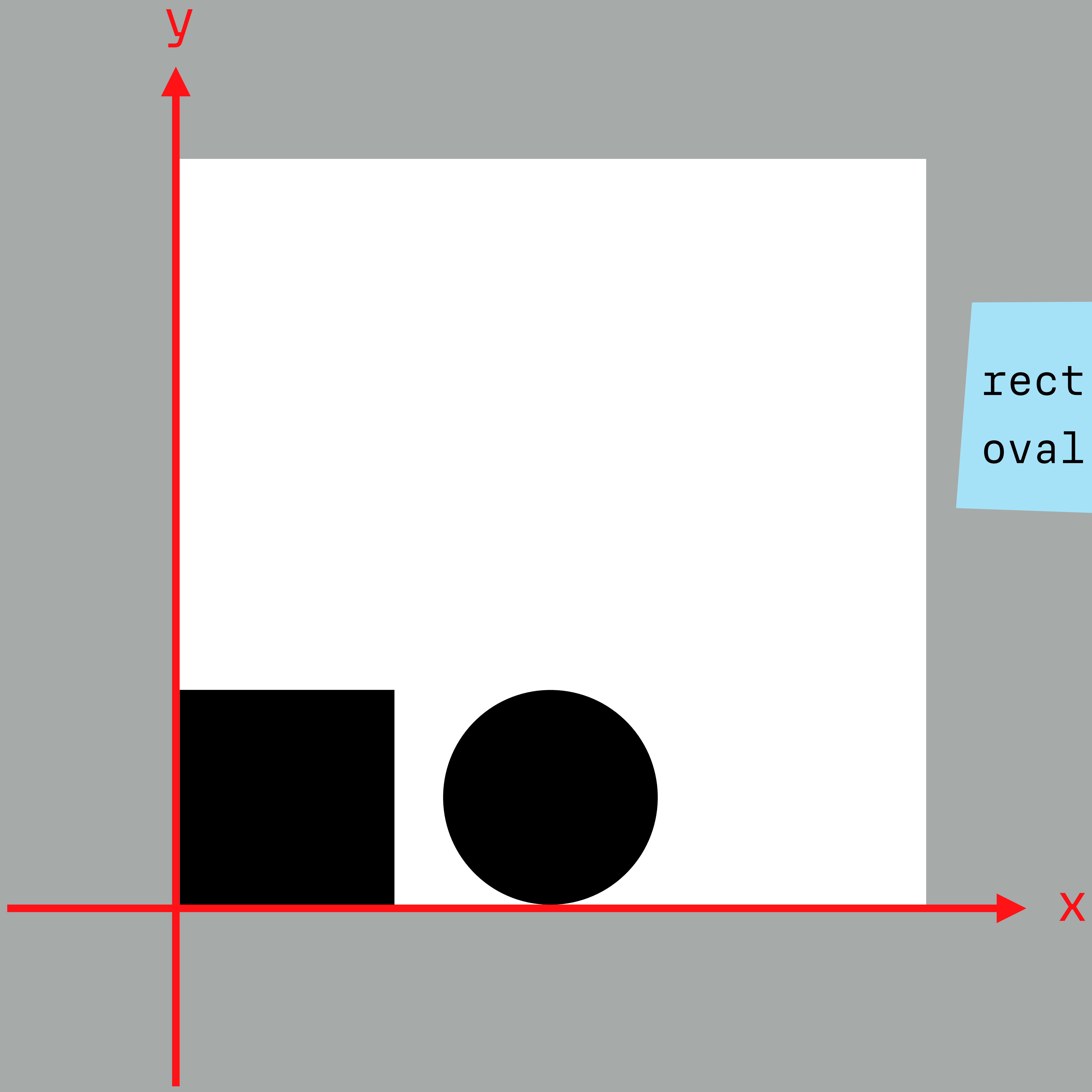
```
rotate(45)
rect(0, 0, 300, 300)
oval(400, 0, 300, 300)
```

wtf? 🧐 😡

Rotation

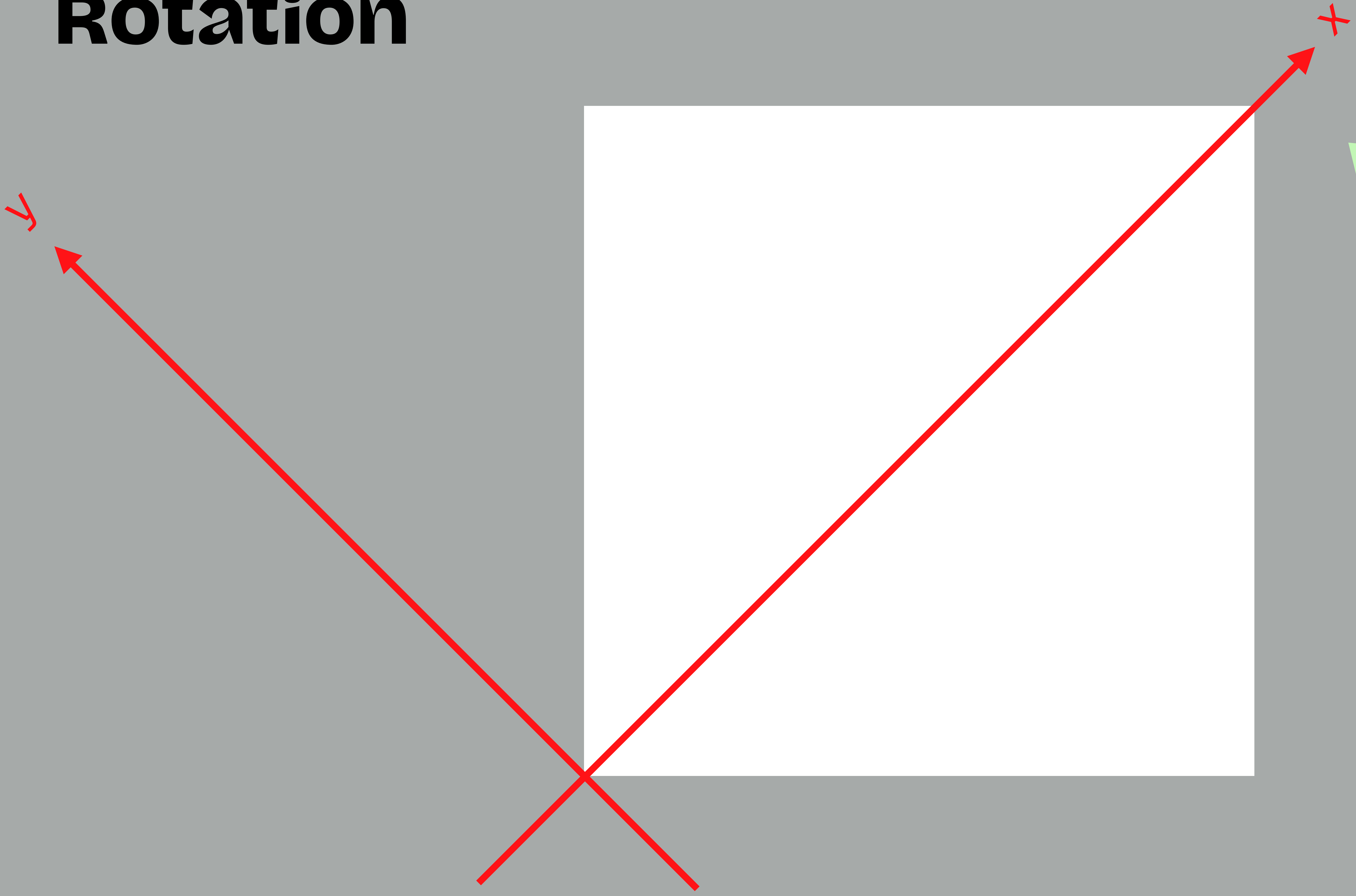


Rotation



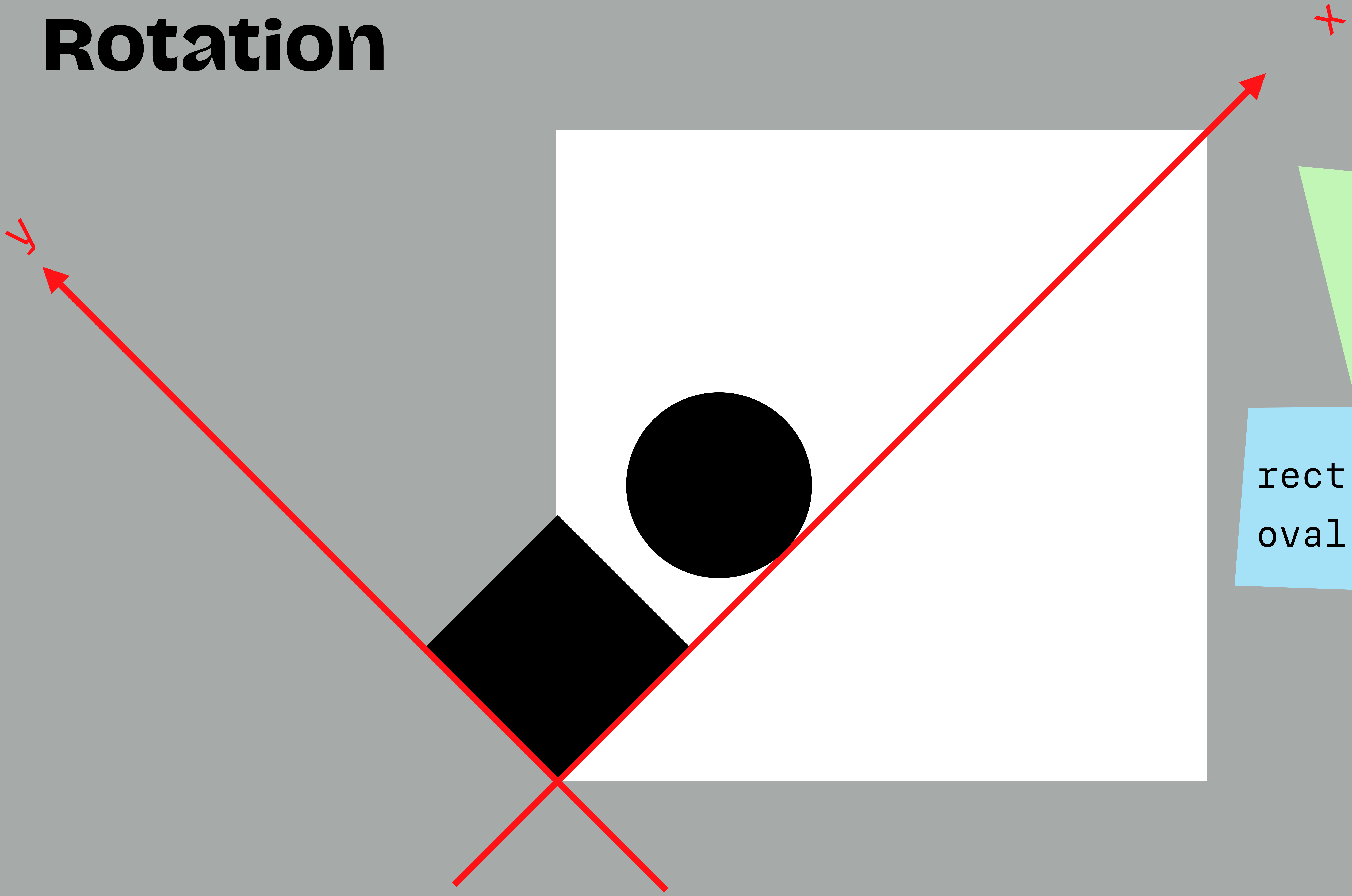
```
rect(0, 0, 300, 300)
oval(400, 0, 300, 300)
```

Rotation



```
rotate(45)
```

Rotation

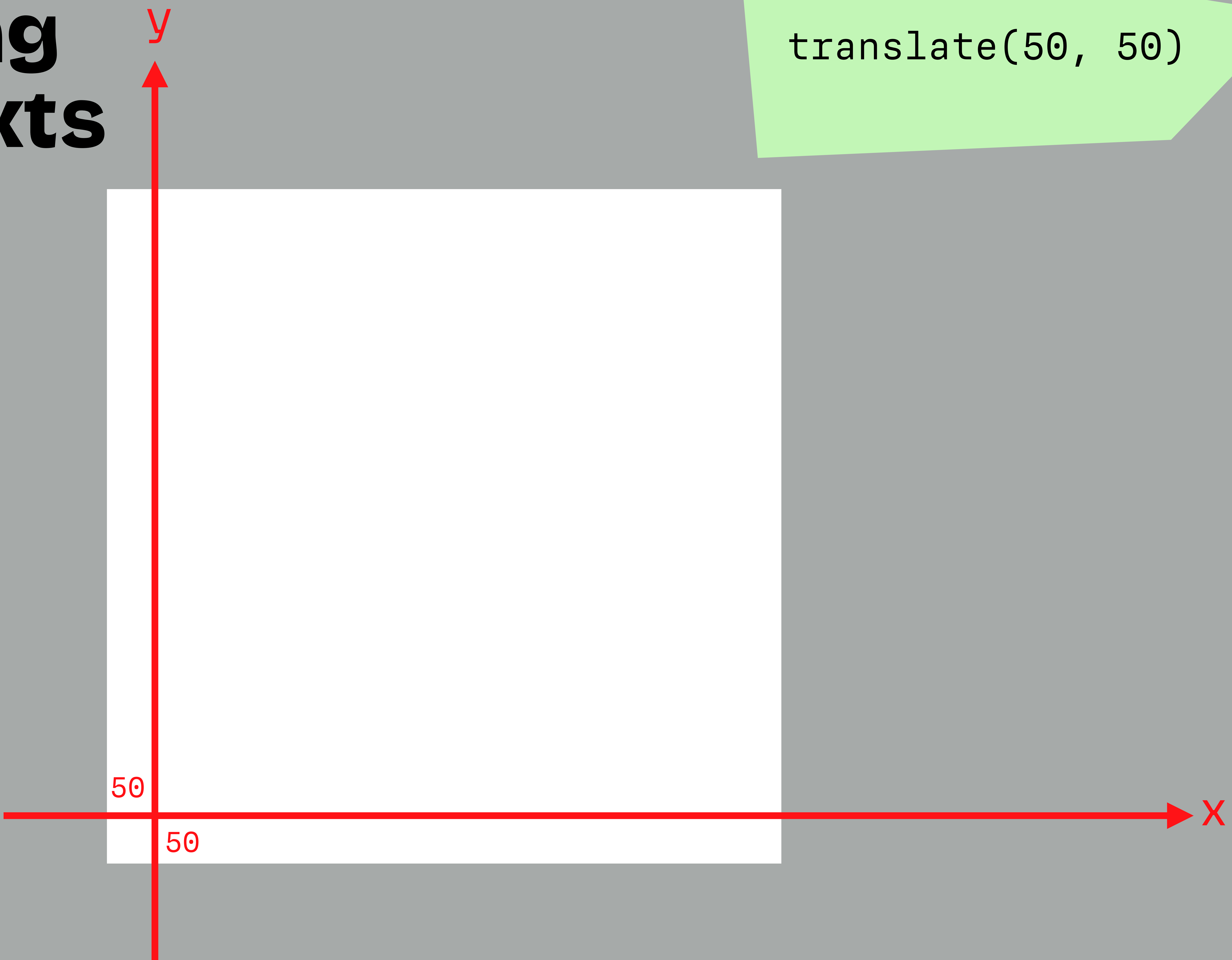


```
rotate(45)
```

```
rect(0, 0, 300, 300)
oval(400, 0, 300, 300)
```

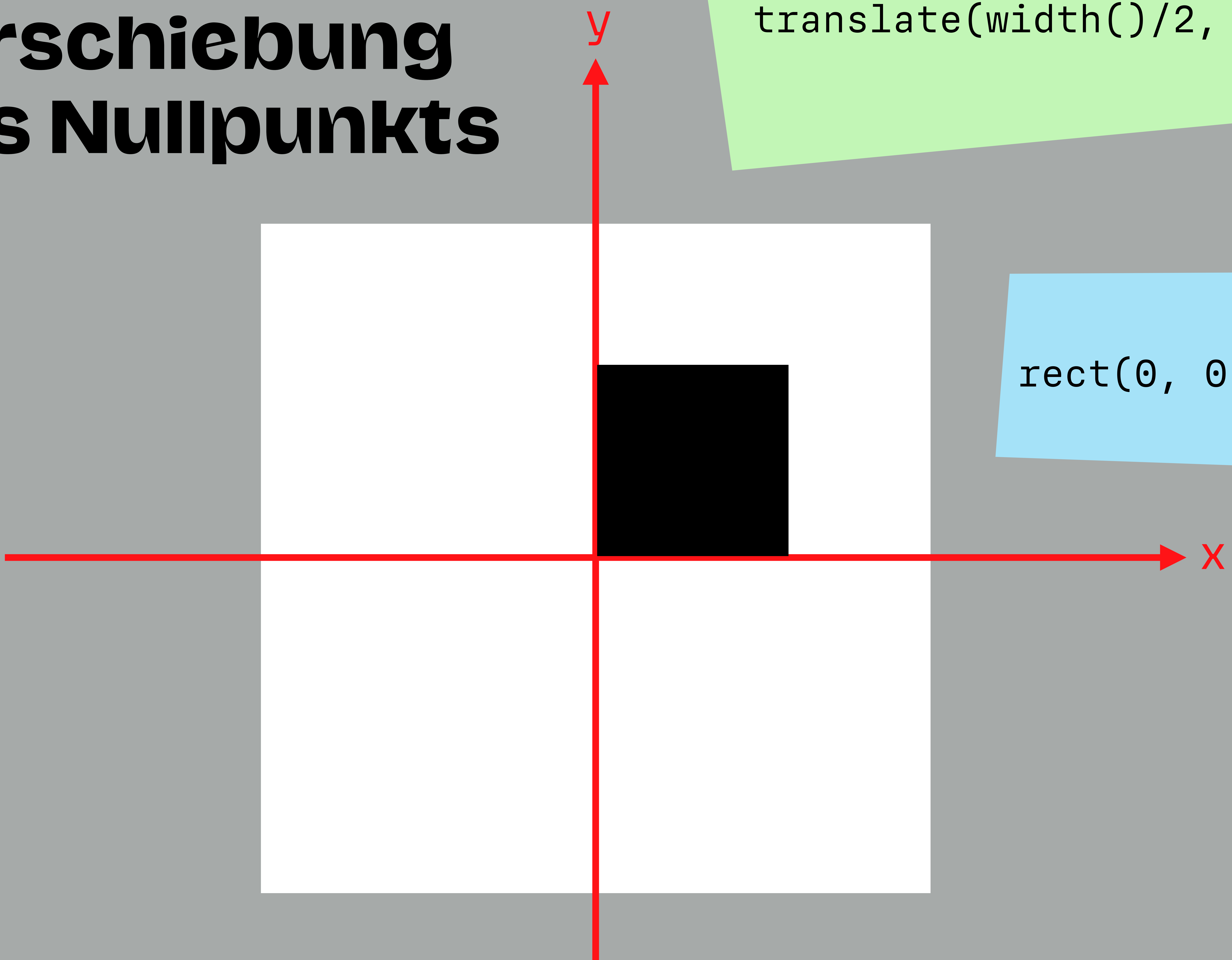
Verschiebung des Nullpunkts

```
translate(50, 50)
```



Verschiebung des Nullpunkts

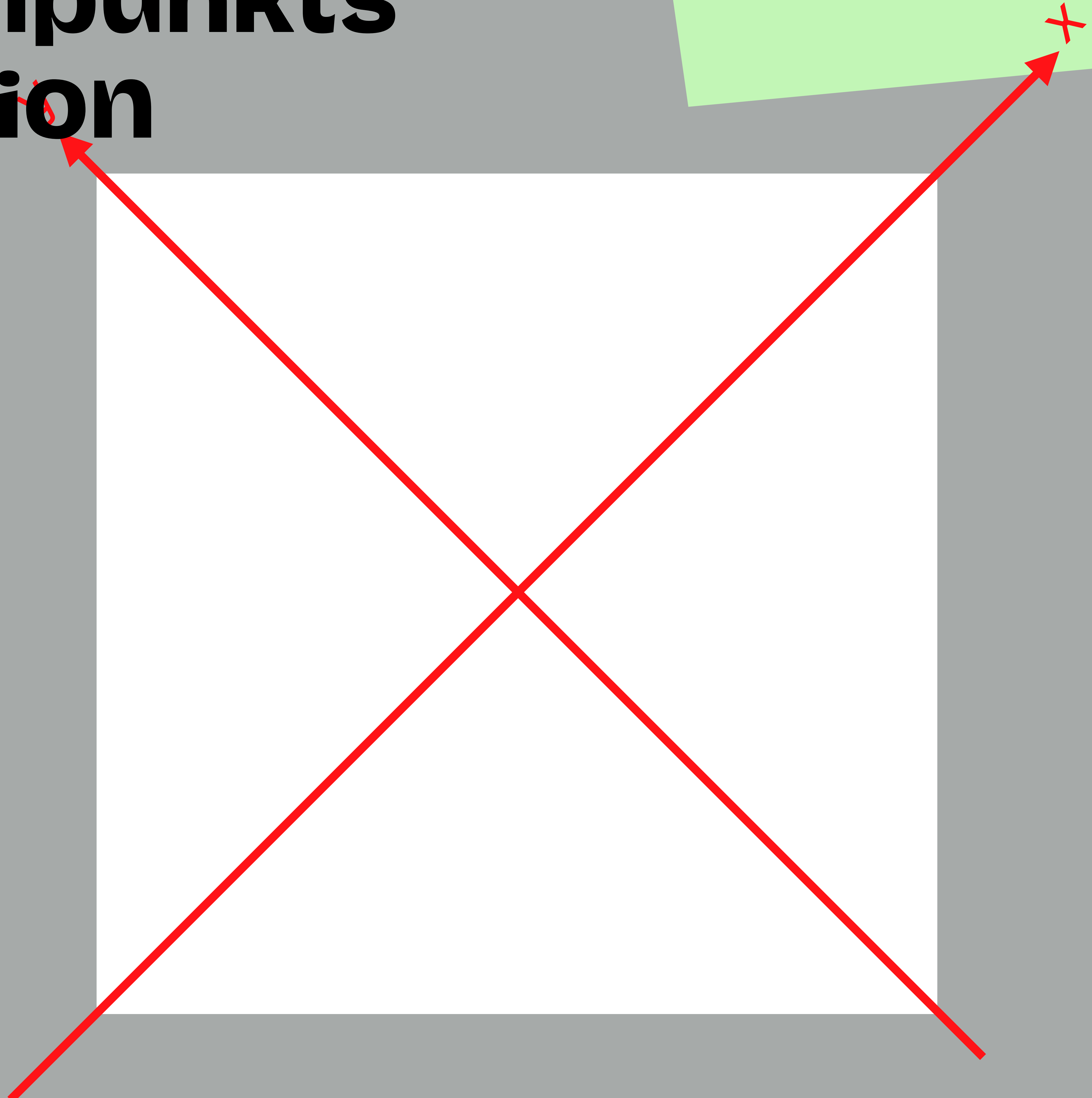
```
translate(width()/2, height()/2)
```



```
rect(0, 0, 300, 300)
```

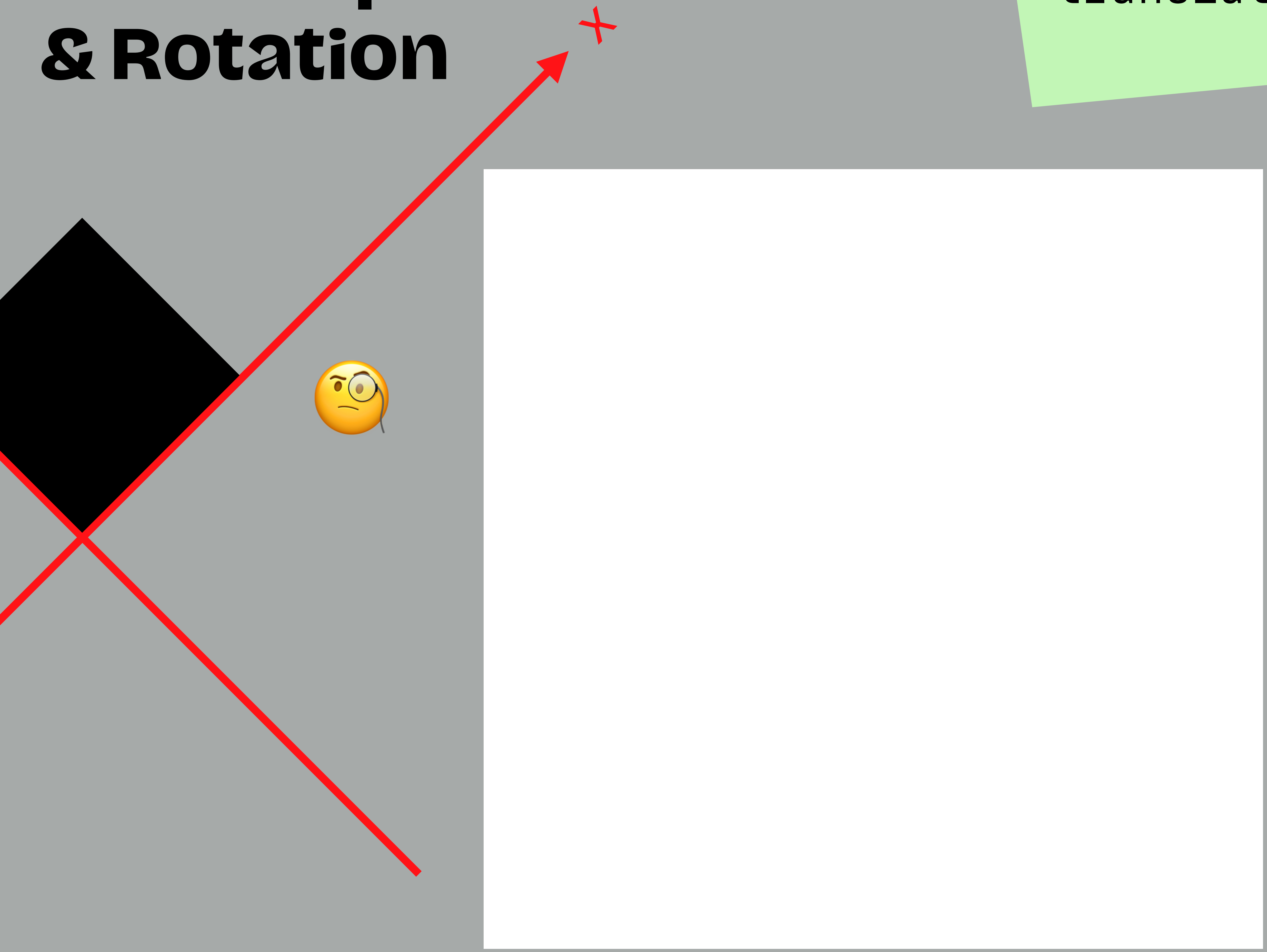
Verschiebung des Nullpunkts & Rotation

```
translate(width()/2, height()/2)
rotate(45)
```



Verschiebung des Nullpunkts & Rotation

```
rotate(45)
translate(width() / 2, height() / 2)
```

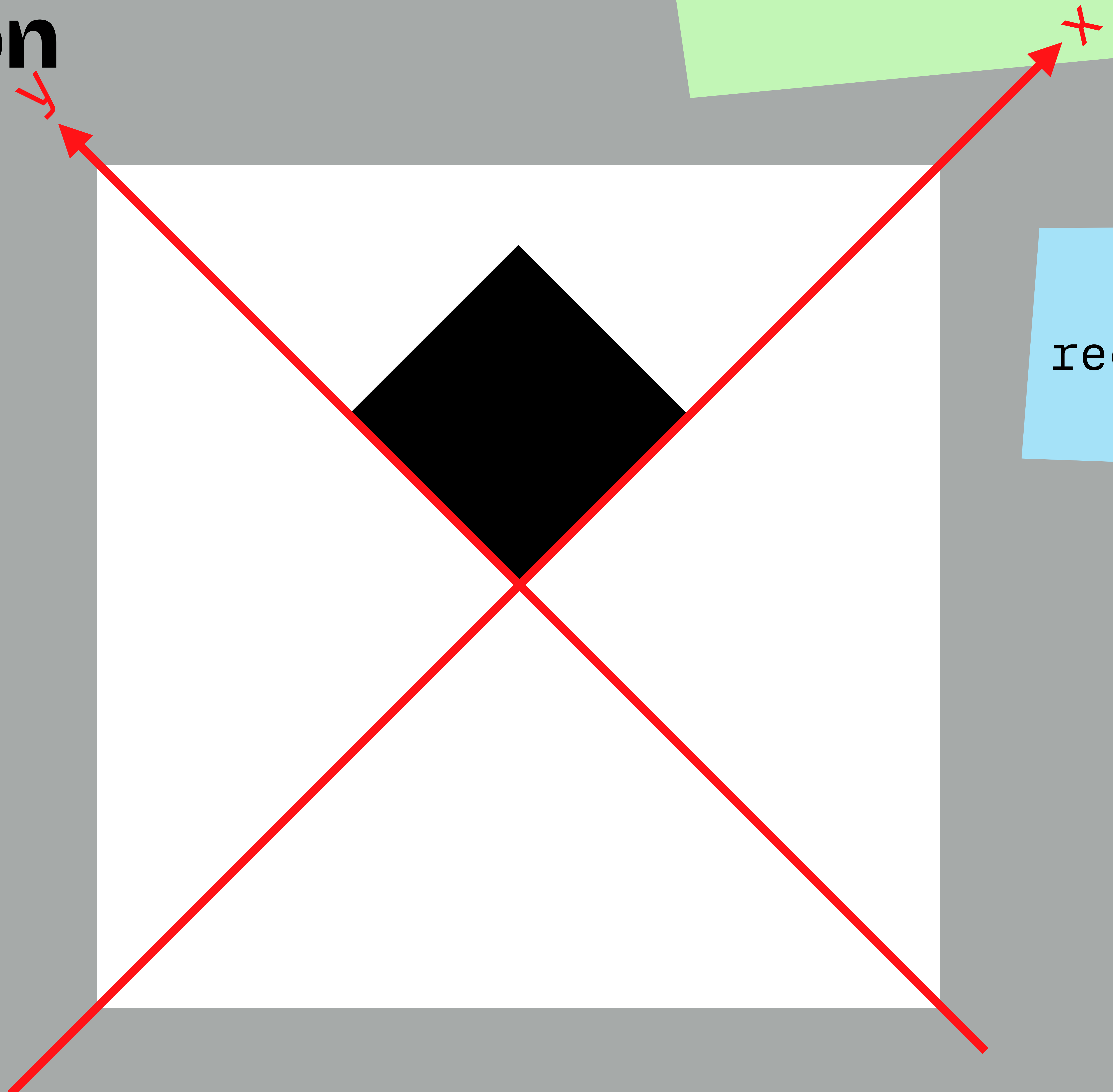


```
rect(0, 0, 300, 300)
```

Achtung bei der Reihenfolge!

Verschiebung des Nullpunkts & Rotation

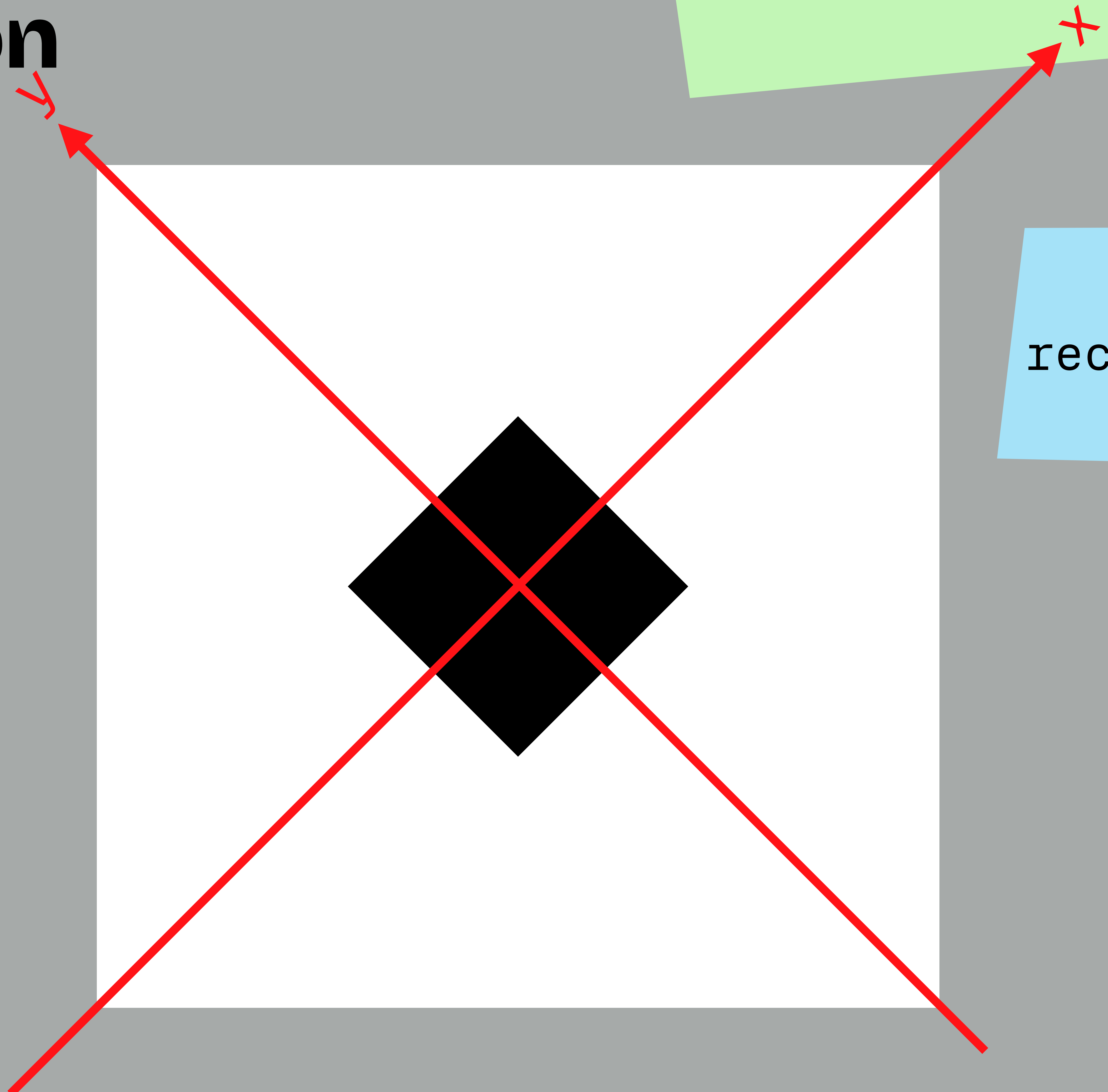
```
translate(width()/2, height()/2)
rotate(45)
```



```
rect(0, 0, 300, 300)
```

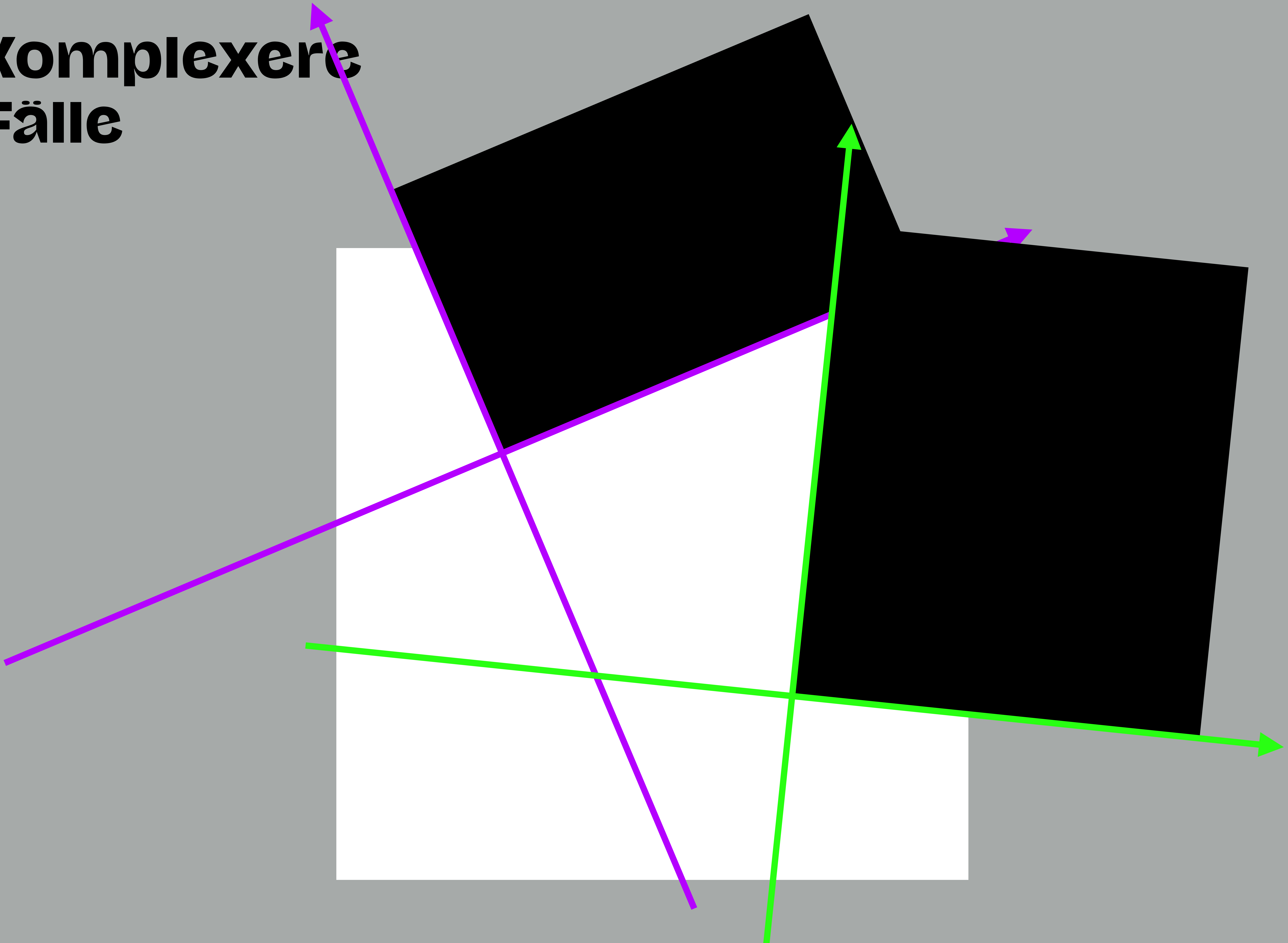
Verschiebung des Nullpunkts & Rotation

```
translate(width()/2, height()/2)
rotate(45)
```



```
rect(0-150, 0-150, 300, 300)
```

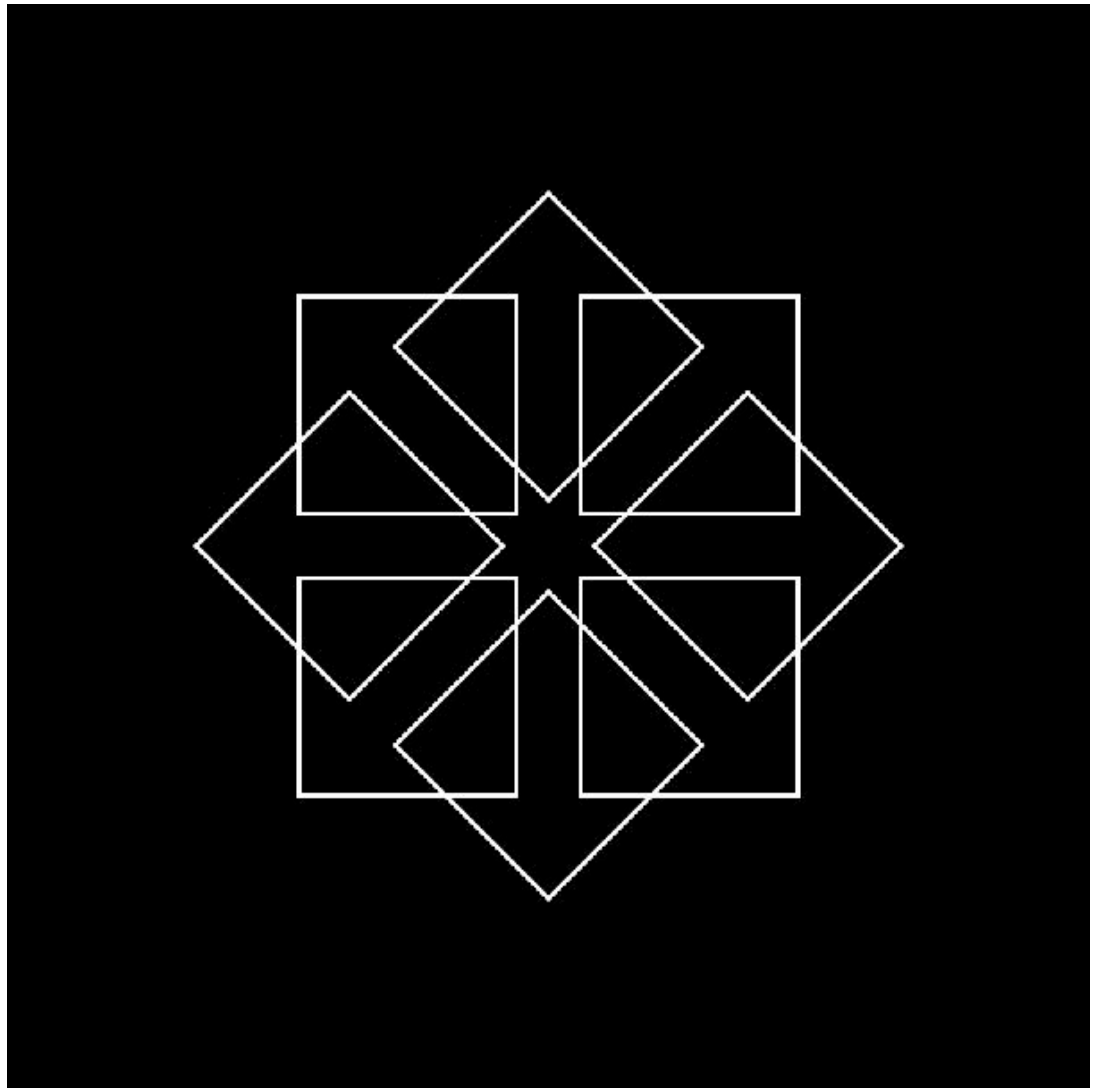
Komplexere Fälle

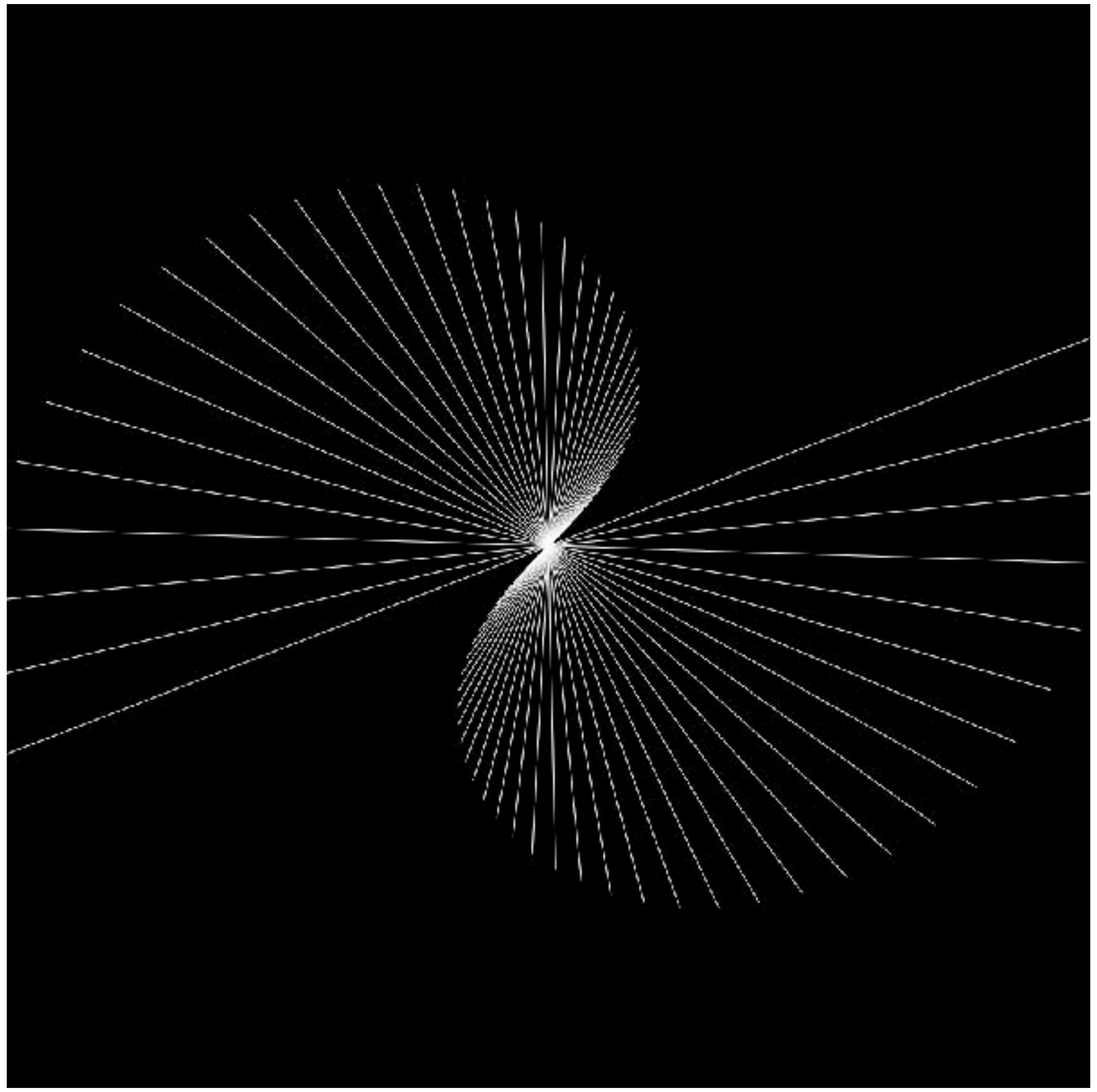


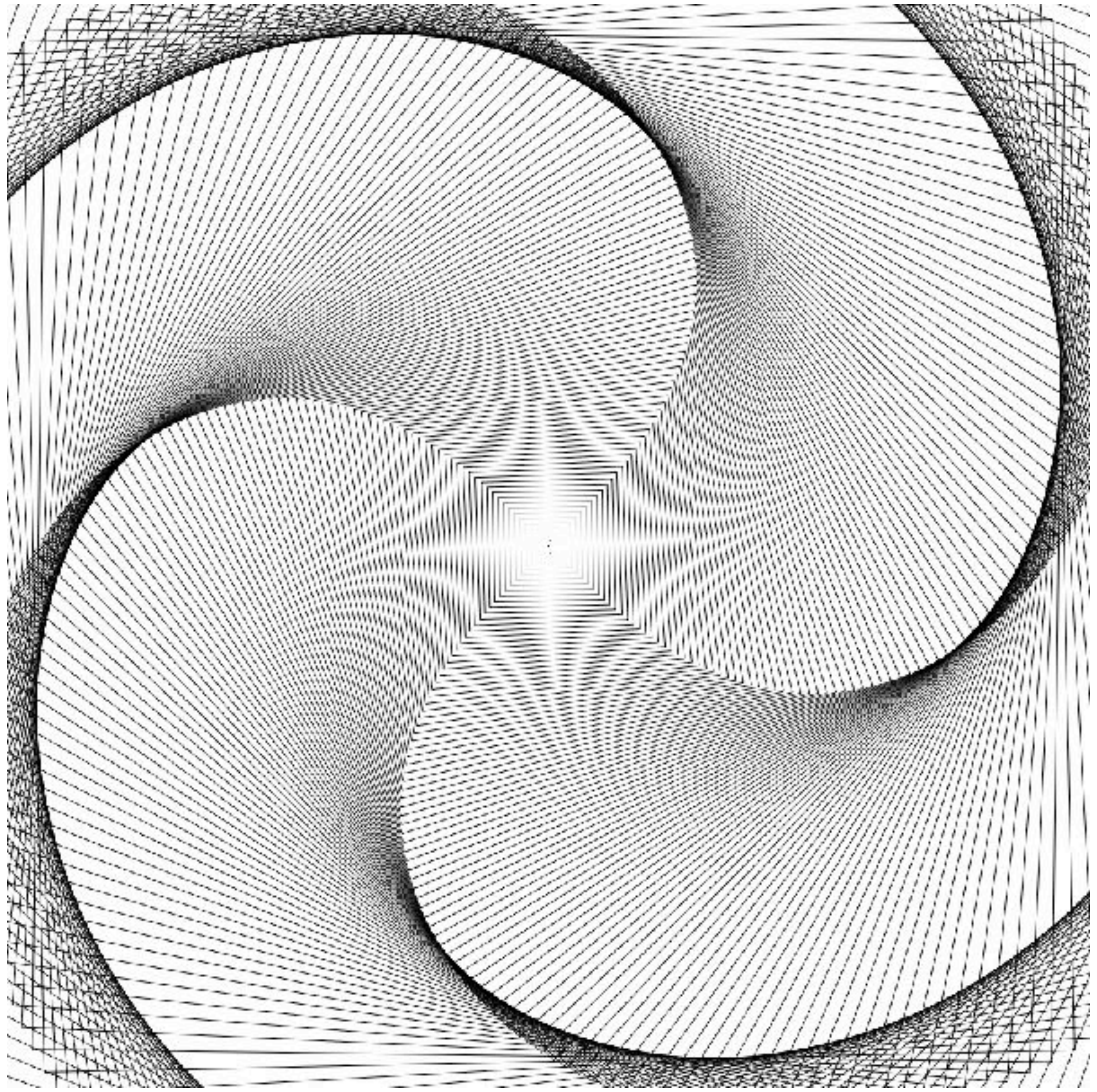
Die Rotate-Funktion vereinfacht

```
translate(100, 100)
rotate(-45)

# Kurzschreibweise
rotate(-45, (100, 100))
```

Probier mal, etwas zu rotieren







am besten mit einem Loop ...

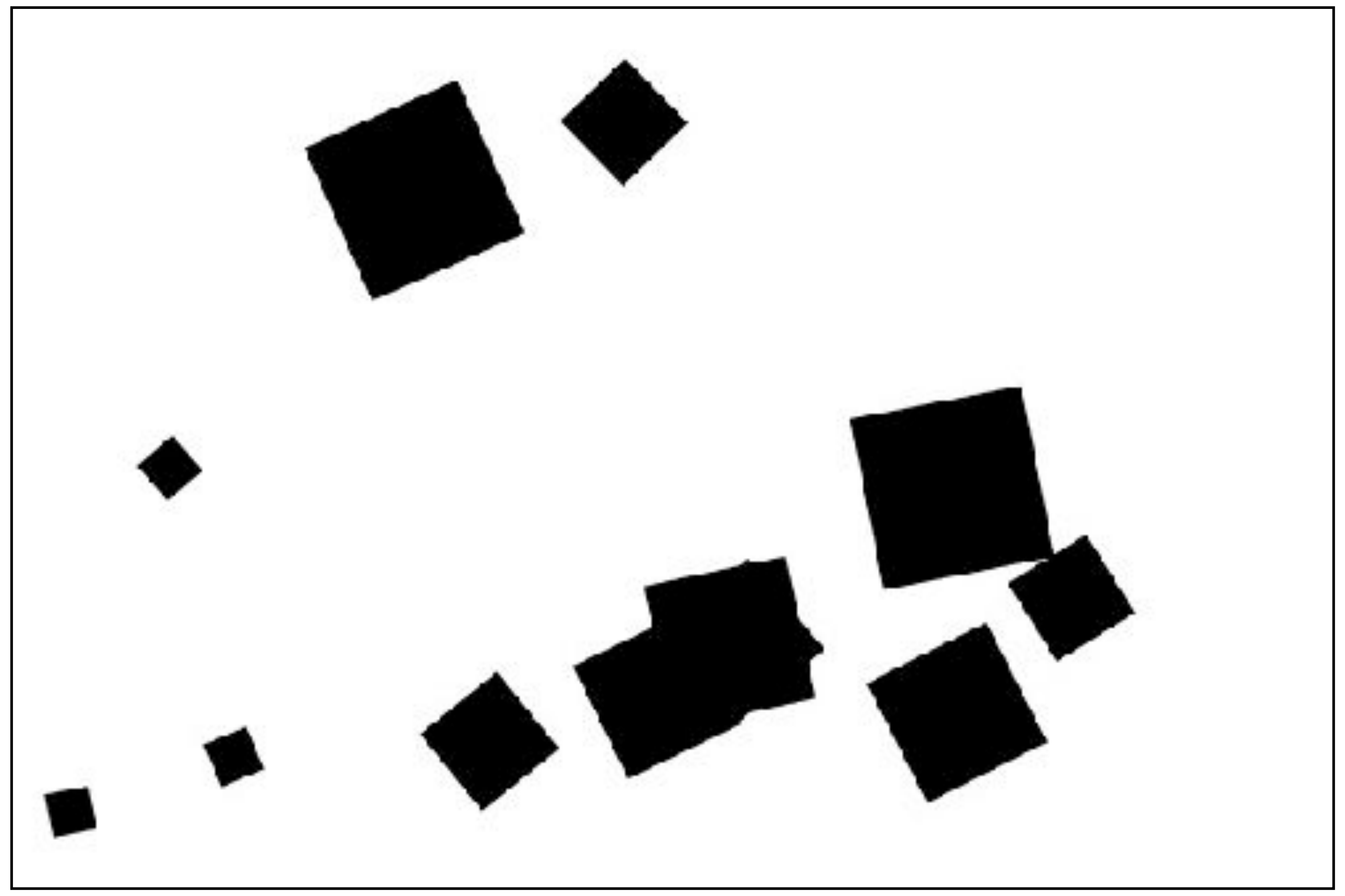
saved state

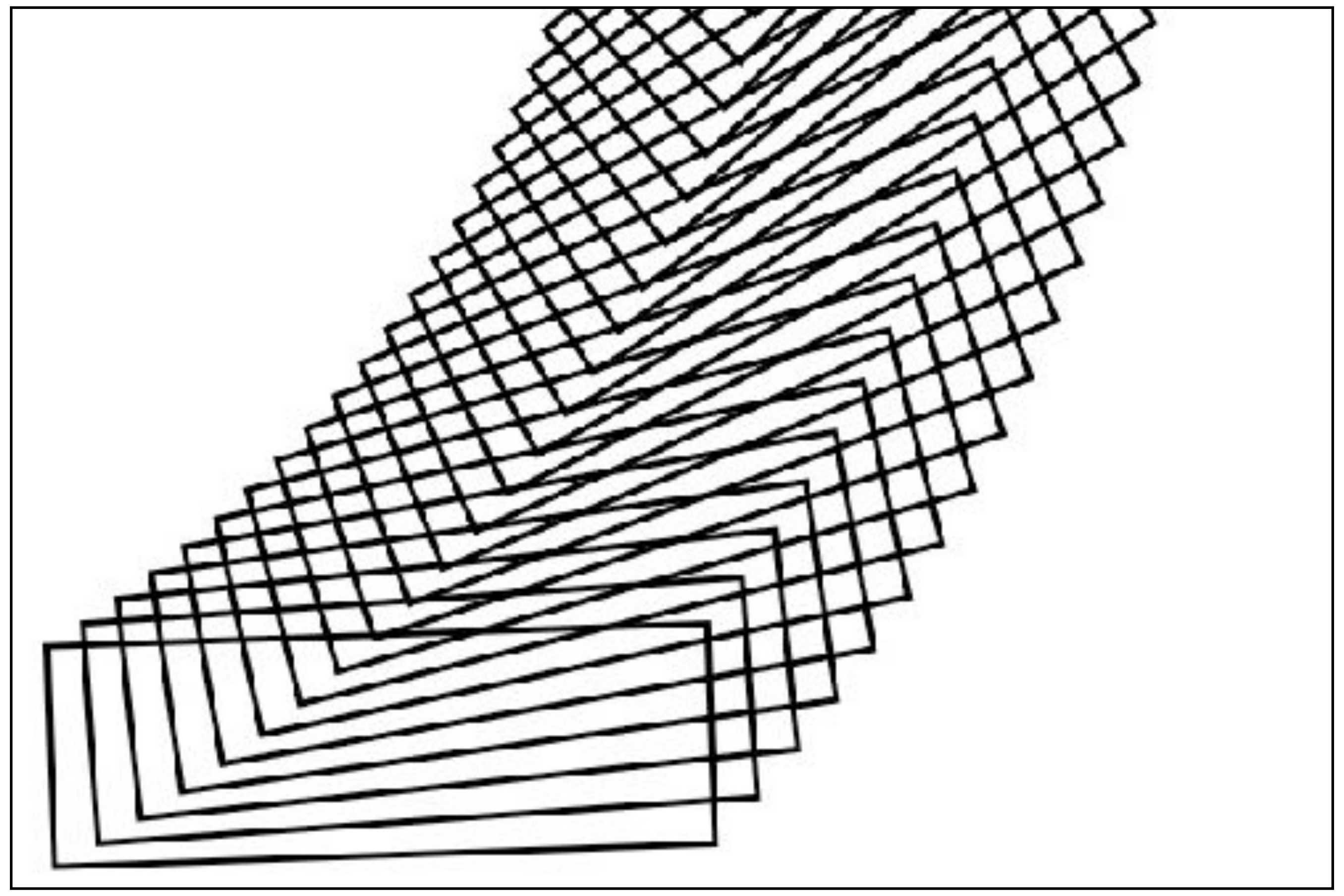
Ausgangszustand wiederherstellen

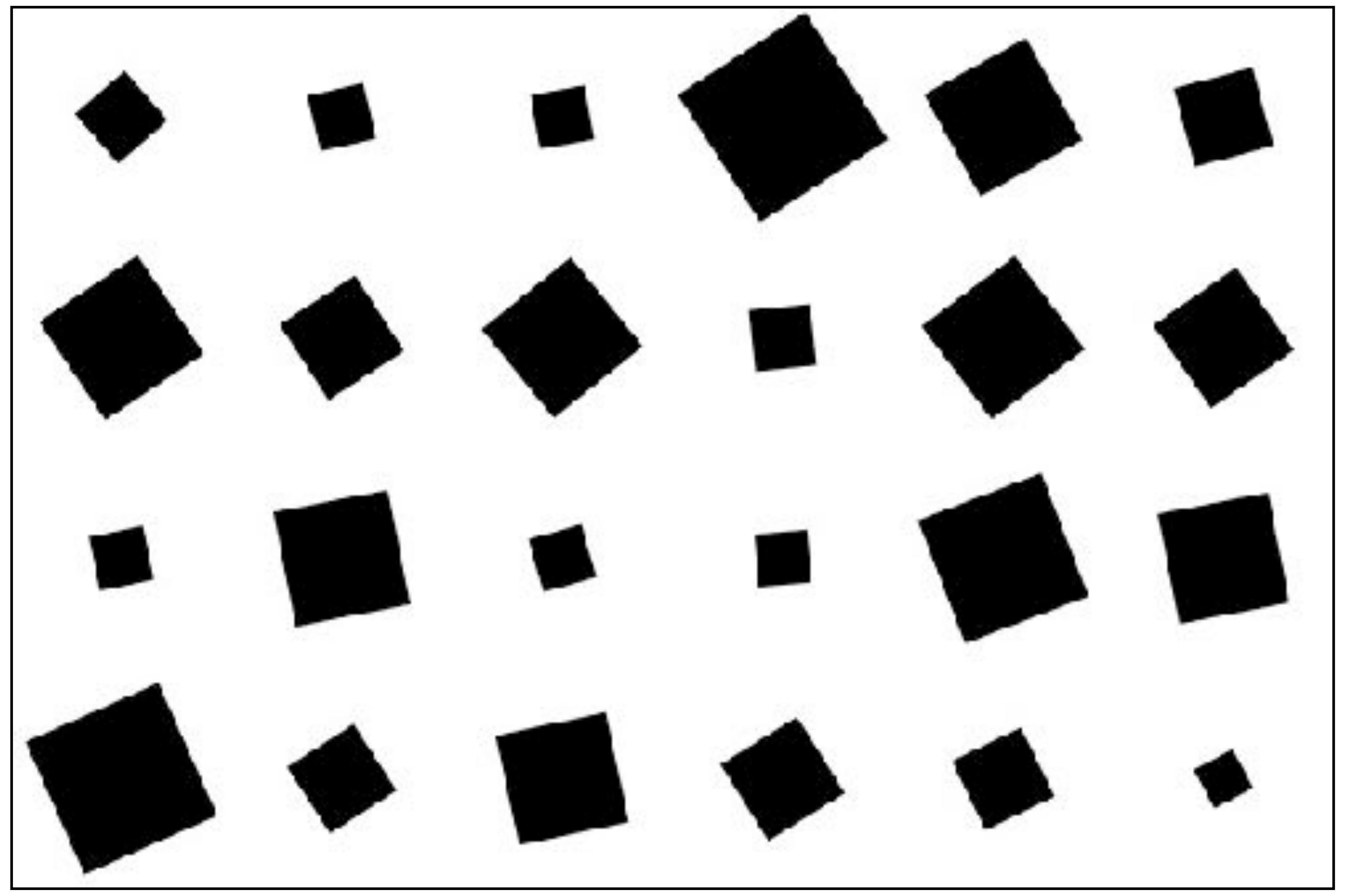
```
with savedState():
    translate(300, 300)
    rotate(30)
    fill(1, 0, 0)
    rect(0, 0, 400, 400)
rect(0, 0, 300, 300)
```

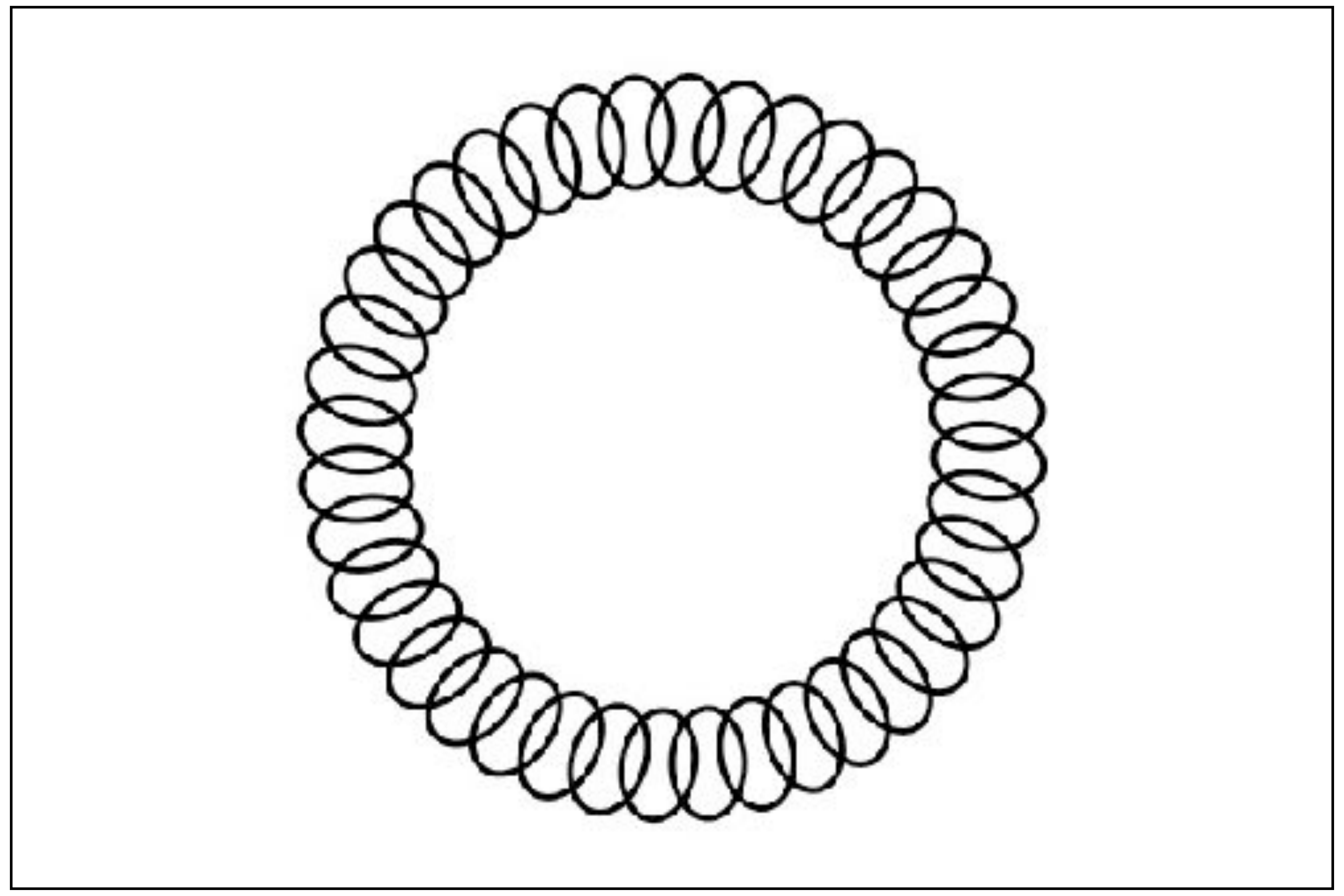
Diese Veränderungen gelten nur im eingerückten Block.
Danach werden Nullpunkt, Rotation und Farbe zurückgesetzt.

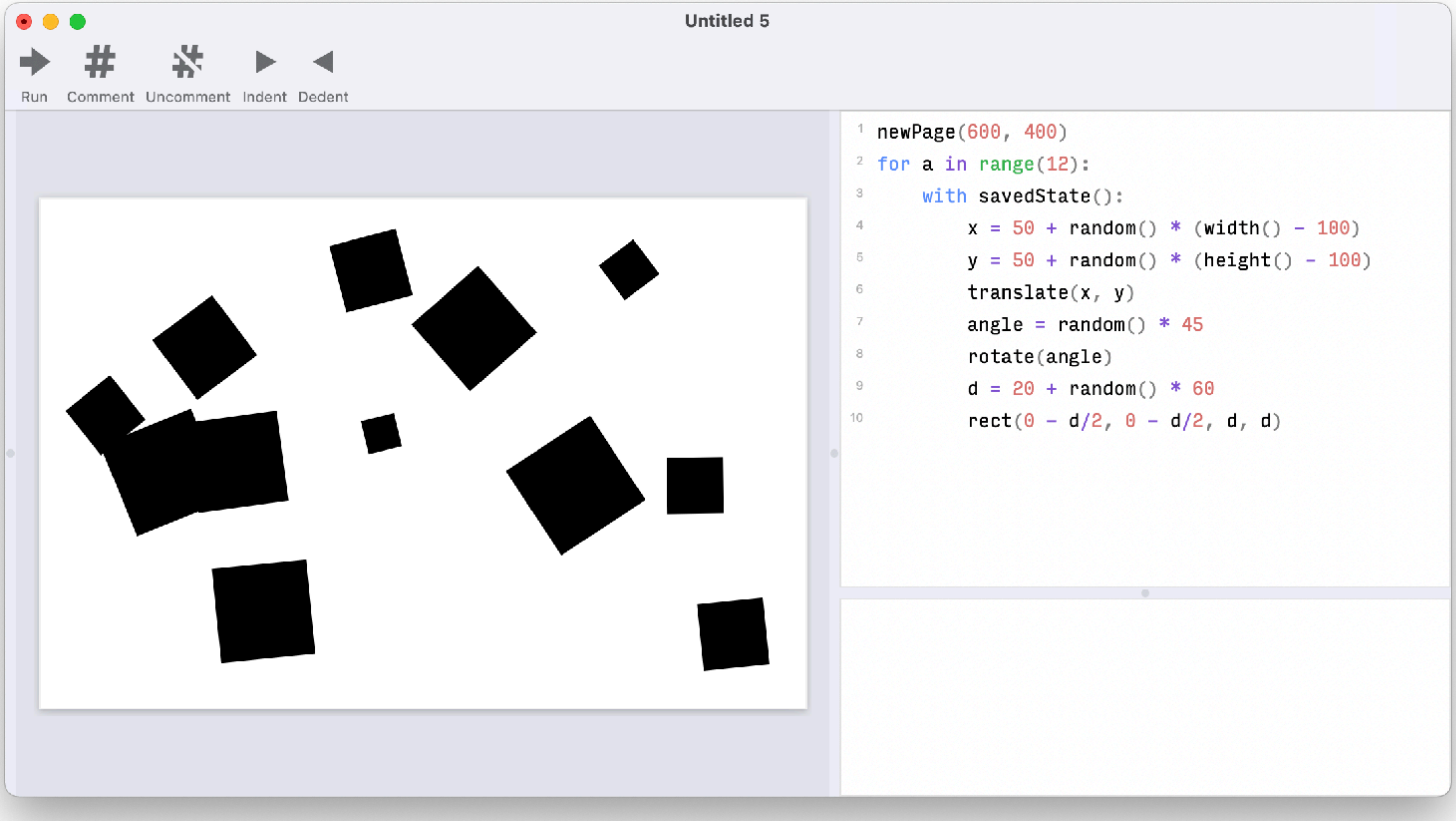
Für welche Bilder braucht es savedState?





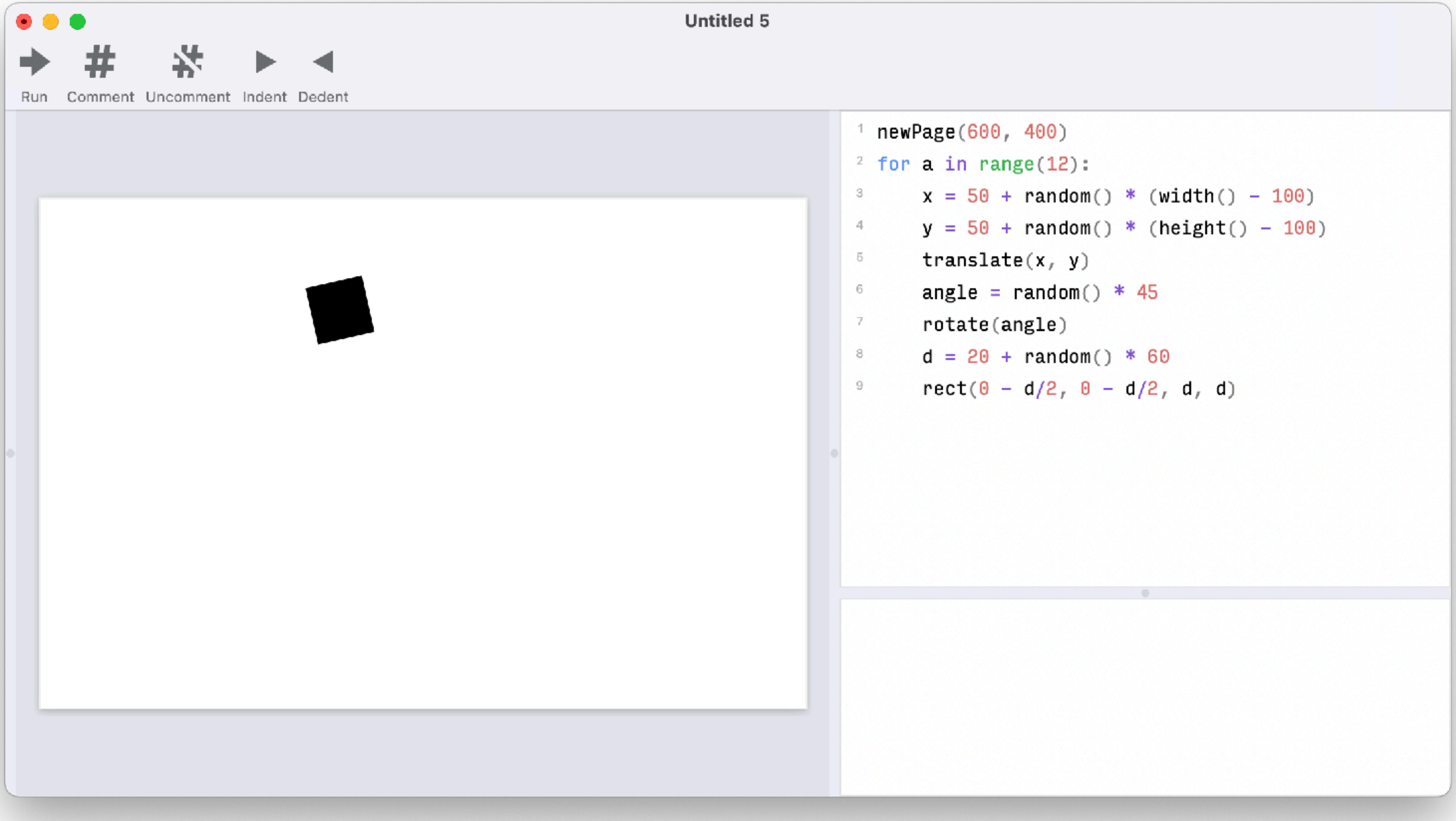






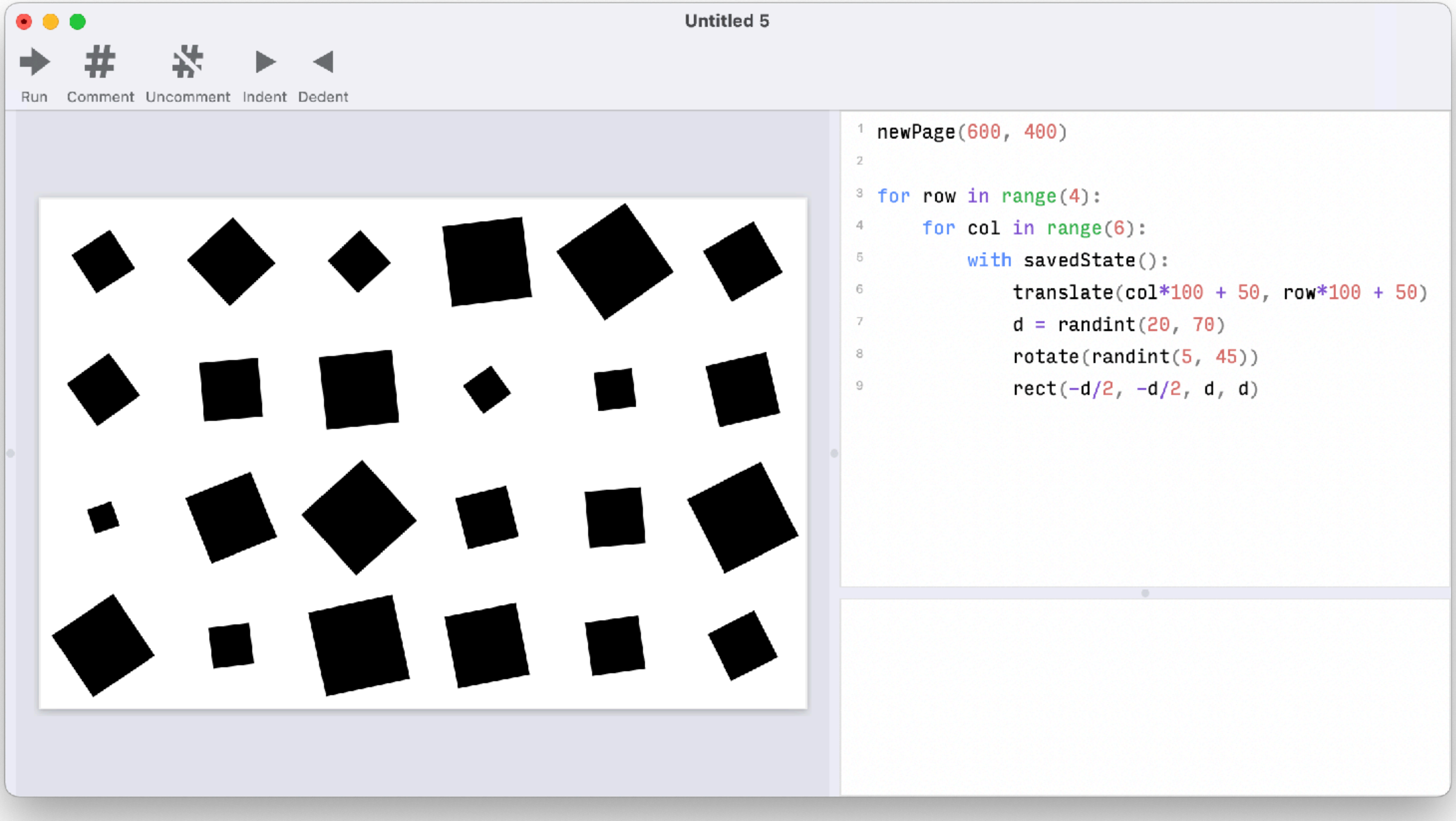
```
newPage(600, 400)
for a in range(12):
    with savedState():
        x = 50 + random() * (width() - 100)
        y = 50 + random() * (height() - 100)
        translate(x, y)
        angle = random() * 45
        rotate(angle)
        d = 20 + random() * 60
        rect(0 - d/2, 0 - d/2, d, d)
```

mit savedState



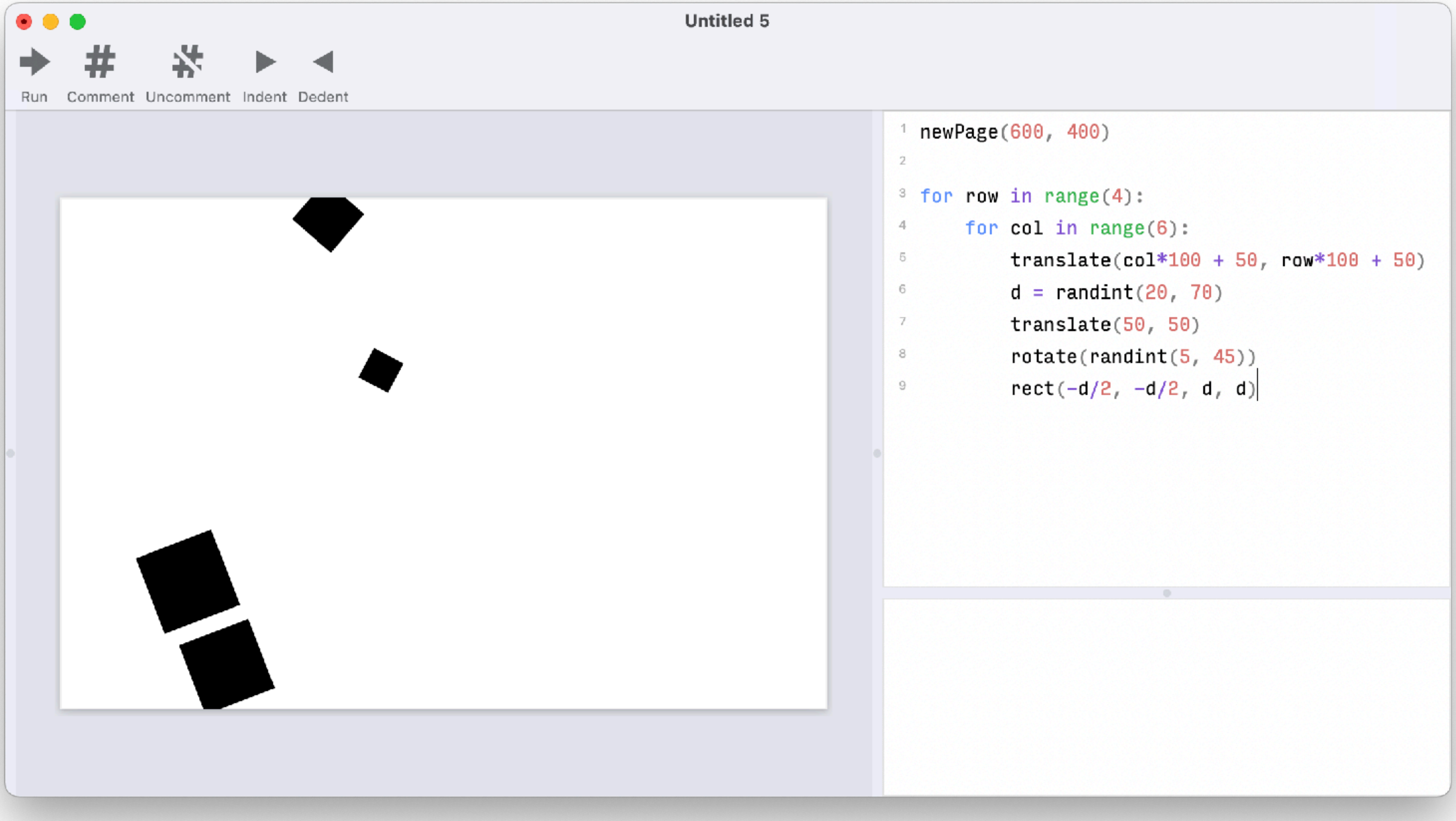
```
newPage(600, 400)
for a in range(12):
    x = 50 + random() * (width() - 100)
    y = 50 + random() * (height() - 100)
    translate(x, y)
    angle = random() * 45
    rotate(angle)
    d = 20 + random() * 60
    rect(0 - d/2, 0 - d/2, d, d)
```

ohne savedState



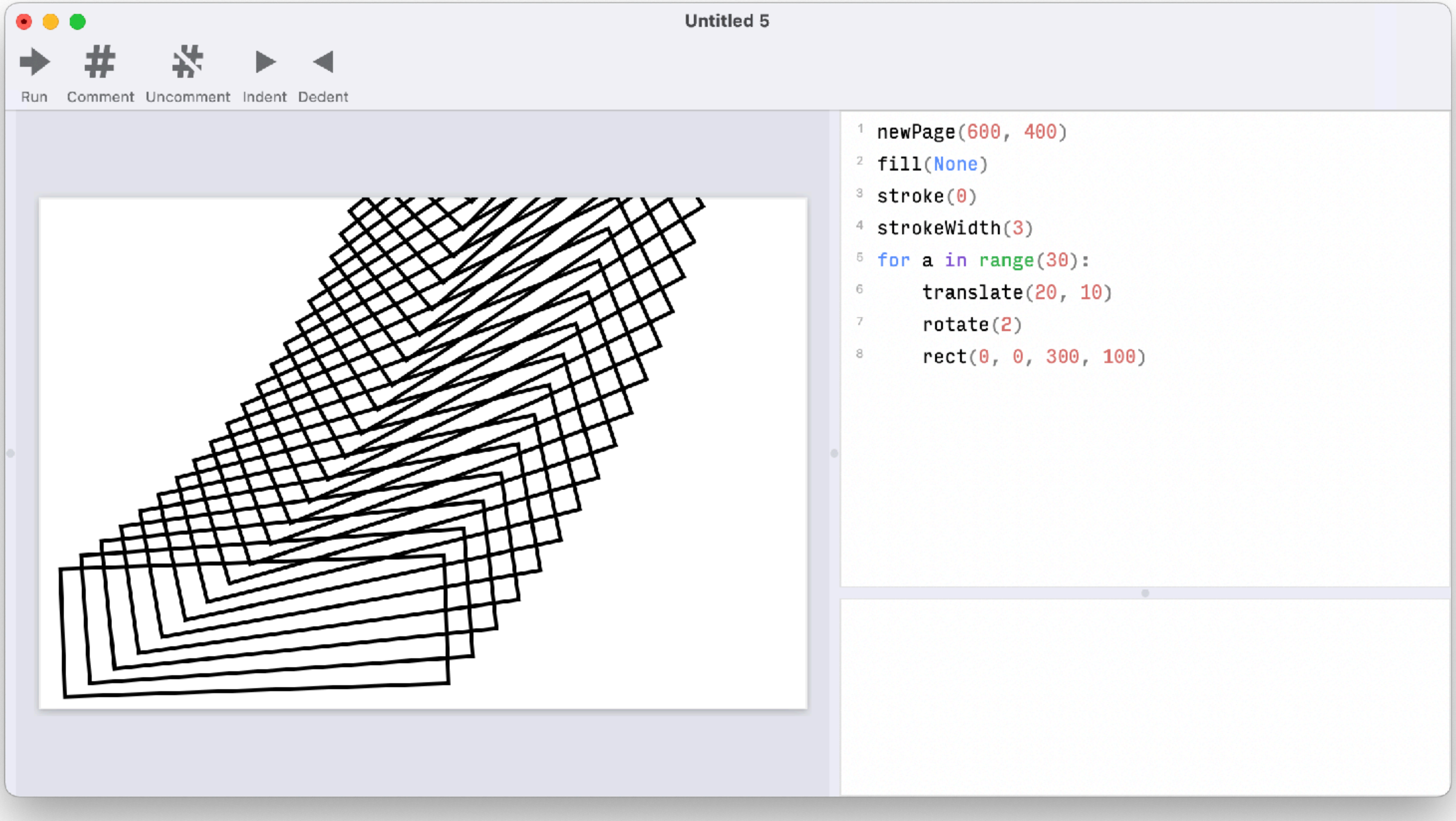
```
newPage(600, 400)

for row in range(4):
    for col in range(6):
        with savedState():
            translate(col*100 + 50, row*100 + 50)
            d = randint(20, 70)
            rotate(randint(5, 45))
            rect(-d/2, -d/2, d, d)
```

mit savedState



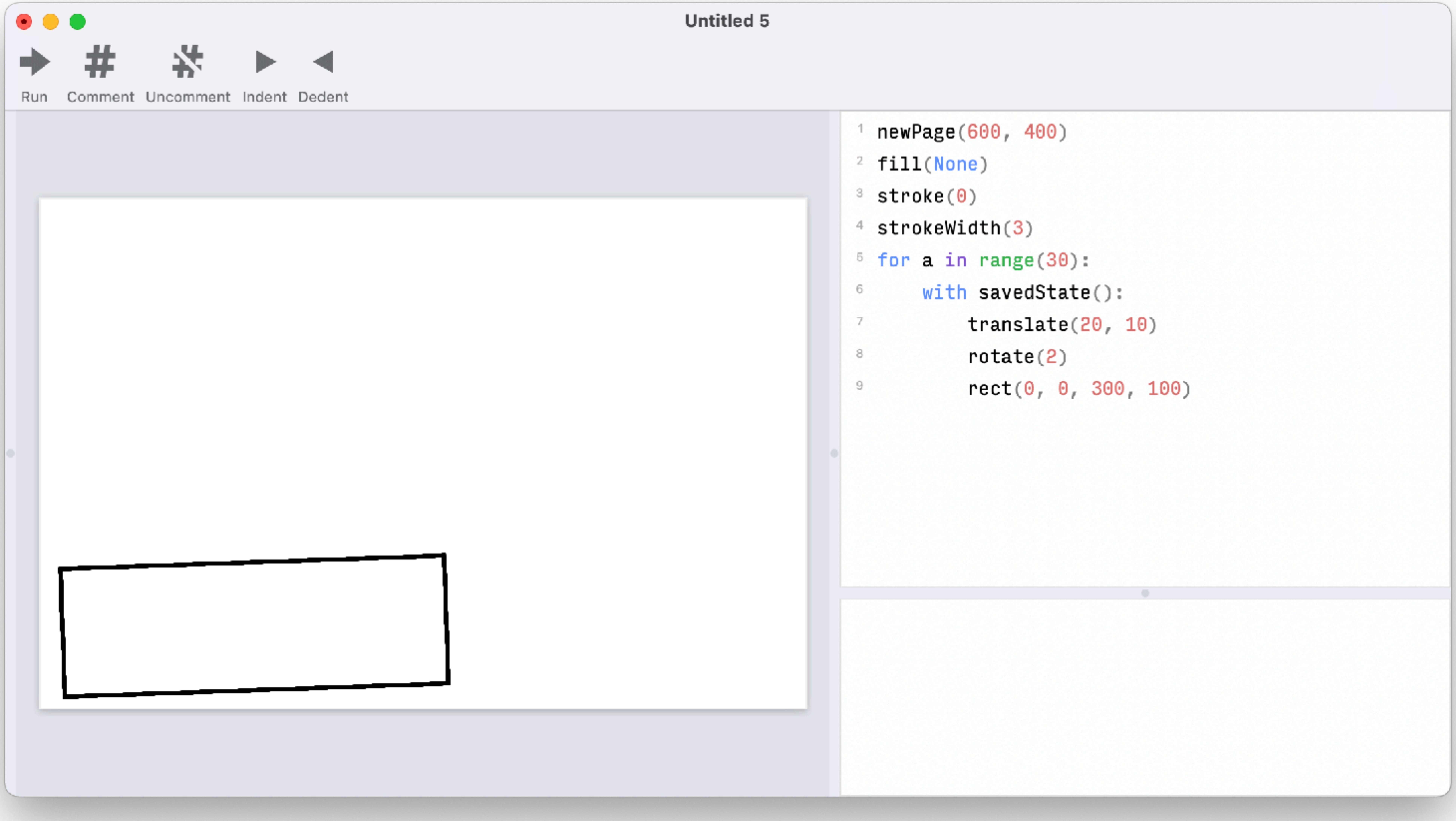
```
newPage(600, 400)

for row in range(4):
    for col in range(6):
        translate(col*100 + 50, row*100 + 50)
        d = randint(20, 70)
        translate(50, 50)
        rotate(randint(5, 45))
        rect(-d/2, -d/2, d, d)
```

ohne savedState



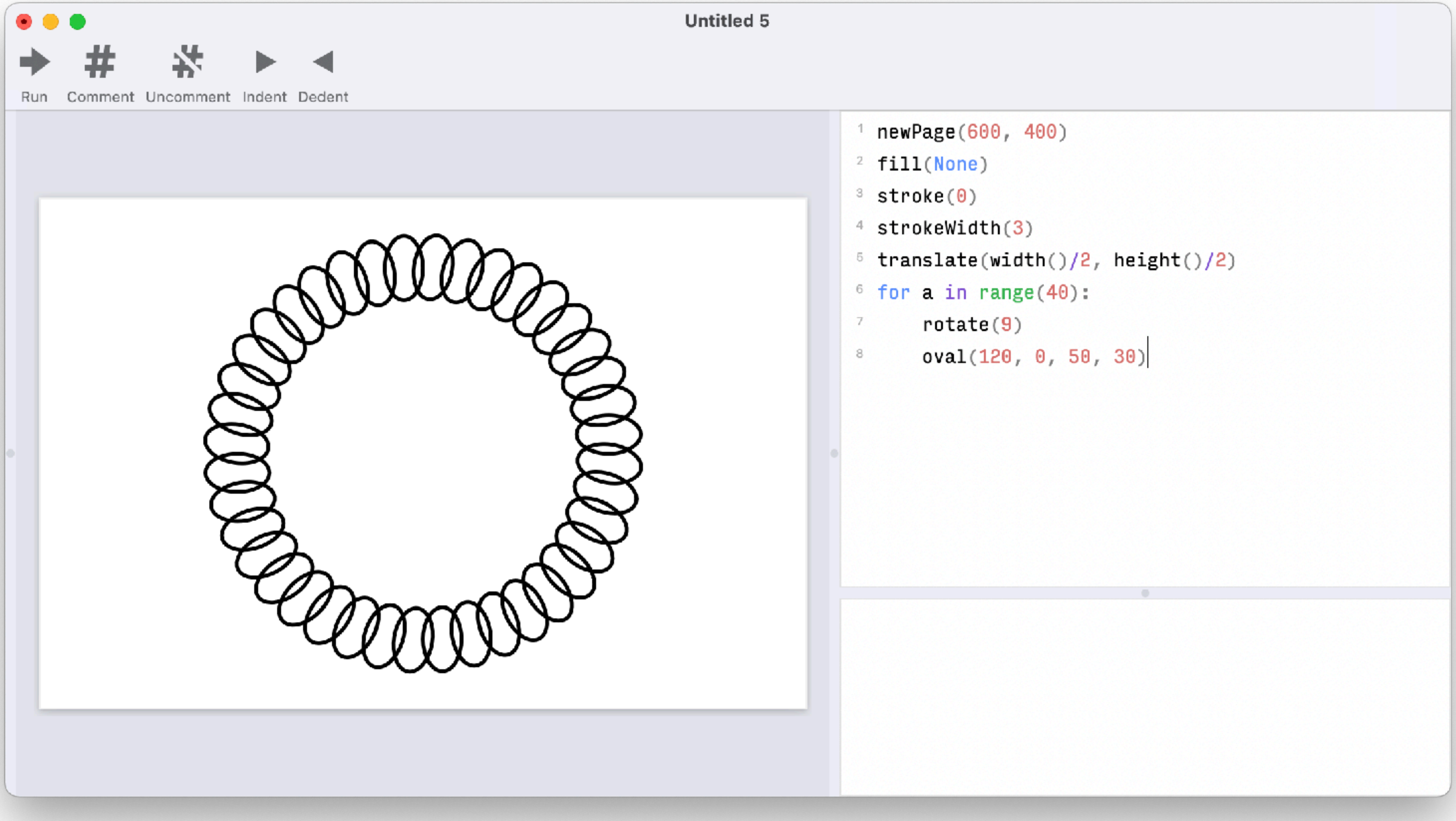
```
newPage(600, 400)
fill(None)
stroke(0)
strokeWidth(3)
for a in range(30):
    translate(20, 10)
    rotate(2)
    rect(0, 0, 300, 100)
```

ohne savedState



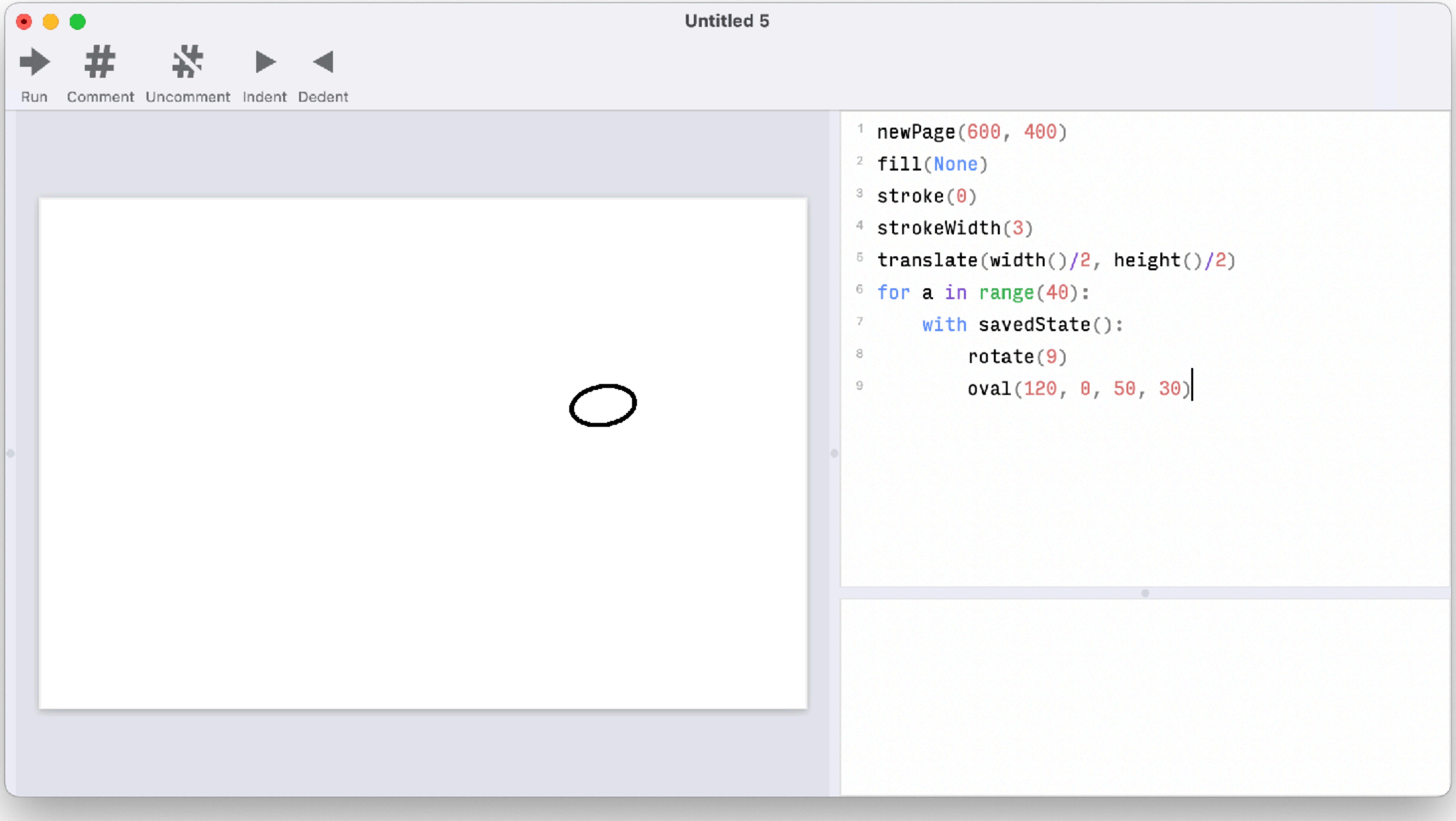
```
newPage(600, 400)
fill(None)
stroke(0)
strokeWidth(3)
for a in range(30):
    with savedState():
        translate(20, 10)
        rotate(2)
        rect(0, 0, 300, 100)
```

mit savedState



```
newPage(600, 400)
fill(None)
stroke(0)
strokeWidth(3)
translate(width()/2, height()/2)
for a in range(40):
    rotate(9)
    oval(120, 0, 50, 30)
```

ohne savedState



```
newPage(600, 400)
fill(None)
stroke(0)
strokeWidth(3)
translate(width()/2, height()/2)
for a in range(40):
    with savedState():
        rotate(9)
        oval(120, 0, 50, 30)
```

mit savedState