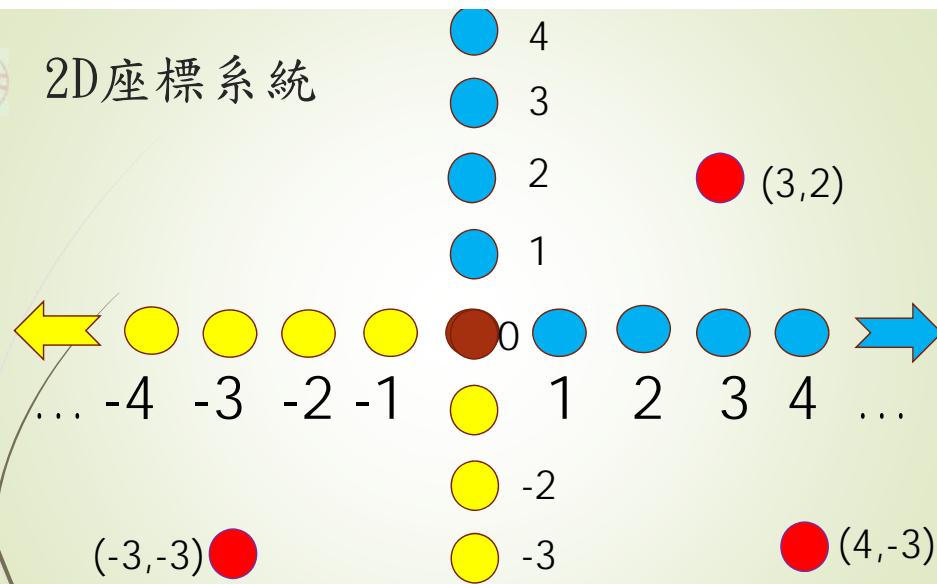
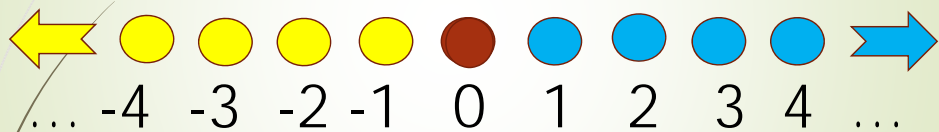


Turtle Graphics : 2D Coordinates

2D座標系統



1D座標系統



座標相關的method

- home()
- setheading()
- heading()
- setx()
- sety()
- xcor()
- ycor()
- goto()



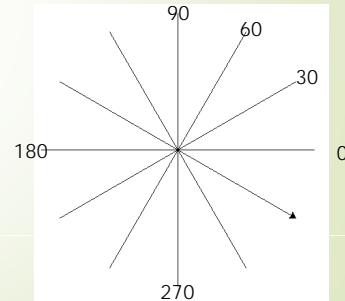
home、setheading、heading

home(): 把turtle放在(0,0)位置

setheading(): 設定目前turtle的方向

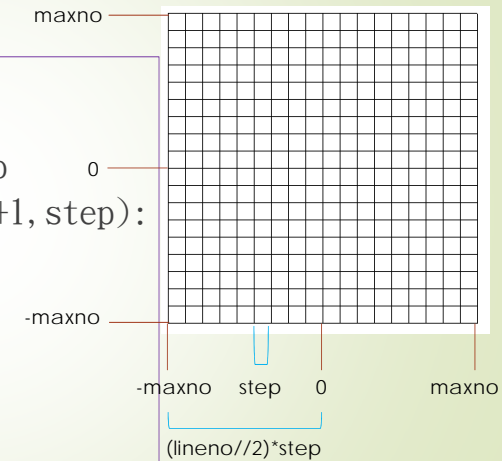
heading(): return目前turtle的方向

```
for i in range(12):
    home()
    setheading(30*i)
    forward(200)
```



Example 1: 如何繪製圍棋棋盤

```
def board(step):
    lineno=19 # odd number
    maxno = (lineno // 2) * step
    for i in range(-maxno, maxno+1, step):
        column(i, maxno)
        row(maxno, i)
def main():
    step = 20
    board(step)
main()
```



setx、sety、xcor、ycor、setposition

假使目前turtle的位置在(x, y)

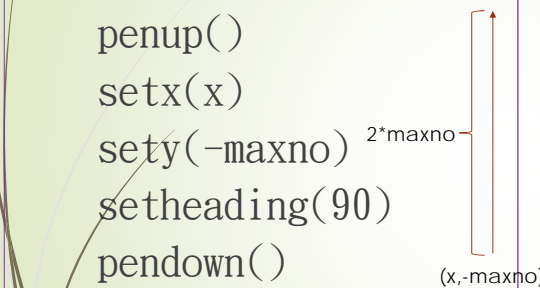
setx(x1): 把turtle位置改成(x1, y), 若pendown時會畫線從(x, y)到(x1, y)

sety(y1): 把turtle位置改成(x, y1), 若pendown時會畫線從(x, y)到(x, y1)



Example 1: 如何繪製圍棋棋盤

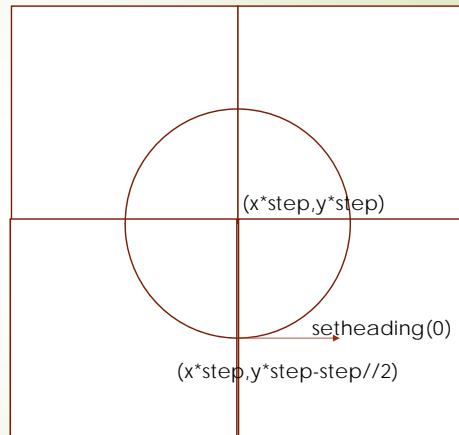
```
def column(x, maxno):
    penup()
    setx(x)
    sety(-maxno)
    setheading(90)
    pendown()
    forward(2*maxno)
    penup()
def row(maxno, y):
    penup()
    setx(-maxno)
    sety(y)
    setheading(0)
    pendown()
    forward(2*maxno)
    penup()
```



draw a vertical line from (x,-maxno) to (x,maxno) draw a horizontal line from (-maxno,y) to (maxno,y)

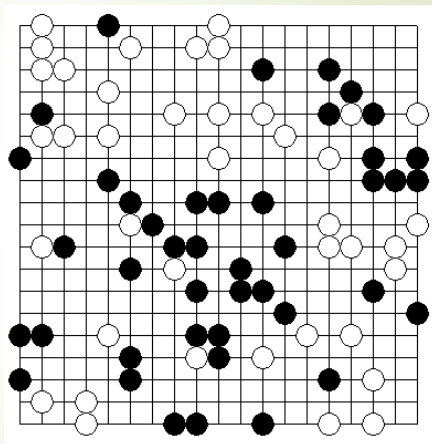
Example 2: 如何繪製圓型棋子

```
def piece(x, y, step, col):  
    penup()  
    setx(x*step)  
    sety(y*step-step//2)  
    setheading(0)  
    pendown()  
    color(col)  
    begin_fill()  
    circle(step//2)  
    end_fill()  
    penup()
```



Example 3: 以黑白順序隨機擺放n個棋子

```
def main():  
    N = 100  
    col = 'black'  
    step = 20  
    board(step)  
    for i in range(N):  
        x = randint(-9, 9)  
        y = randint(-9, 9)  
        piece(x, y, step, col)  
        if col == 'black':  
            col = 'white'  
        else:  
            col = 'black'  
main()
```



Example 4: 繪製一個正方形

假使目前turtle的位置在 (x, y)

$xcor()$: return x (橫軸座標、X軸座標)

$ycor()$: return y (縱軸座標、Y軸座標)

$goto(x1, y1)$: 直接走到座標 $(x1, y1)$ 位置。
若 $pendown()$ 的狀態則也畫線到 $(x1, y1)$

Example 4: 繪製一個正方形

```
step = 100  
goto(step, 0)  
goto(step, step)  
goto(0, step)  
home()  
print(xcor())  
print(ycor())
```

