

Vlakovullingen

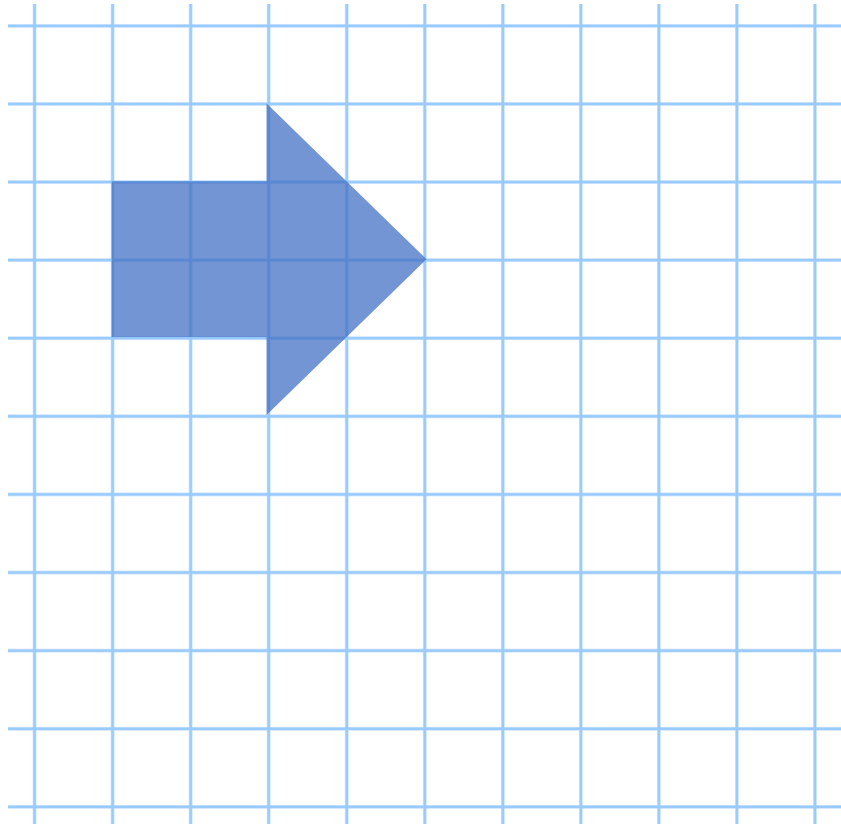
Studiedag 2023

Bert Wikkerink

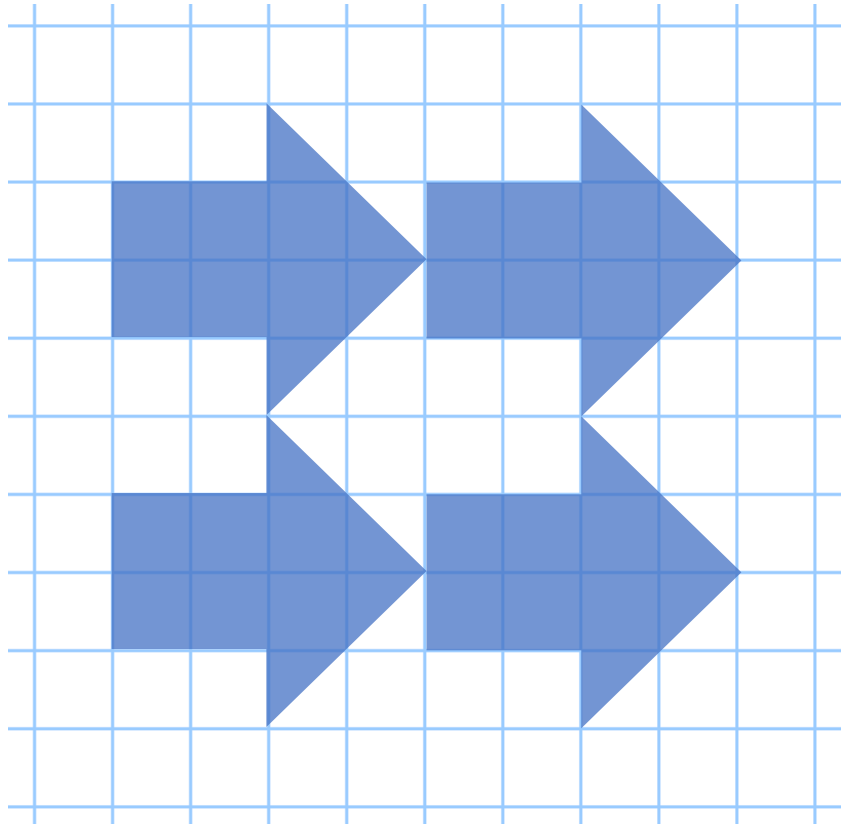
Conform de richtlijnen van de Escher Foundation zijn alle illustraties uit de presentatie verwijderd, met uitzondering van deze rechteenvrije afbeelding van https://commons.wikimedia.org/wiki/File:Denhaag_relief_houtrustweg2.jpg



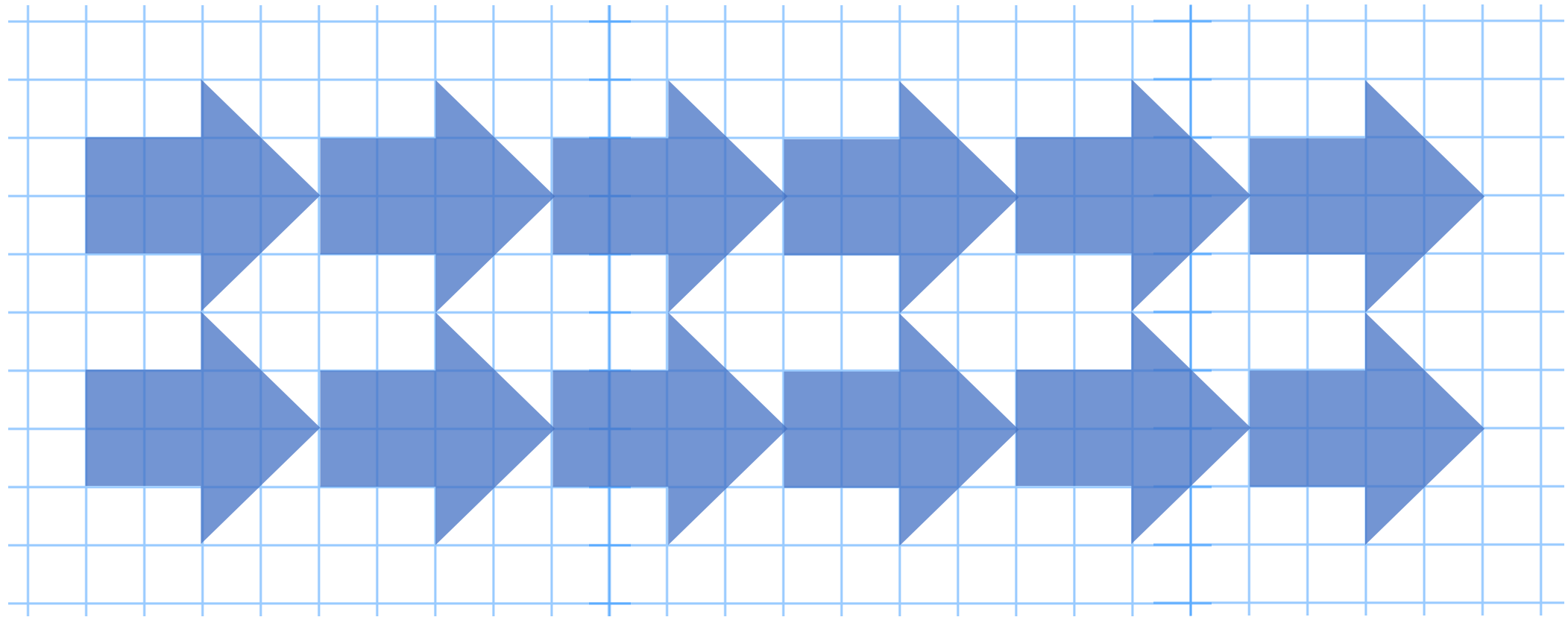
Vlakkvullingen



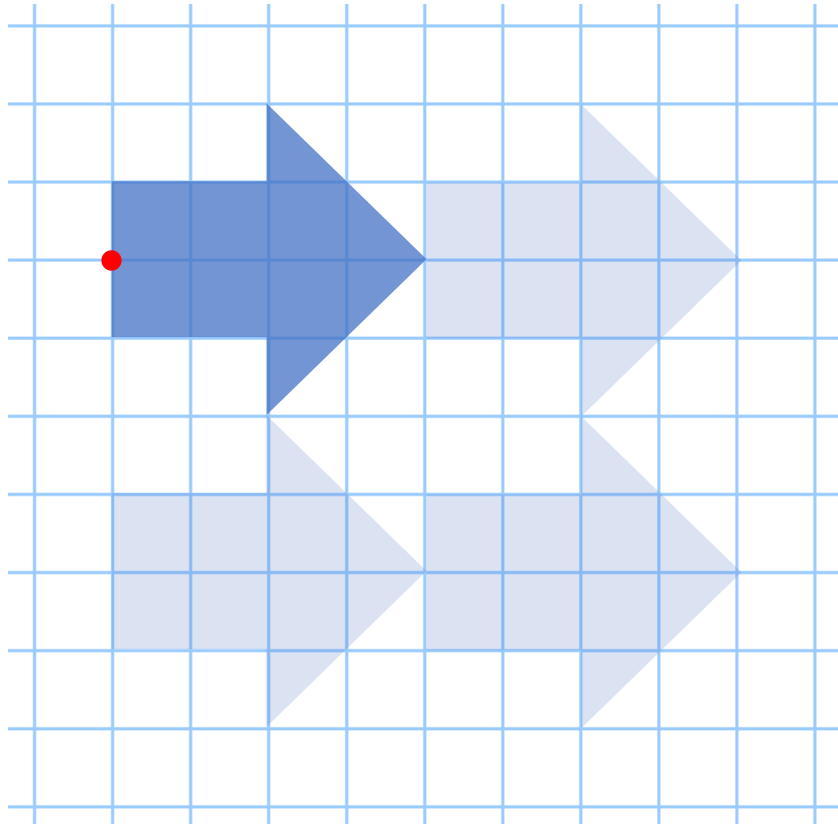
Vlakkvullingen



Vlakovullingen



Vlakkvullingen



$\text{pijl} = [(0, -1), (2, -1), (2, -2), (4, 0), (2, 2), (2, 1), (0, 1), (0, -1)]$

Vlakvullingen

Python vermenigvuldig (veelhoek, factor)

roteer (veelhoek, hoek)

spiegel_hor (veelhoek)

spiegel_vert (veelhoek)

teken (x, y, veelhoek)

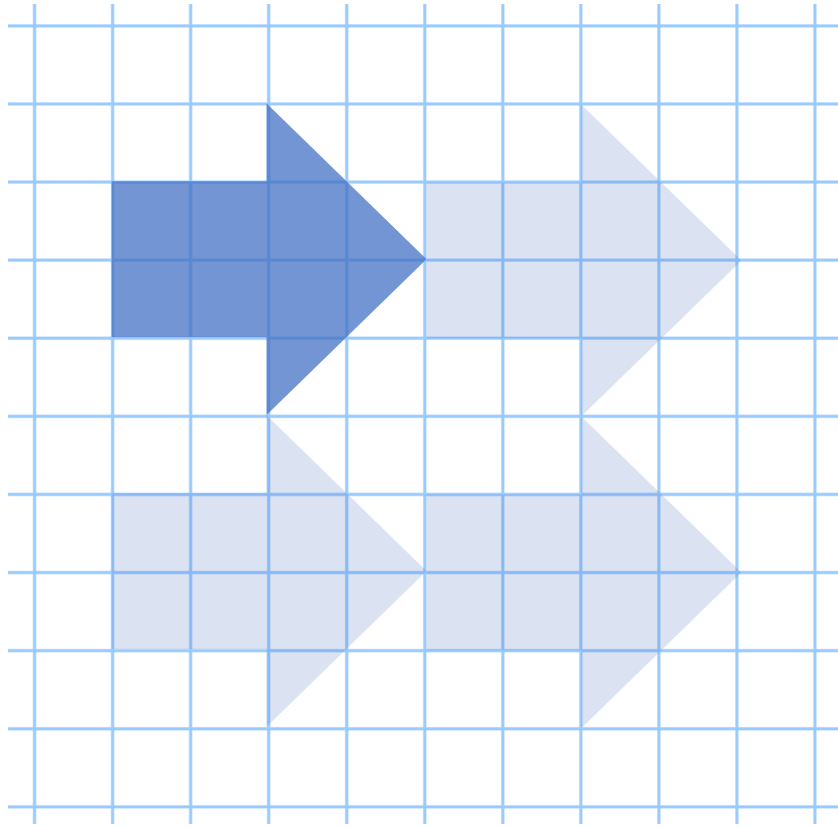
vul (x, y, veelhoek)

x_correctie (veelhoek)

y_correctie (veelhoek)

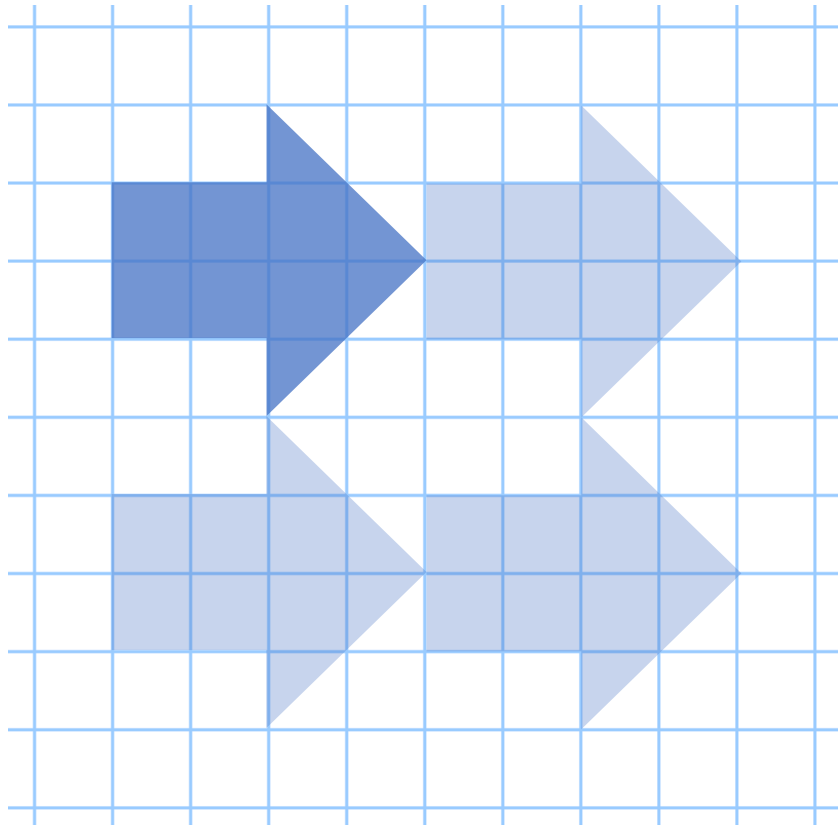
} *isometrisch rooster*

Vlakkvullingen



$\text{pijl} = [(0, -1), (2, -1), (2, -2), (4, 0), (2, 2), (2, 1), (0, 1), (0, -1)]$

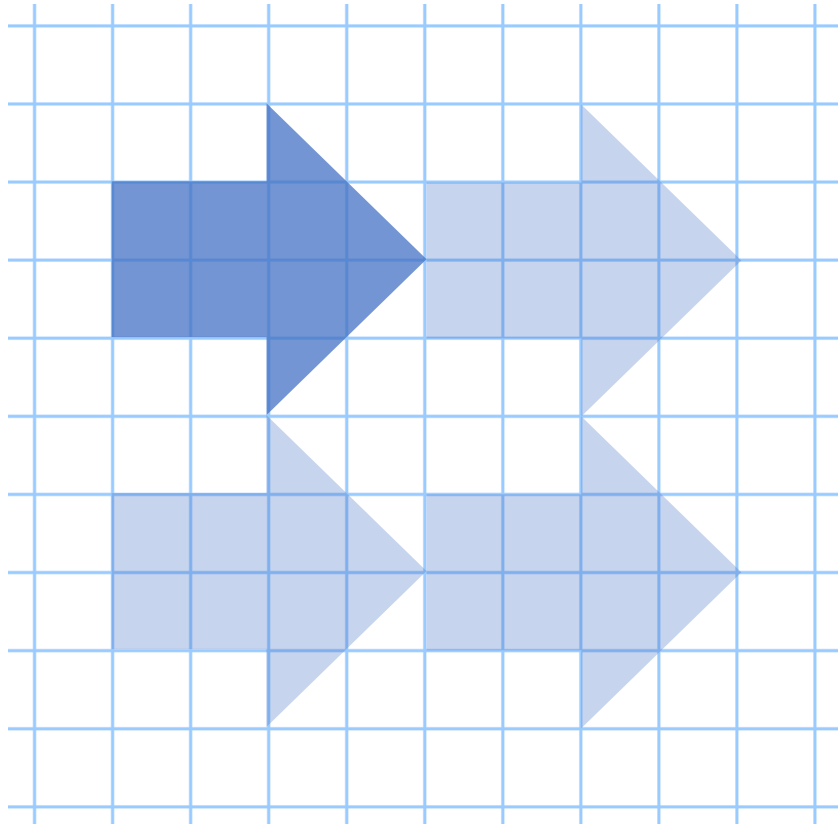
Vlakkvullingen



```
pijl = [(0, -1), (2, -1), (2, -2), (4, 0), (2, 2), (2, 1), (0, 1), (0, -1)]
```

```
for j in range(-3, 4):  
    for i in range(-4, 4):  
        x = 4*i  
        y = 4*j  
        vul(x,y, pijl)
```

Vlakovullingen



```
pijl = [(0, -1), (2, -1), (2, -2), (4, 0), (2, 2), (2, 1), (0, 1), (0, -1)]
```

```
a = 10
```

```
pijl = vermenigvuldig(pijl, a)
```

```
for j in range(-3, 4):
```

```
    ♦♦ for i in range(-4, 4):
```

```
        ♦♦♦♦ x = 4*a*i
```

```
        ♦♦♦♦ y = 4*a*j
```

```
        ♦♦♦♦ vul(x,y, pijl)
```

Vlakvullingen

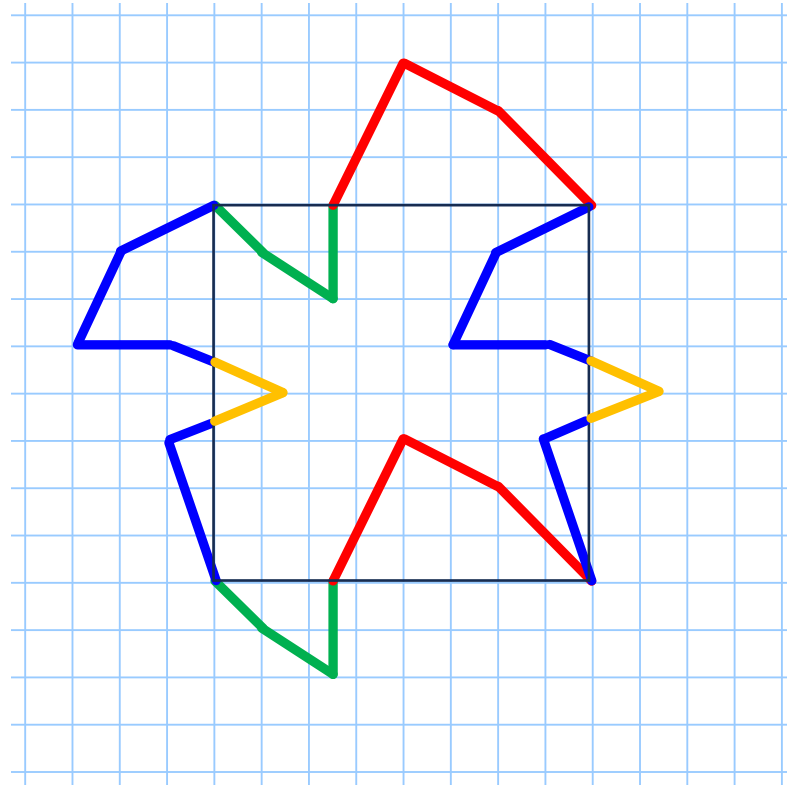
Python IDLE (Integrated Development and Learning Environment)

Nspire software

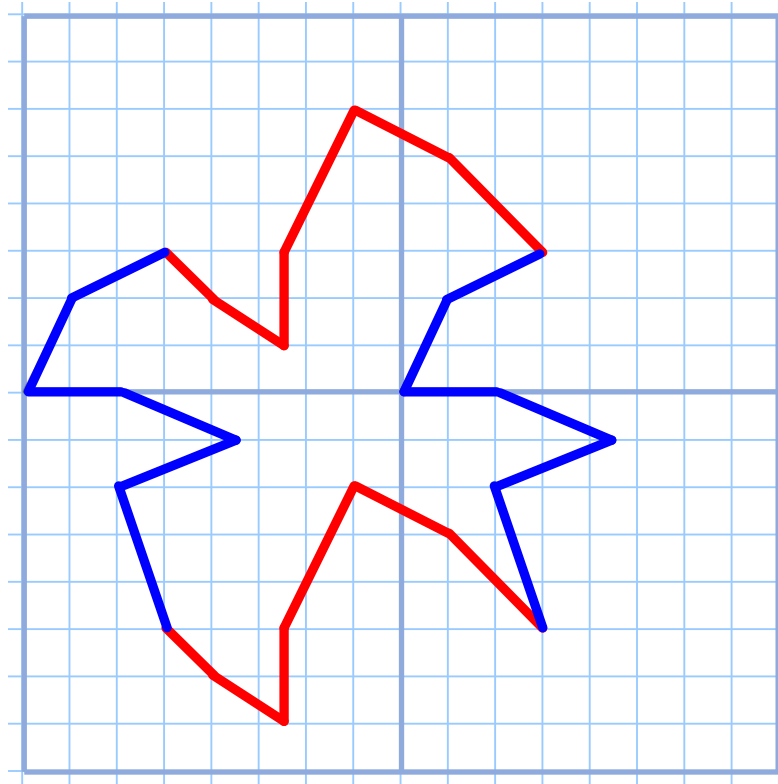
Vogel

Conform de richtlijnen van de Escher Foundation
zijn alle illustraties uit de presentatie verwijderd

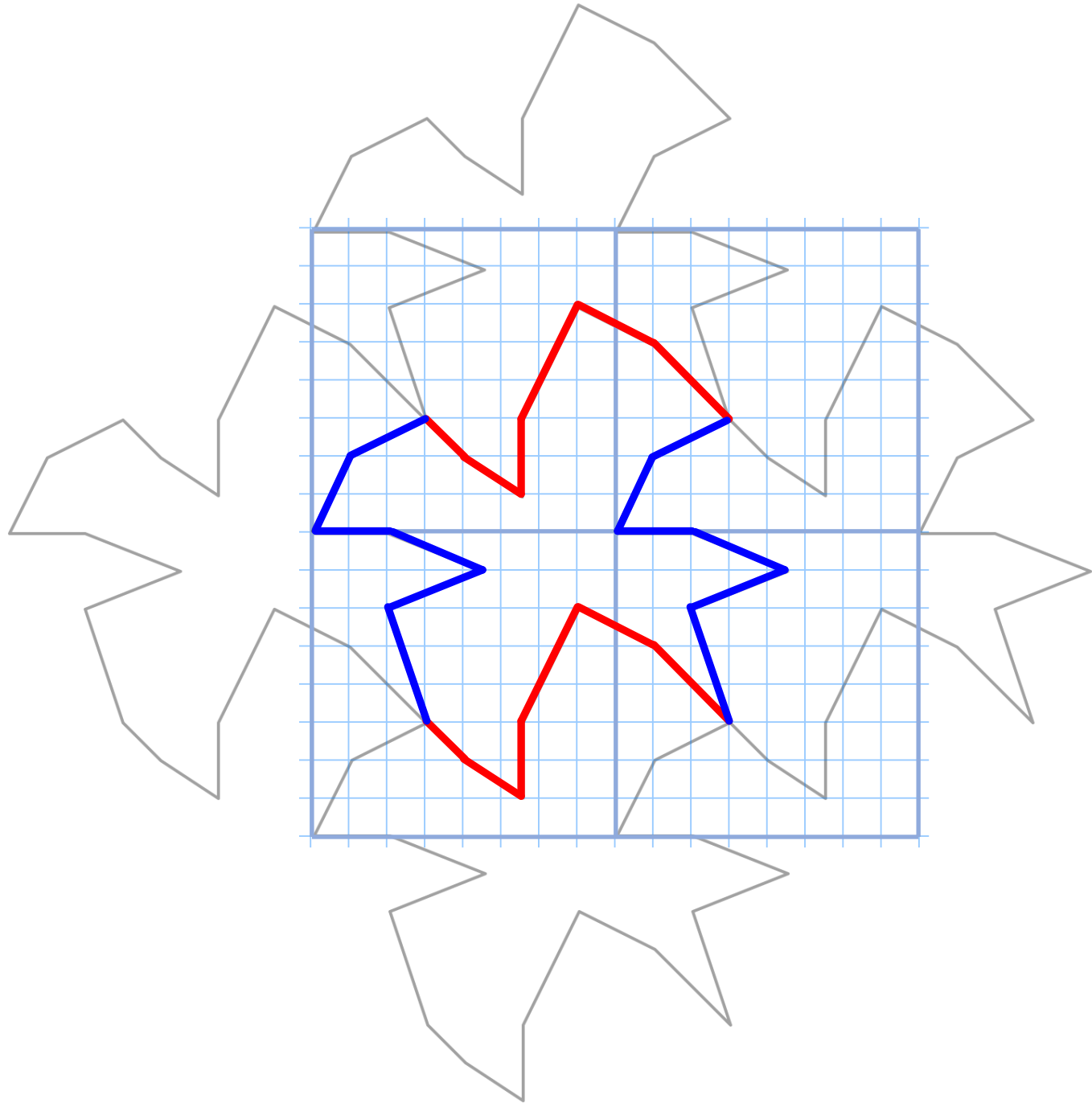
Vogel



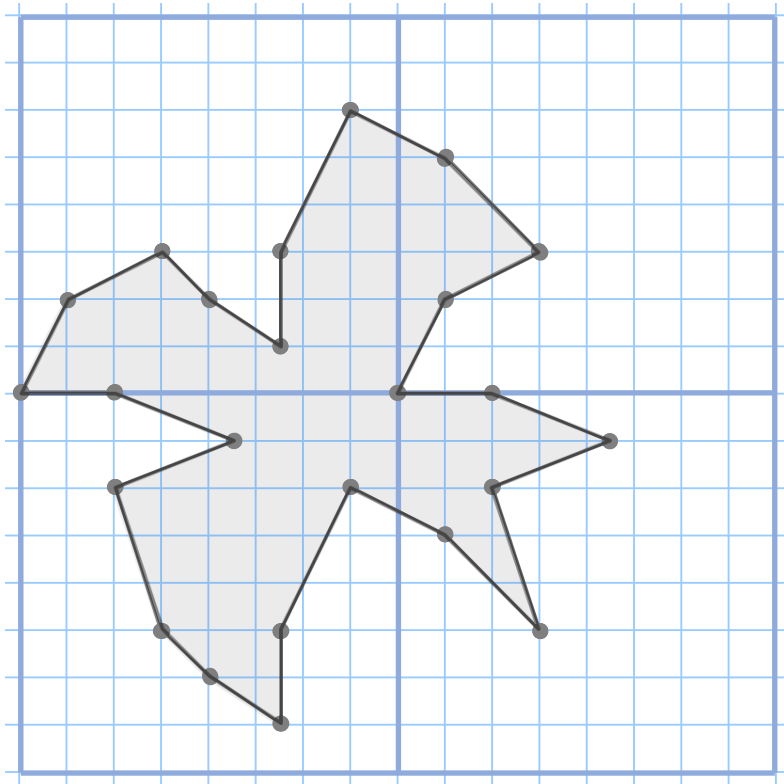
Vogel



Vogel



Vogel



```
vogel = [ (0,0), (1,2), (3,3), (4,2), (5.5,1), (5.5,3), (7,6), (9,5), (11,3),  
(9,2), (8,0), (10,0), (12.5,-1), (10,-2), (11,-5), (9,-3), (7,-2), (5.5,-5),  
(5.5,-7), (4,-6), (3,-5), (2,-2), (4.5,-1), (2,0), (0,0)]
```

```
vogel = vermenigvuldig(vogel,1/8)
```

```
a = 120
```

```
vogel = vermenigvuldig(vogel,a)
```

```
for j in range(-4,5):
```

```
    for i in range(-7,6):
```

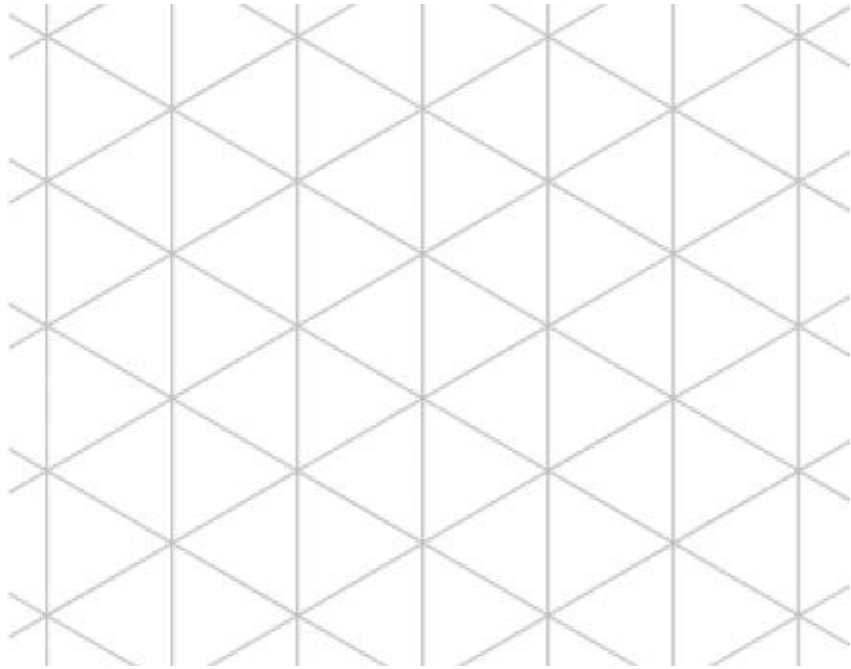
```
        x = a*i
```

```
        y = a*j
```

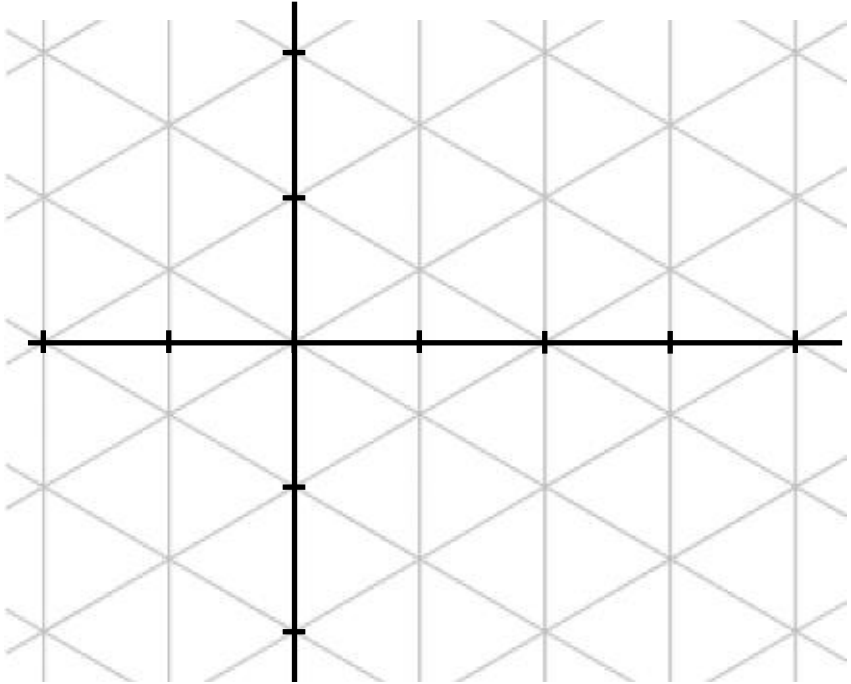
```
        if (i+j)%2 == 0:
```

```
            vul(x,y,vogel)
```

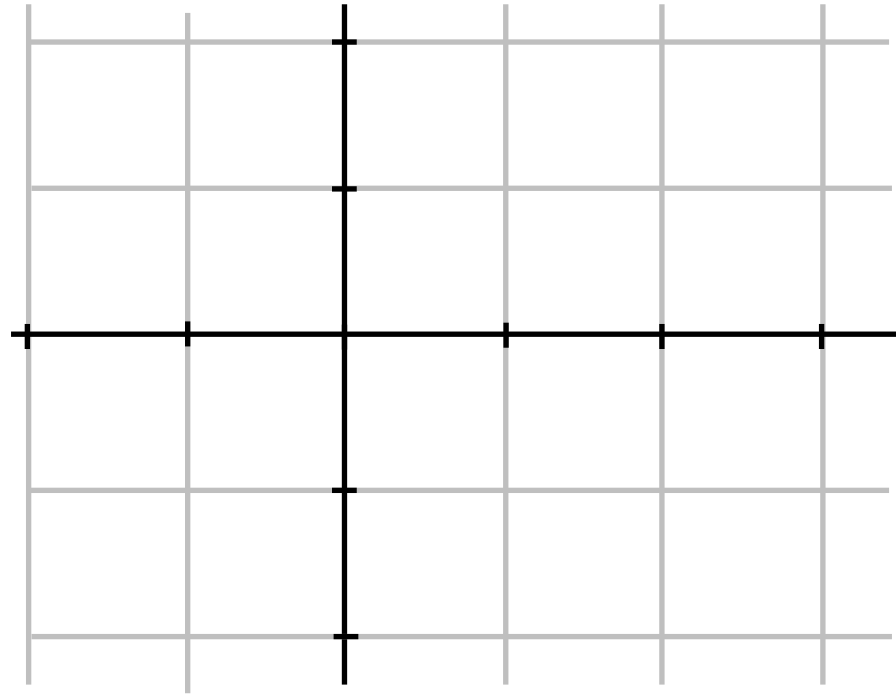
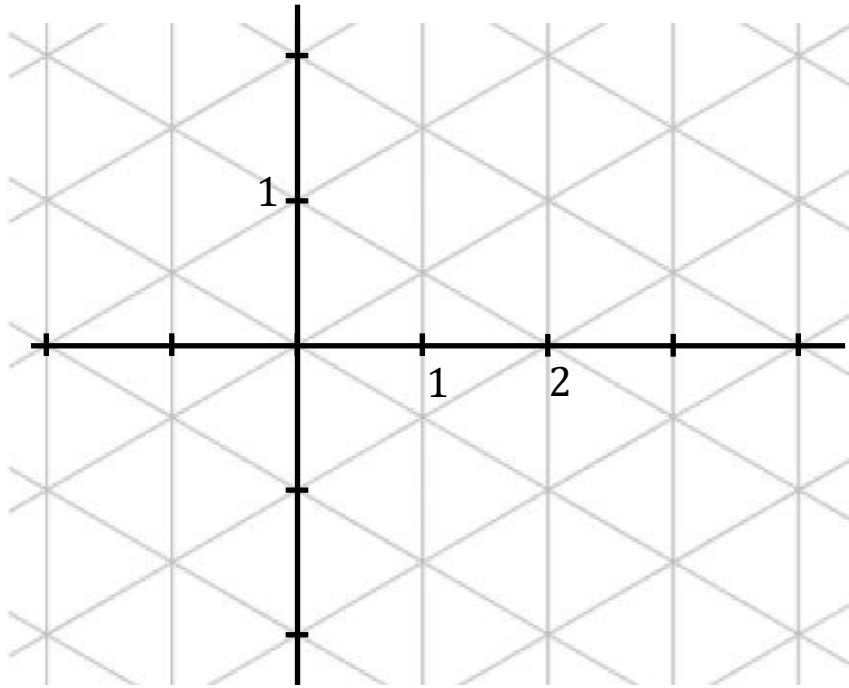
Isometrisch rooster



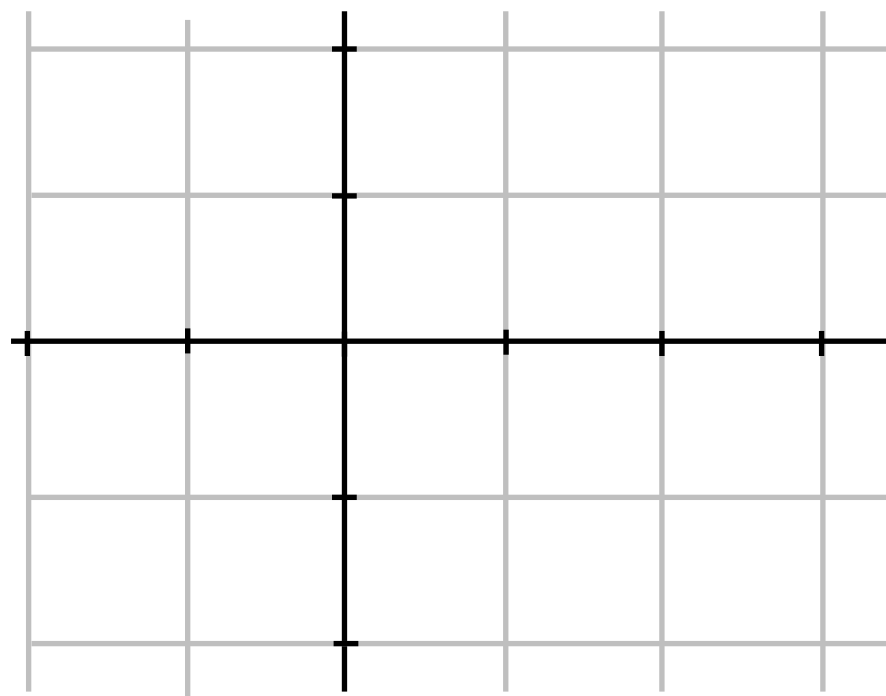
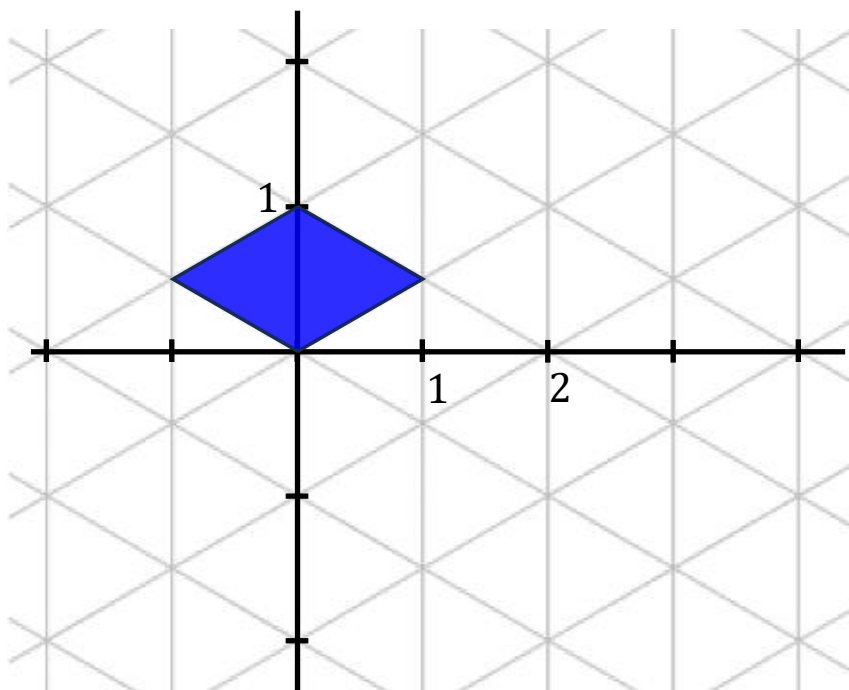
Isometrisch rooster



Isometrisch rooster

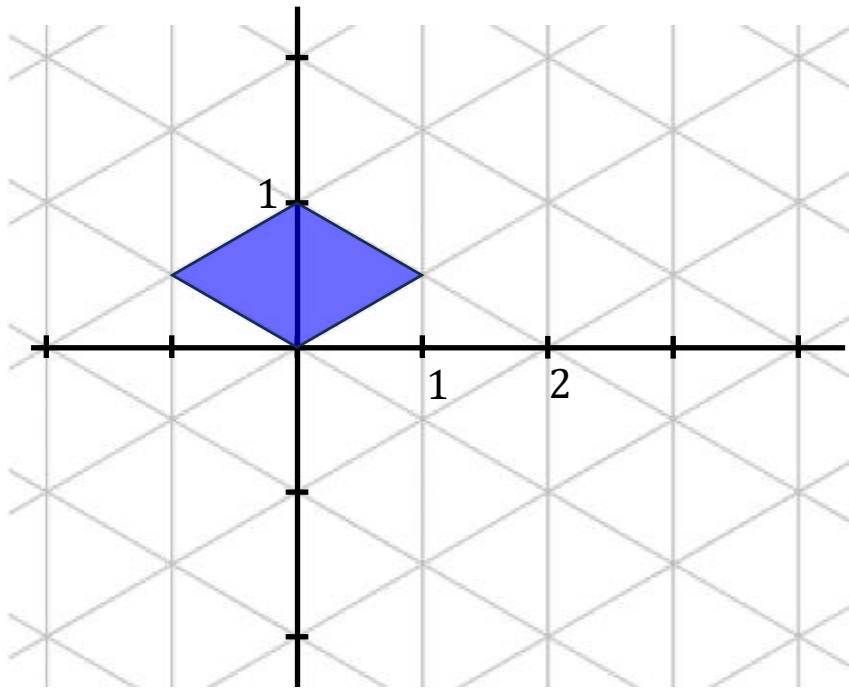


Isometrisch rooster

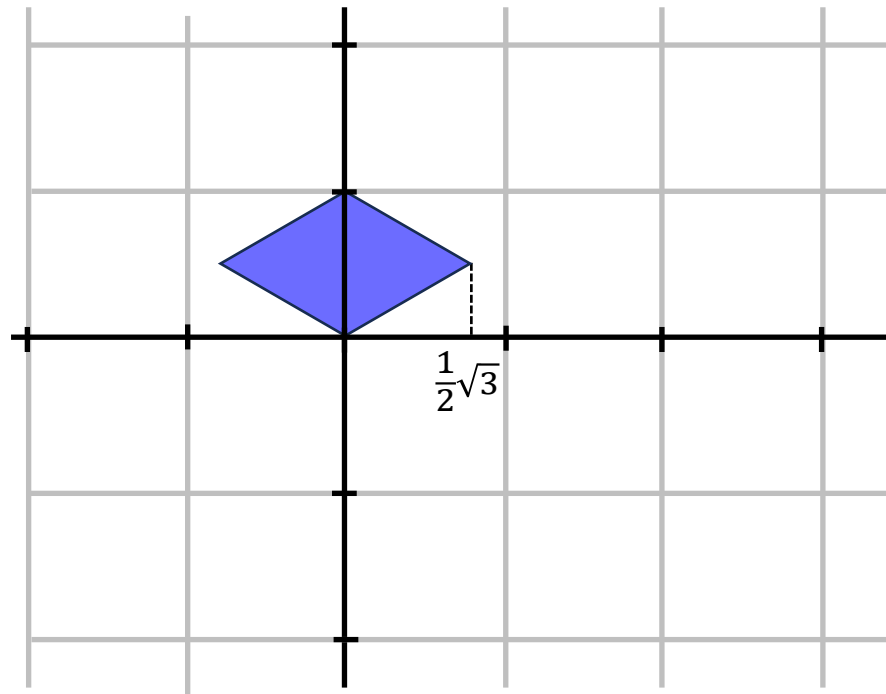


$$\text{ruit} = [(0, 0), (-1, \frac{1}{2}), (0, 1), (1, \frac{1}{2}), (0, 0)]$$

Isometrisch rooster



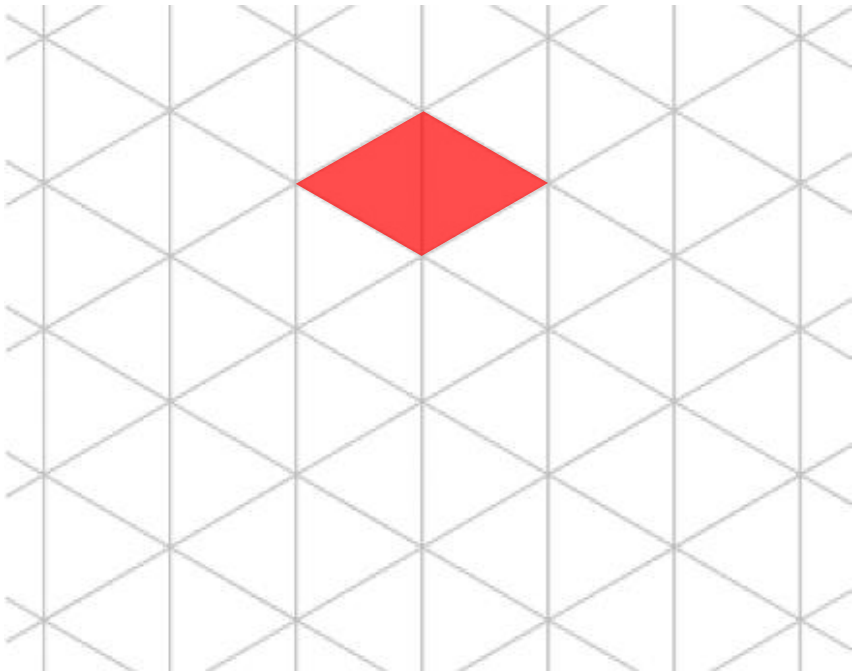
$$\text{ruit} = [(0, 0), (-1, \frac{1}{2}), (0, 1), (1, \frac{1}{2}), (0, 0)]$$



$$\text{ruit} = [(0, 0), (-\frac{1}{2}\sqrt{3}, \frac{1}{2}), (0, 1), (\frac{1}{2}\sqrt{3}, \frac{1}{2}), (0, 0)]$$

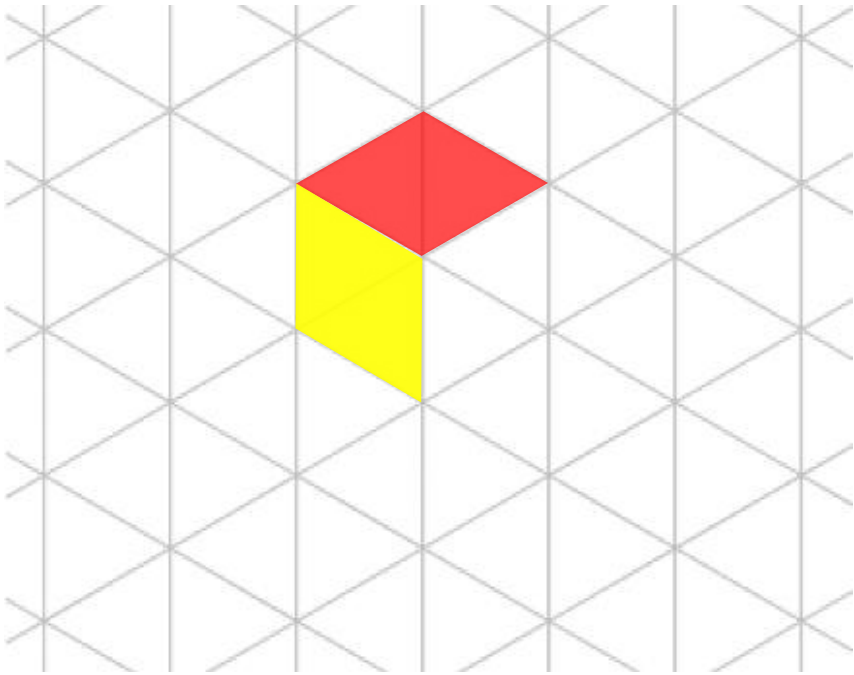
`ruit = x_correctie(ruit)`

Isometrisch rooster



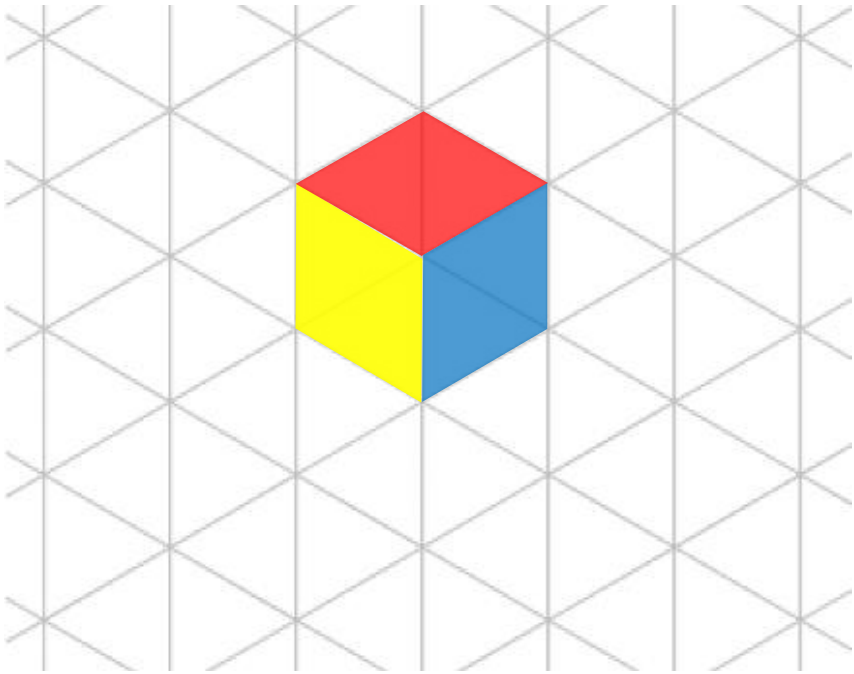
```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]  
ruit = x_correctie(ruit)
```


Isometrisch rooster



```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]  
ruit = x_correctie(ruit)
```

Isometrisch rooster



```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]  
ruit = x_correctie(ruit)
```

Isometrisch rooster



```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]
```

```
ruit = x_correctie(ruit)
```

```
kleuren = [(255,0,0), (255,255,0), (0,0,255)]
```

```
def zeshoek(x,y):
```

```
    for i in range(3):
```

```
        r = roteer(ruit, 120*i)
```

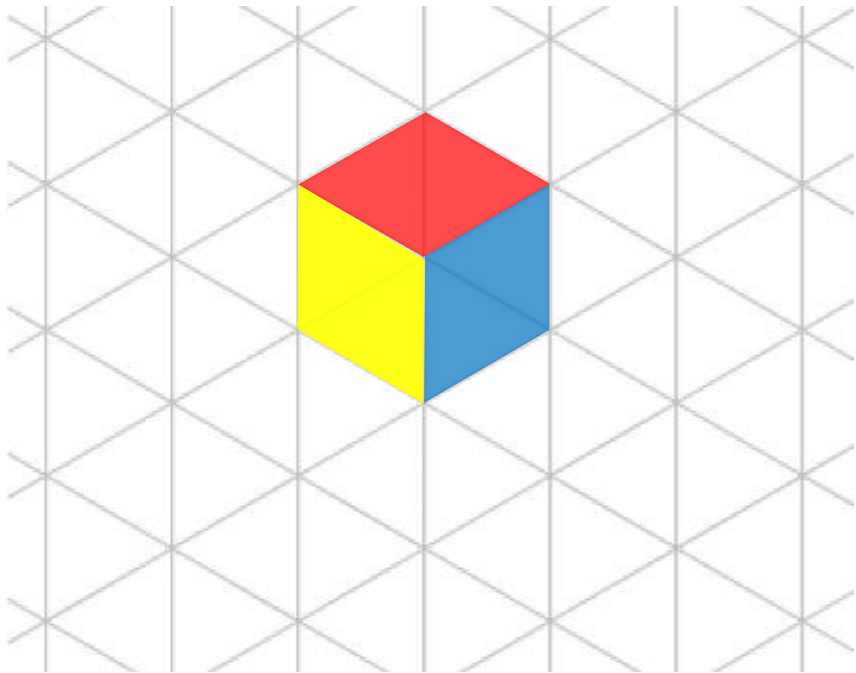
```
        k = kleuren[i]
```

```
        set_color(k)
```

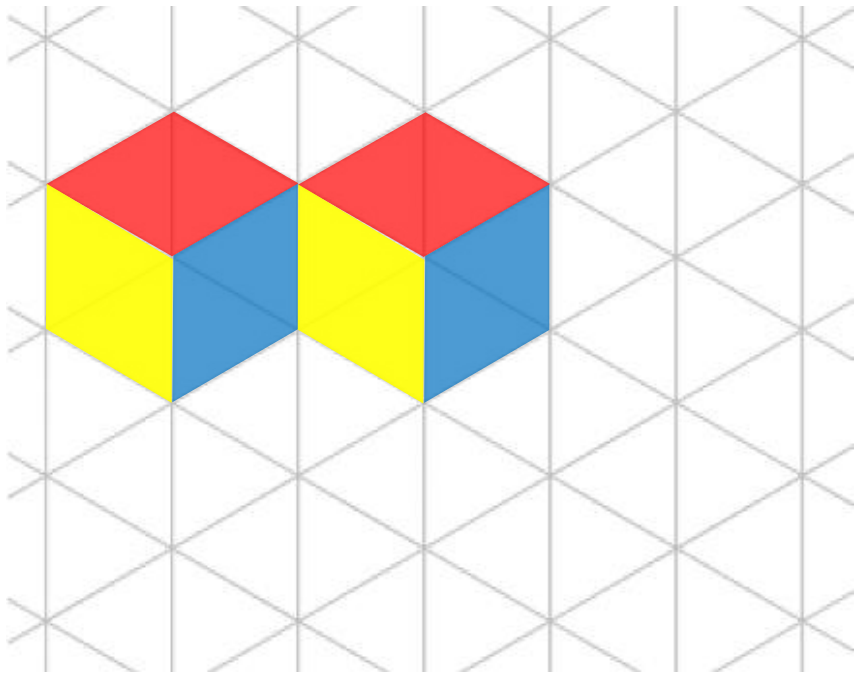
```
        vul(x,y,r)
```

```
zeshoek(0,0)
```

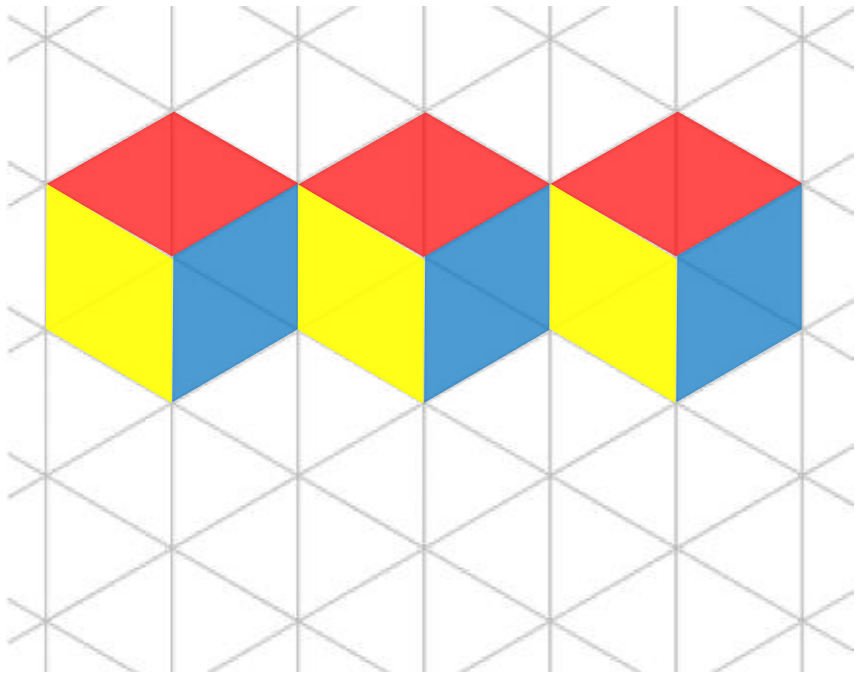
Isometrisch rooster



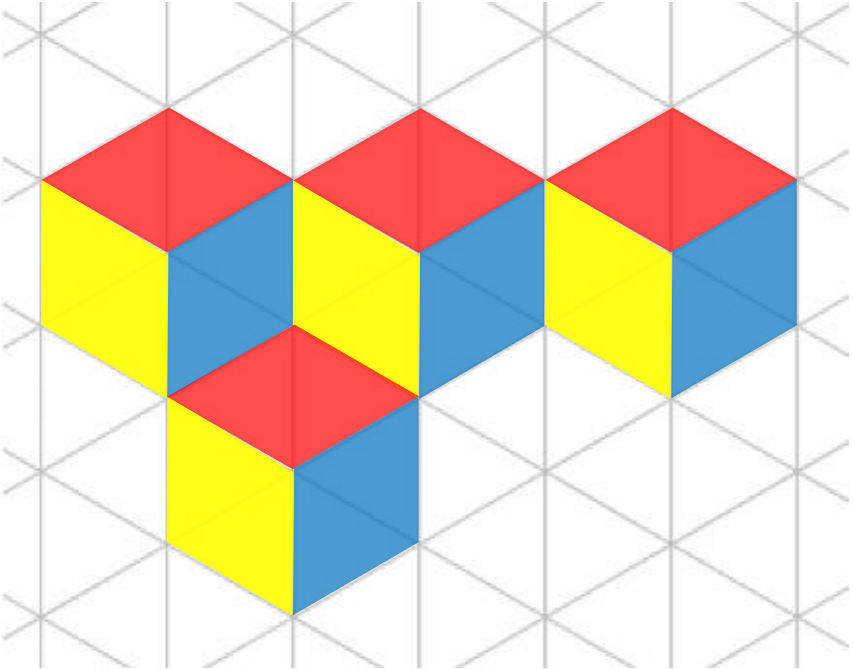
Isometrisch rooster



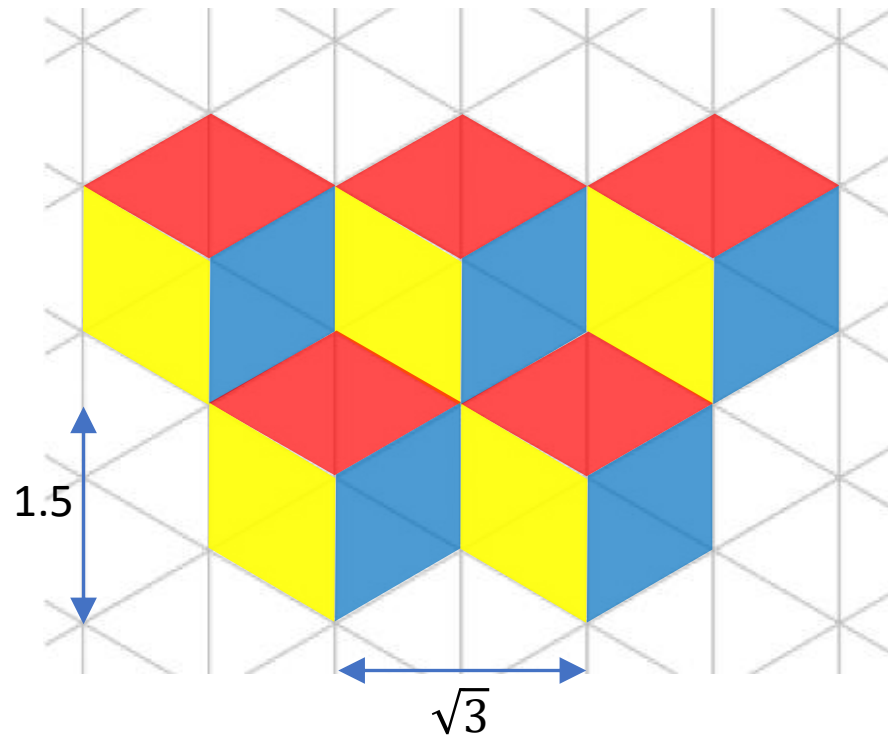
Isometrisch rooster



Isometrisch rooster



Isometrisch rooster



```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]
```

```
ruit = x_correctie(ruit)
```

```
f = sqrt(3)
```

```
for j in range(-2,3):
```

```
    for i in range(-3,4):
```

```
        x = f*i
```

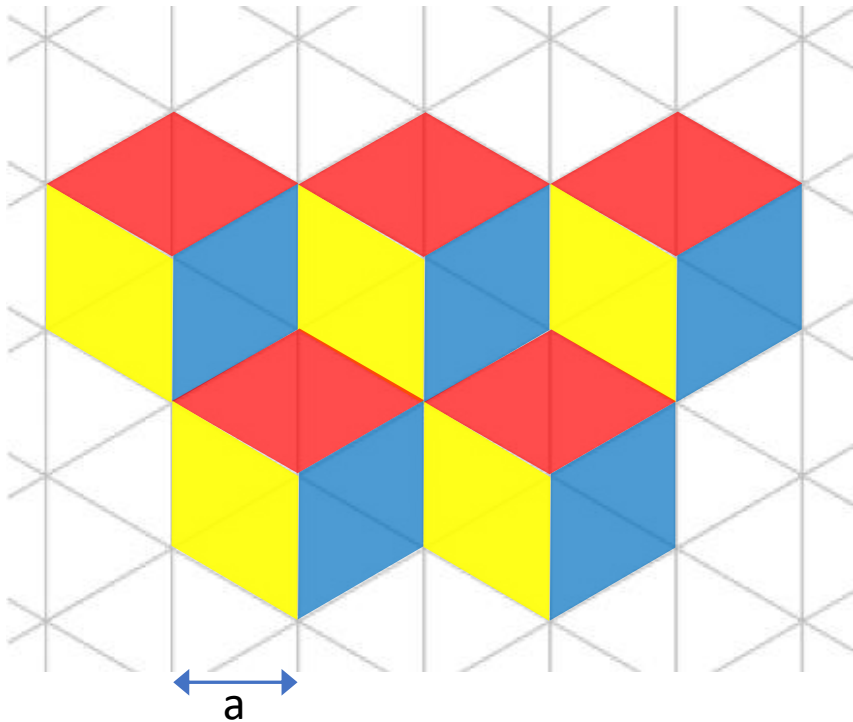
```
        if j%2 == 1:
```

```
            x = x + 0.5*f
```

```
            y = 1.5*j
```

```
            zeshoek(x,y)
```

Isometrisch rooster



```
ruit = [(0, 0), (-1, 0.5), (0, 1), (1, 0.5), (0, 0)]
```

```
ruit = x_correctie(ruit)
```

```
f = sqrt(3)
```

```
a = 32
```

```
ruit = vermenigvuldig(ruit, a)
```

```
for j in range(-2,3):
```

```
    for i in range(-3,4):
```

```
        x = f * i
```

```
        if j%2 == 1:
```

```
            x = x + 0.5 * f
```

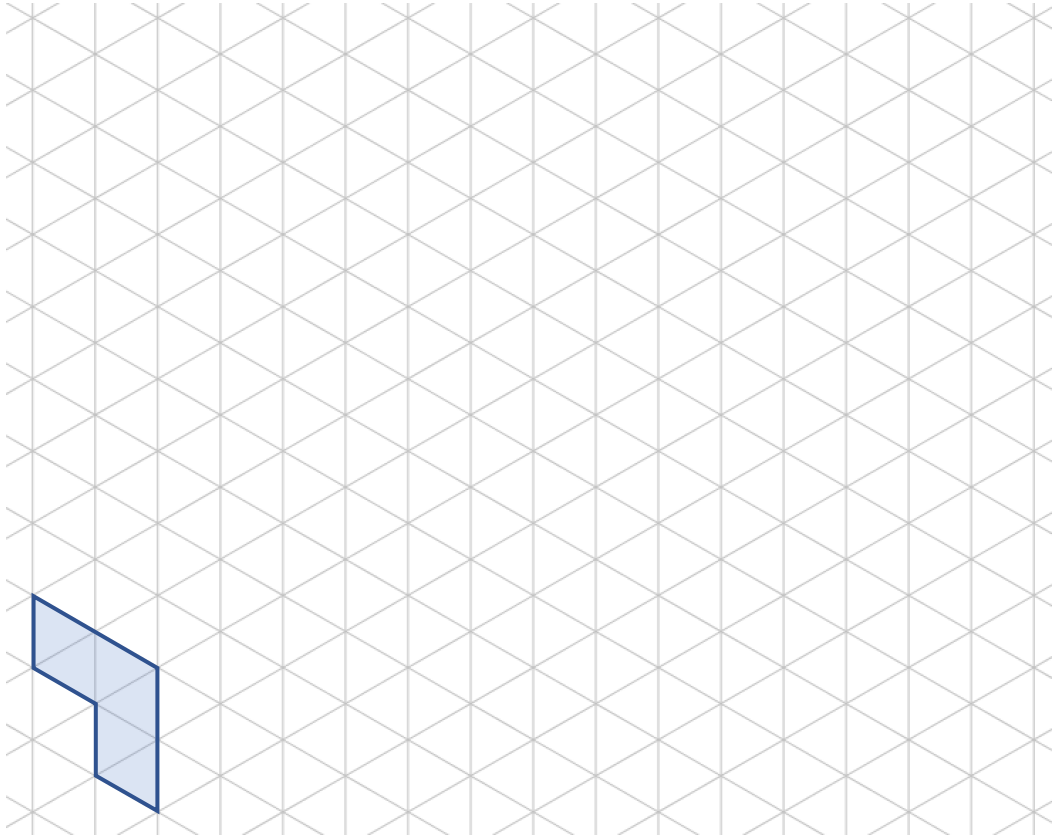
```
            y = 1.5 * j
```

```
            zeshoek(a * x, a * y)
```

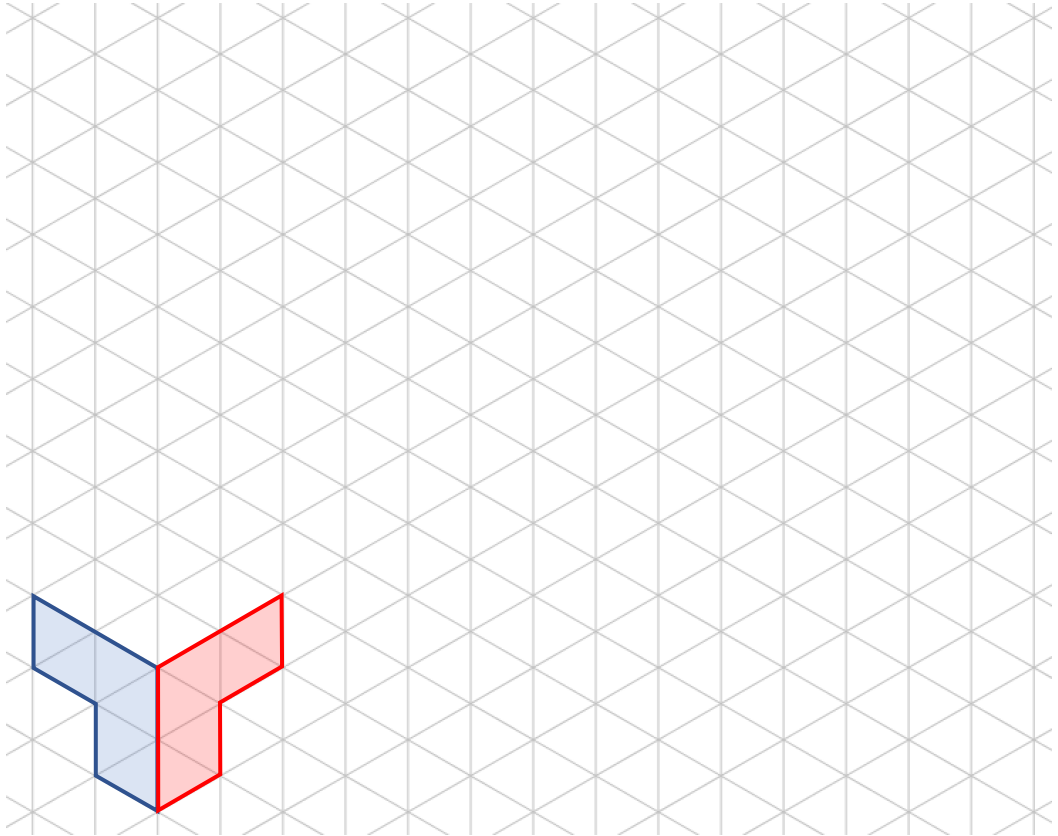
Isometrisch rooster



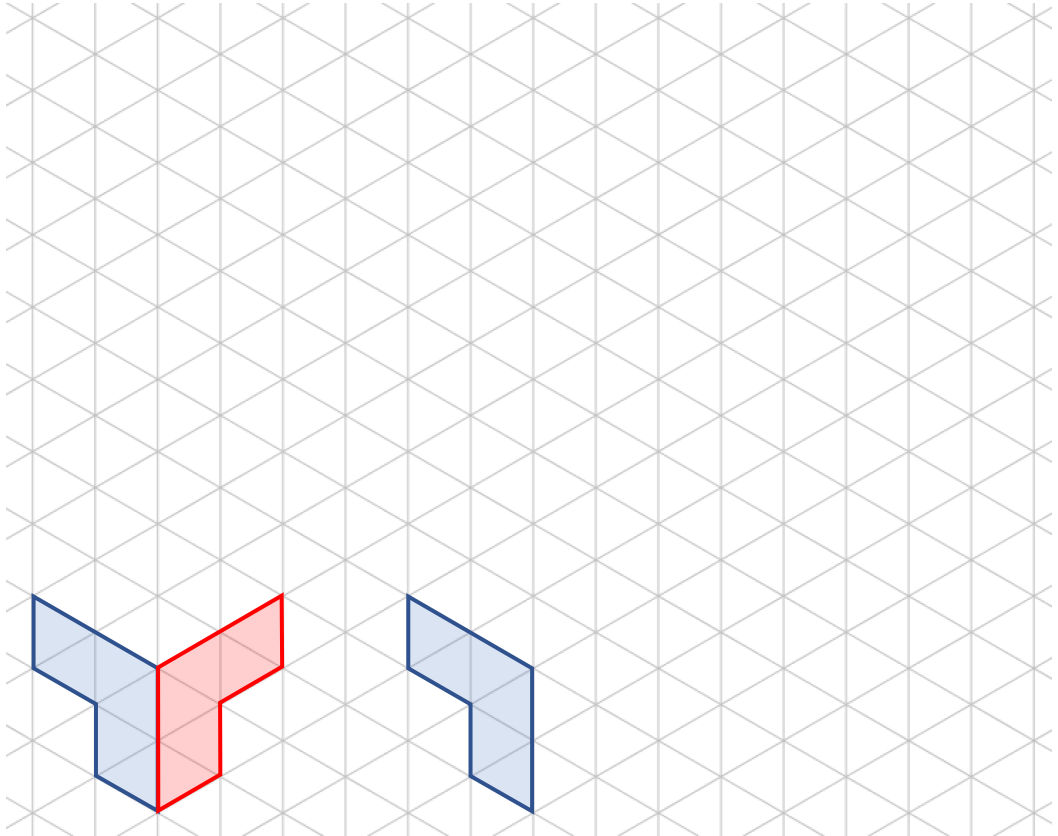
Isometrisch rooster



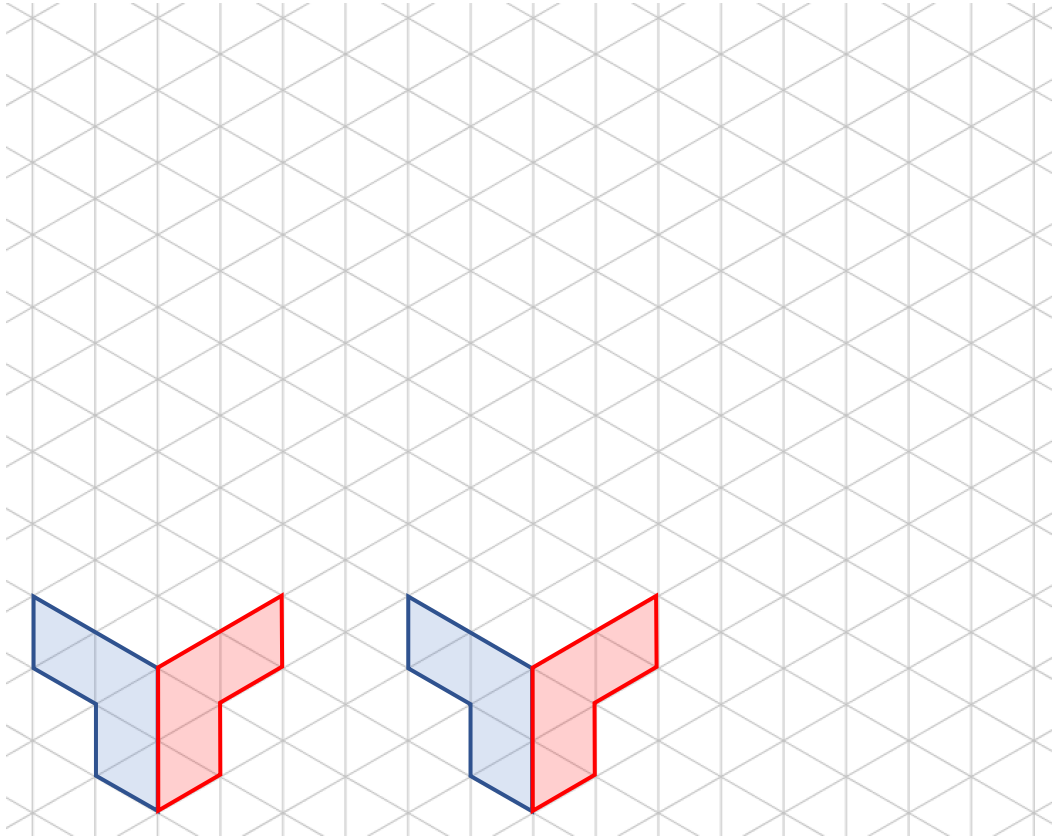
Isometrisch rooster



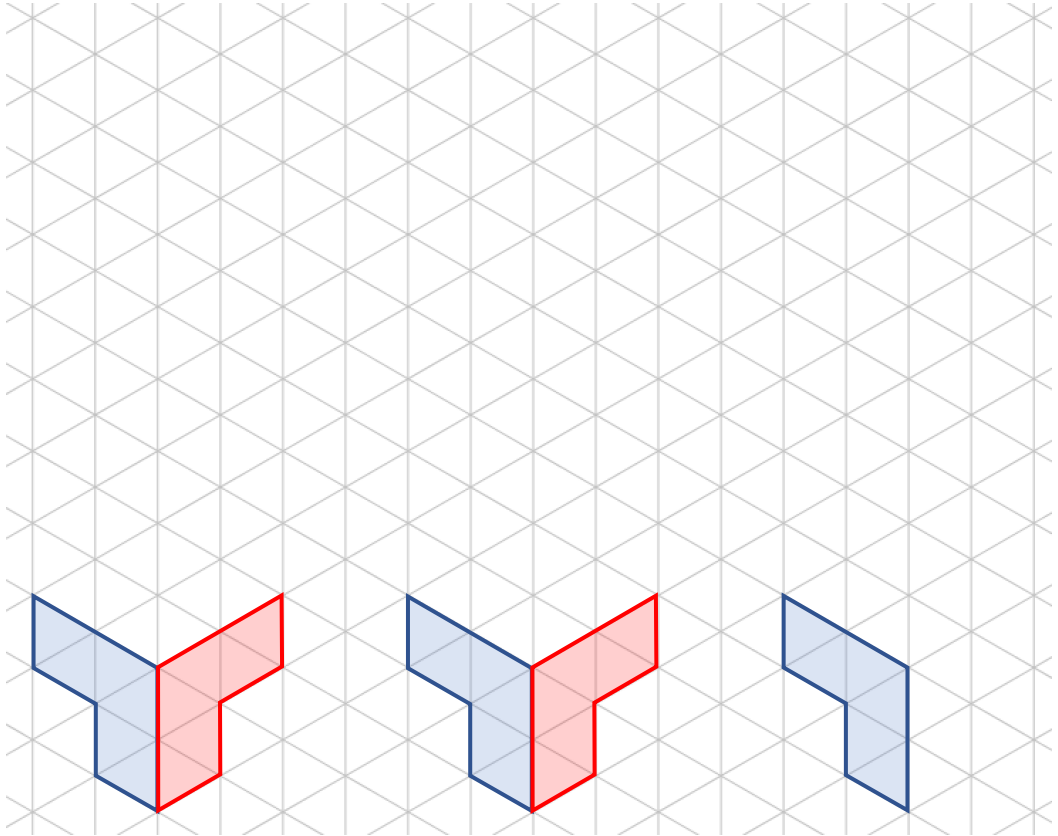
Isometrisch rooster



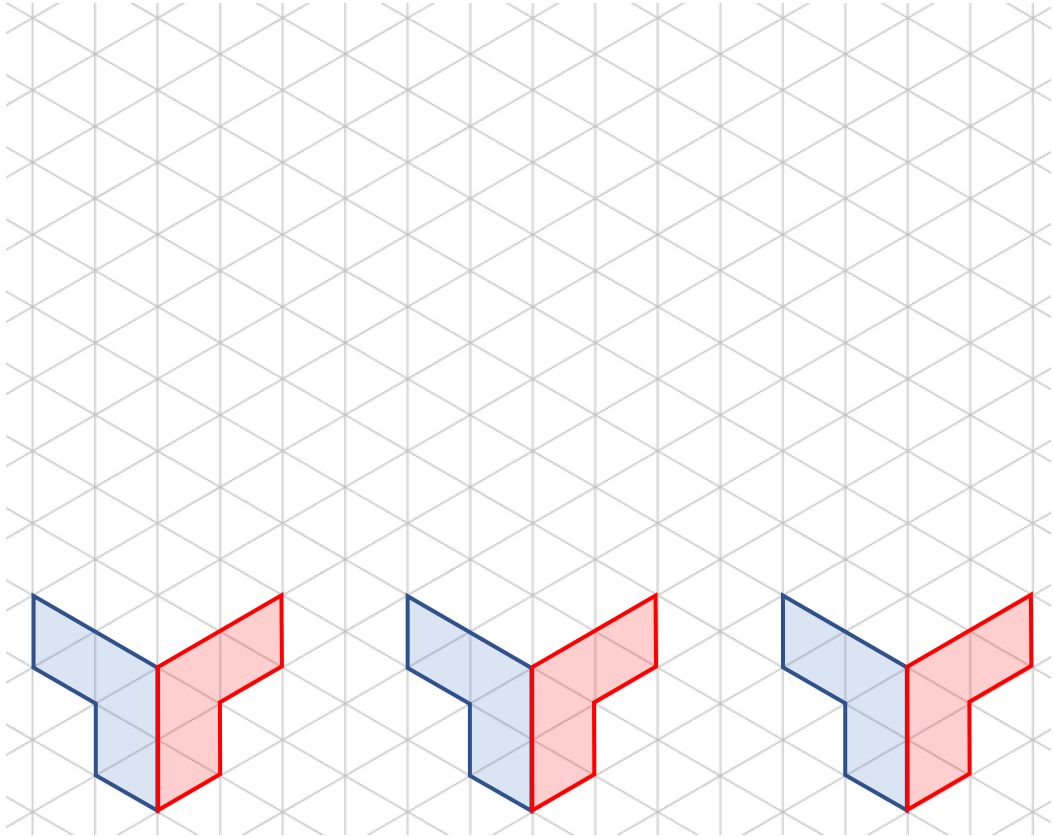
Isometrisch rooster



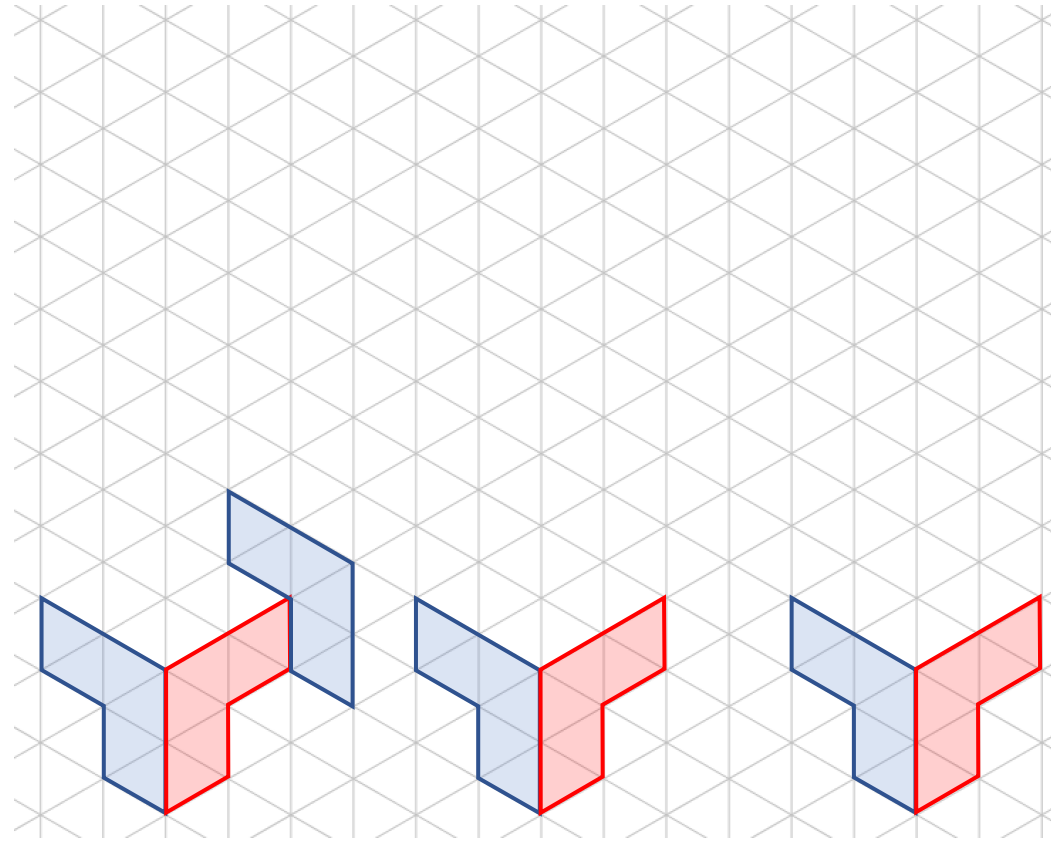
Isometrisch rooster



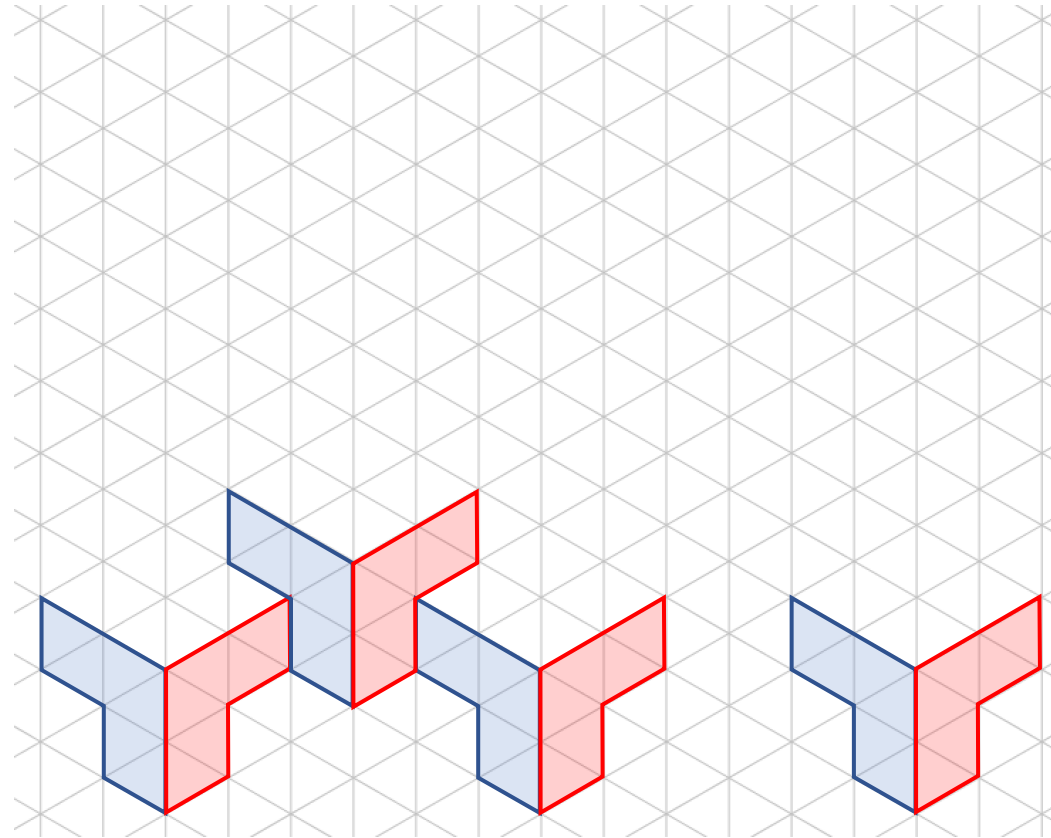
Isometrisch rooster



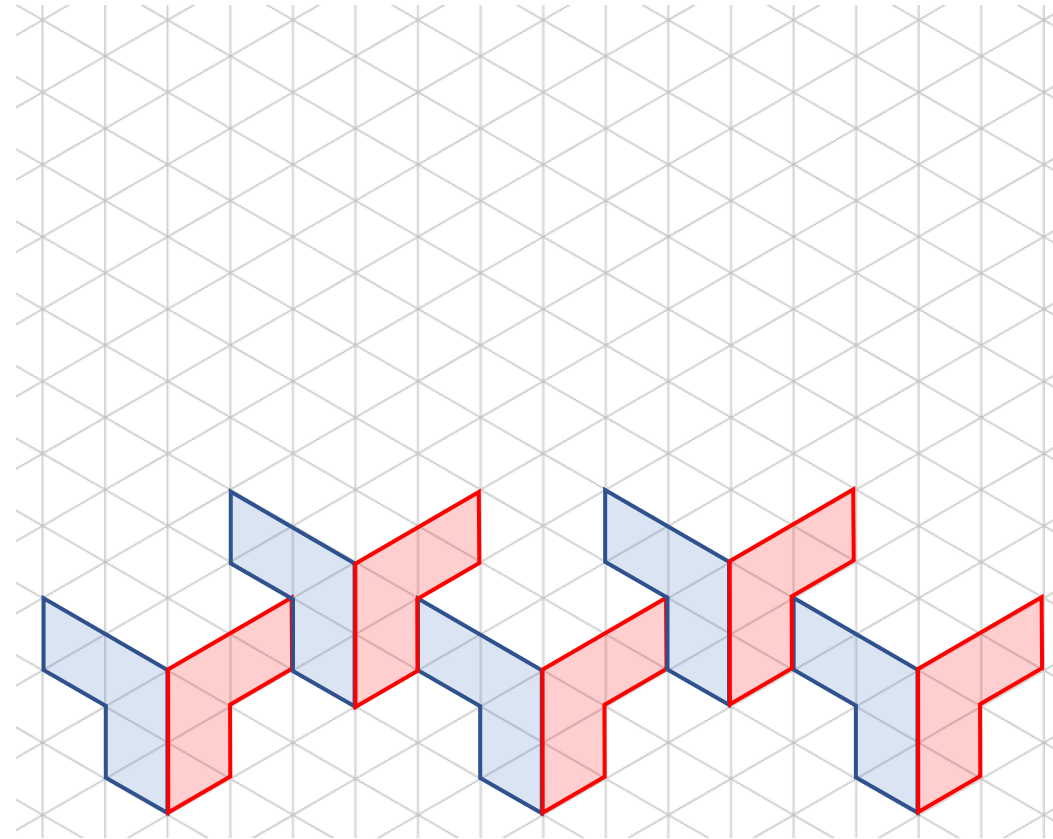
Isometrisch rooster



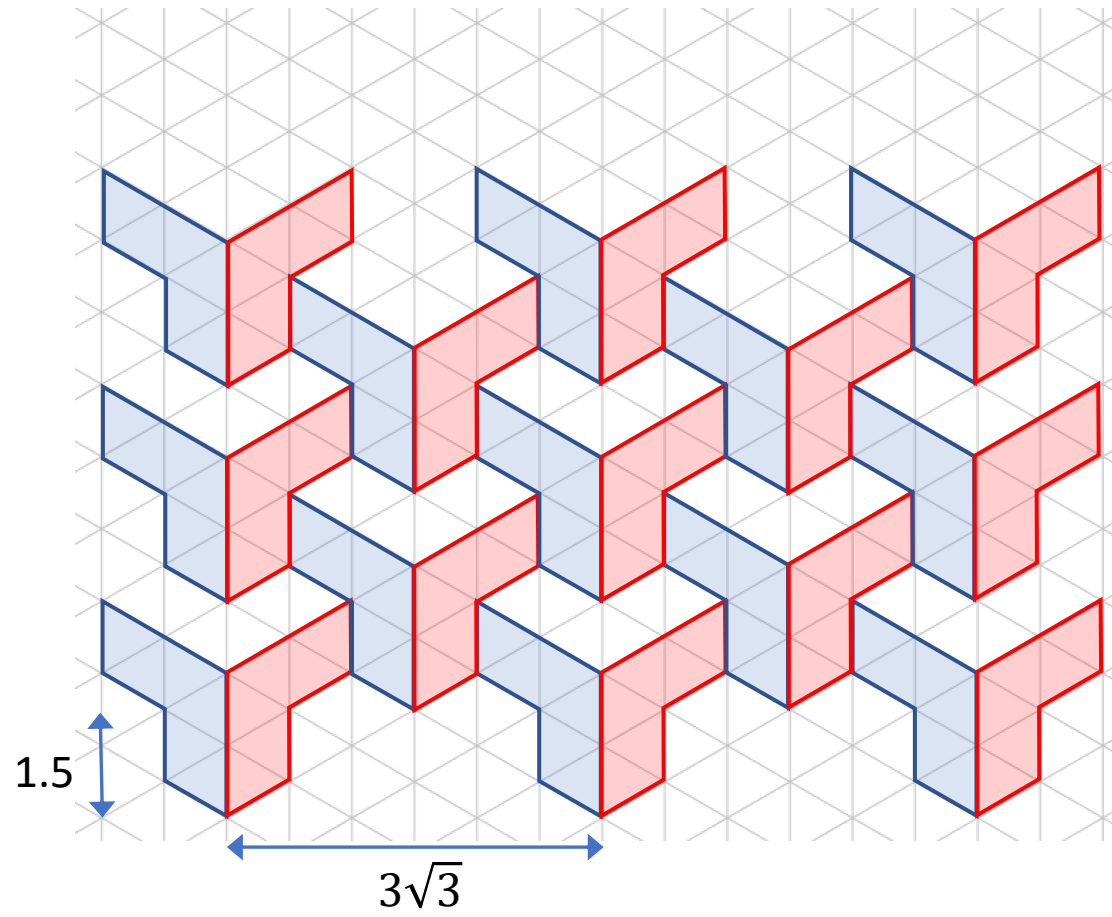
Isometrisch rooster



Isometrisch rooster



Isometrisch rooster



Vlakvullingen

Cairo

Kenia

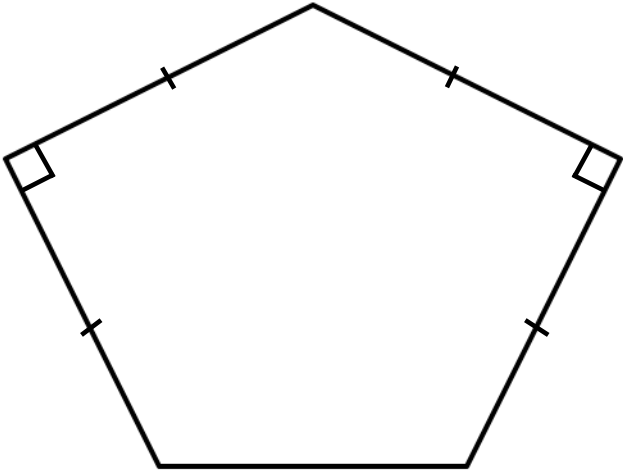
Vissen

Einde

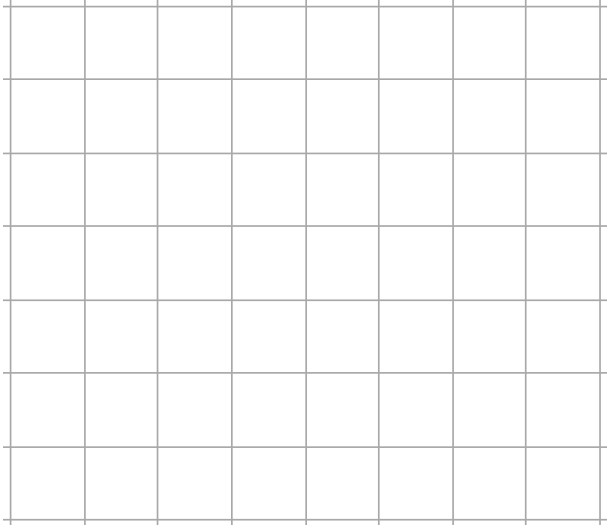
Cairo



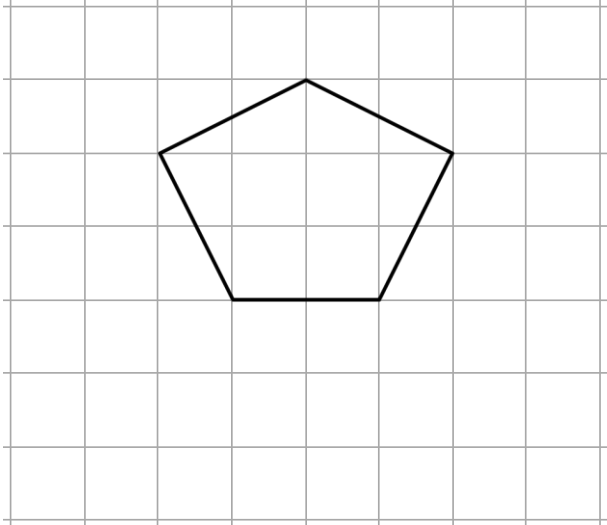
Cairo



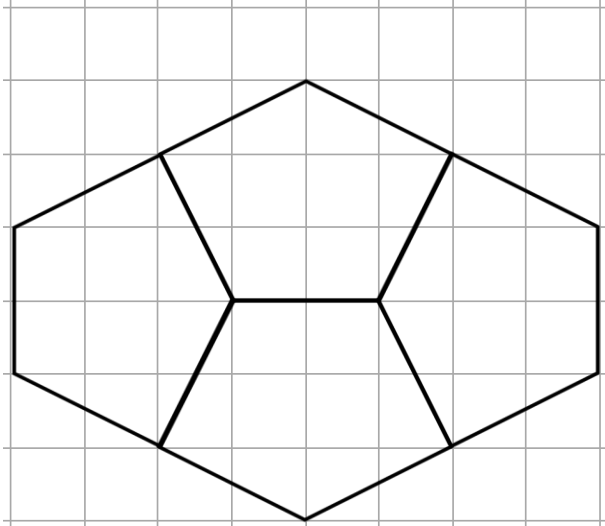
Cairo



Cairo



Cairo



$vijfhoek = [(1,0), (2,2), (0,3), (-2,2), (-1,0), (1,0)]$

```
def zeshoek(x, y):
```

```
    teken(x, y, vijfhoek)
```

```
    v = spiegel_vert(vijfhoek)
```

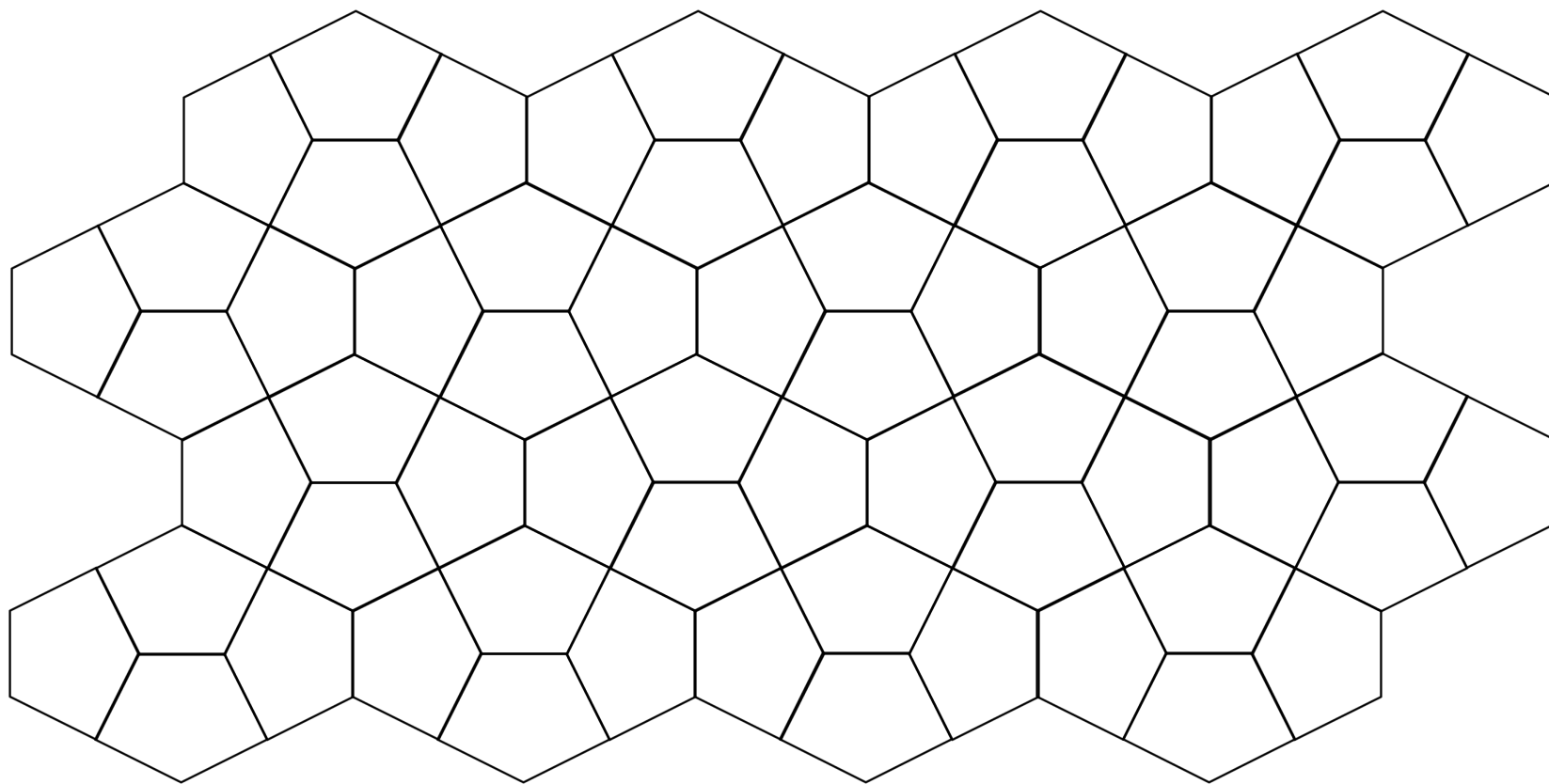
```
    teken(x, y, v)
```

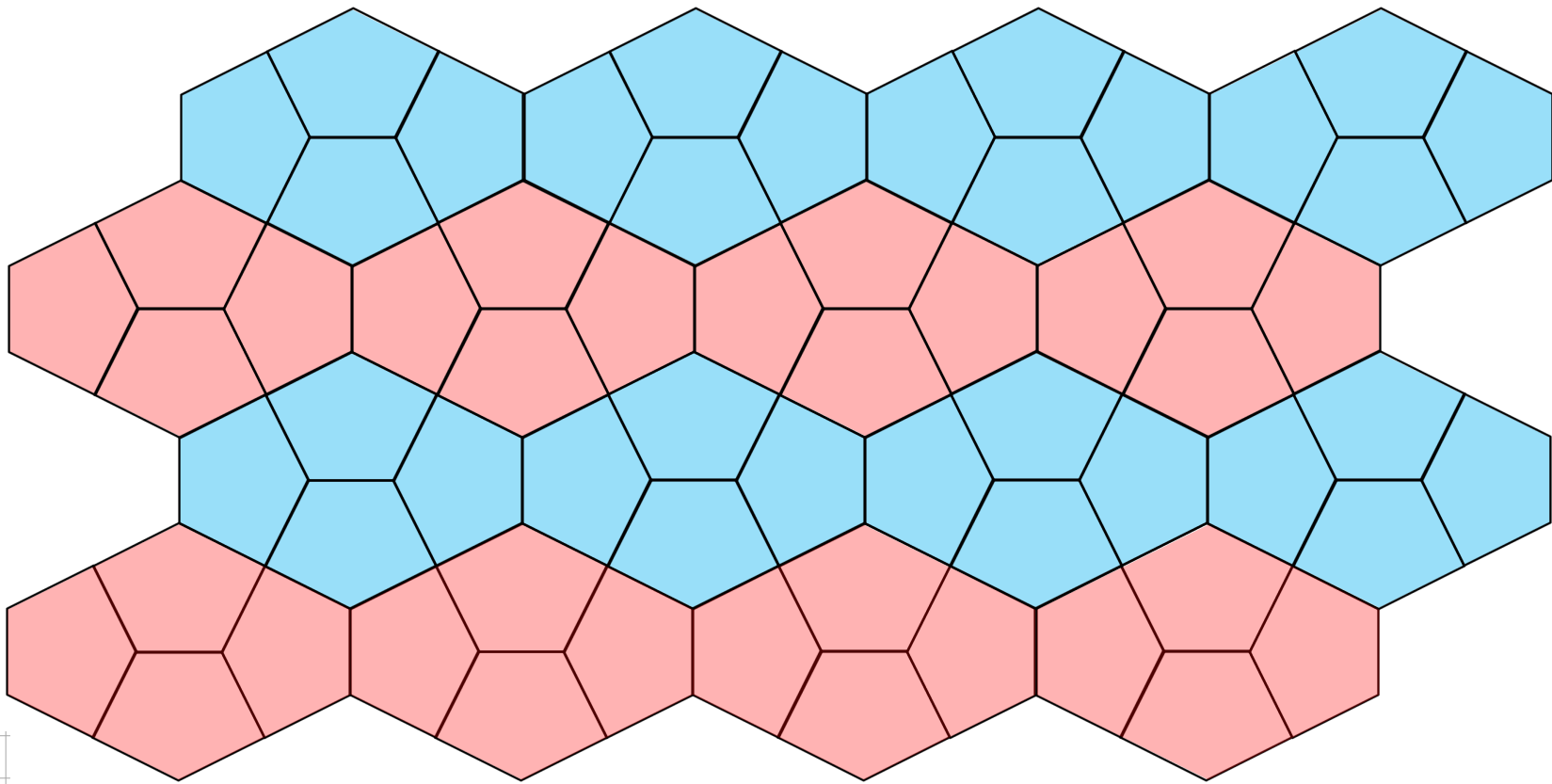
```
    v = roteer(vijfhoek, 90)
```

```
    teken(x + 4, y, v)
```

```
    v = roteer(vijfhoek, -90)
```

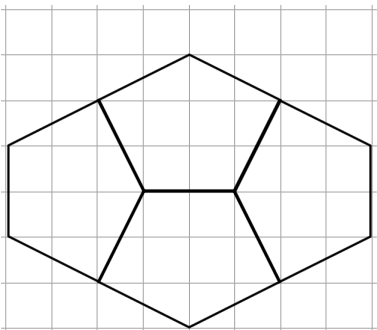
```
    teken(x - 4, y, v)
```

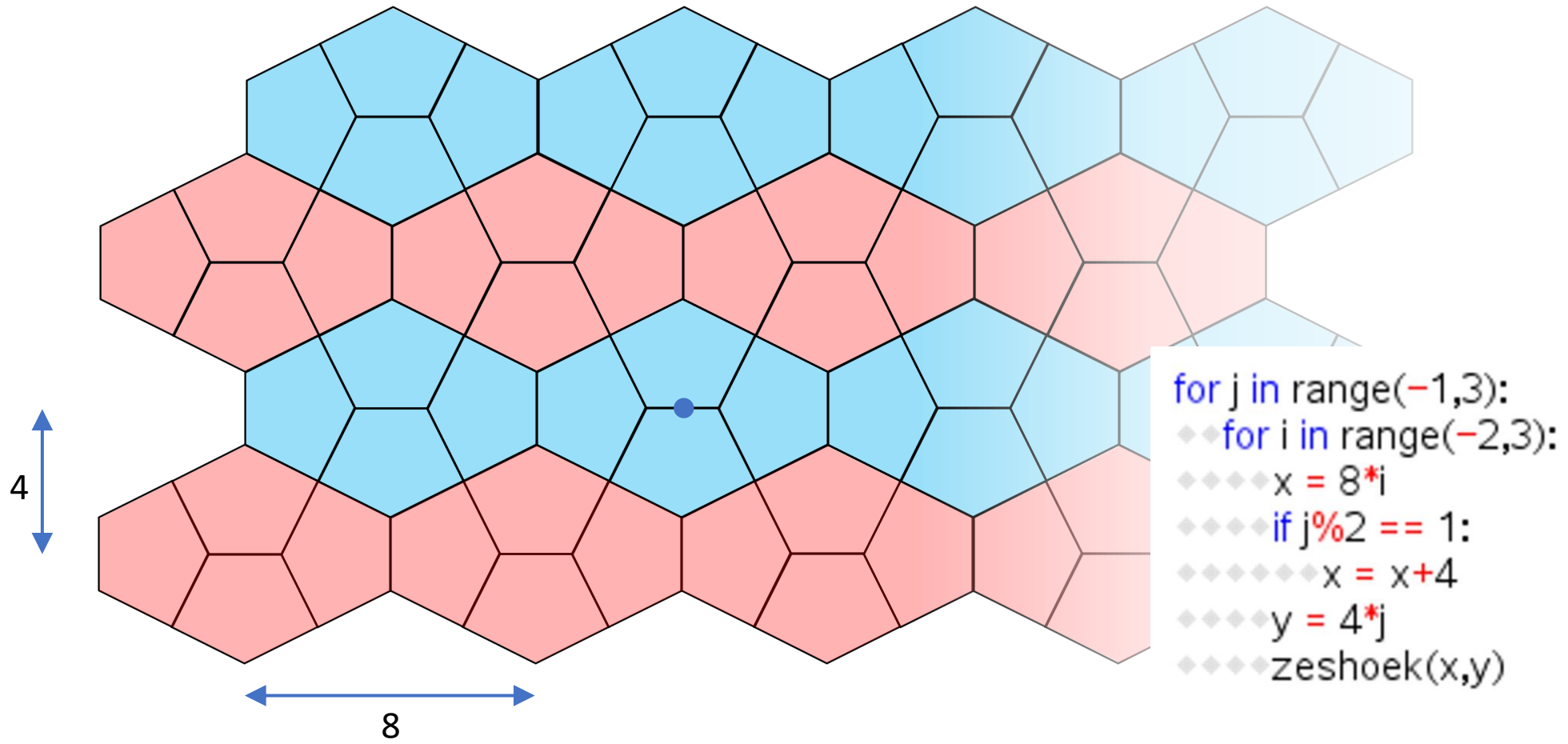




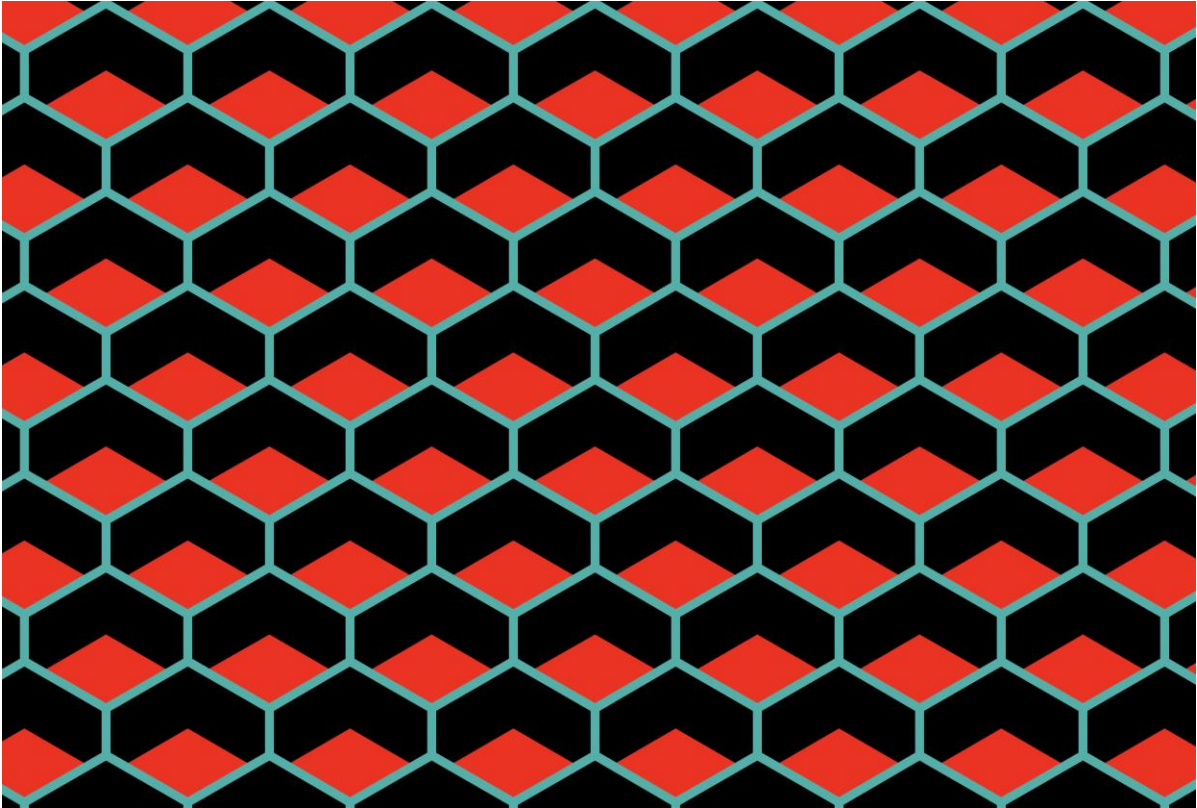
4

8

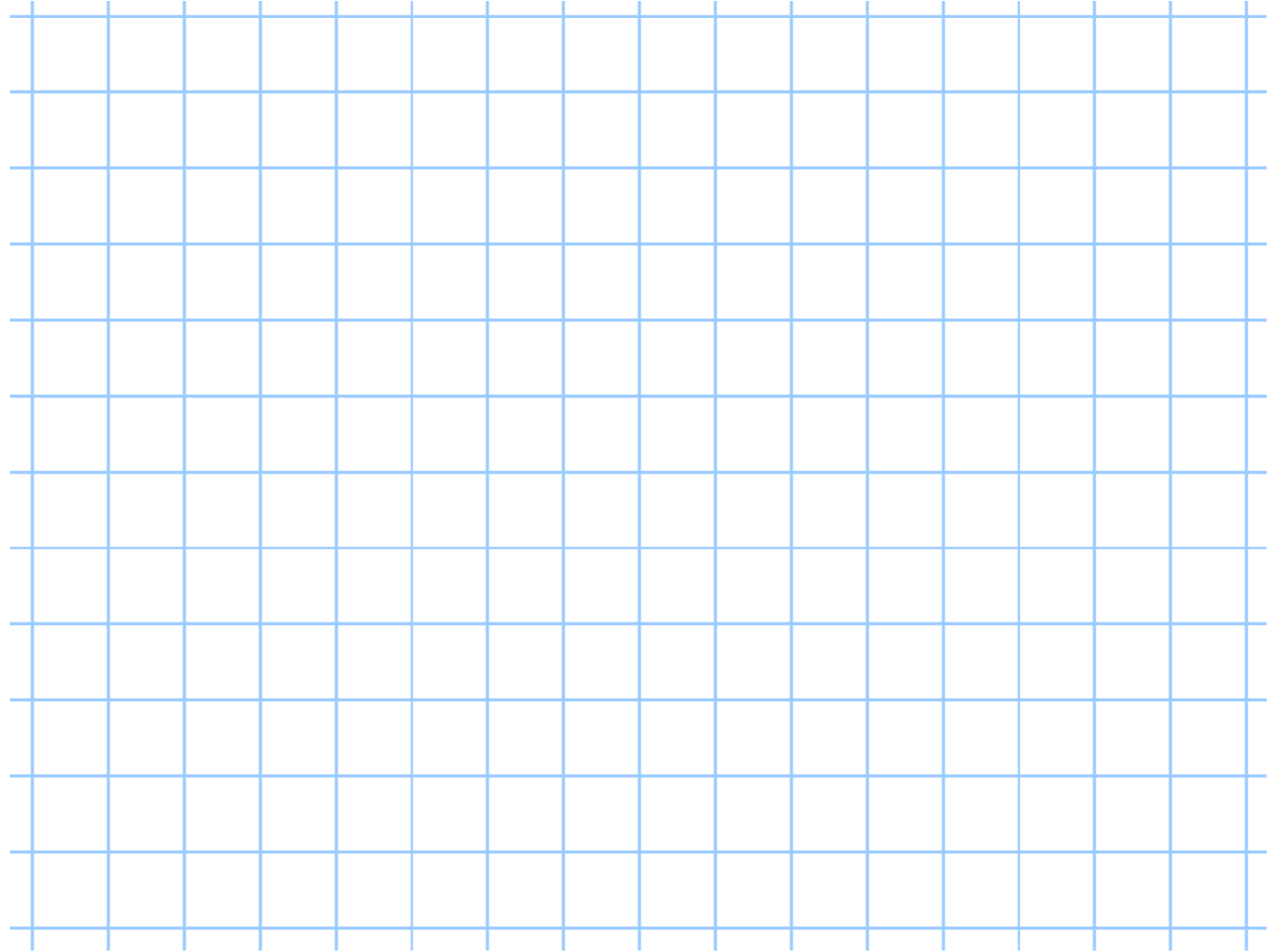




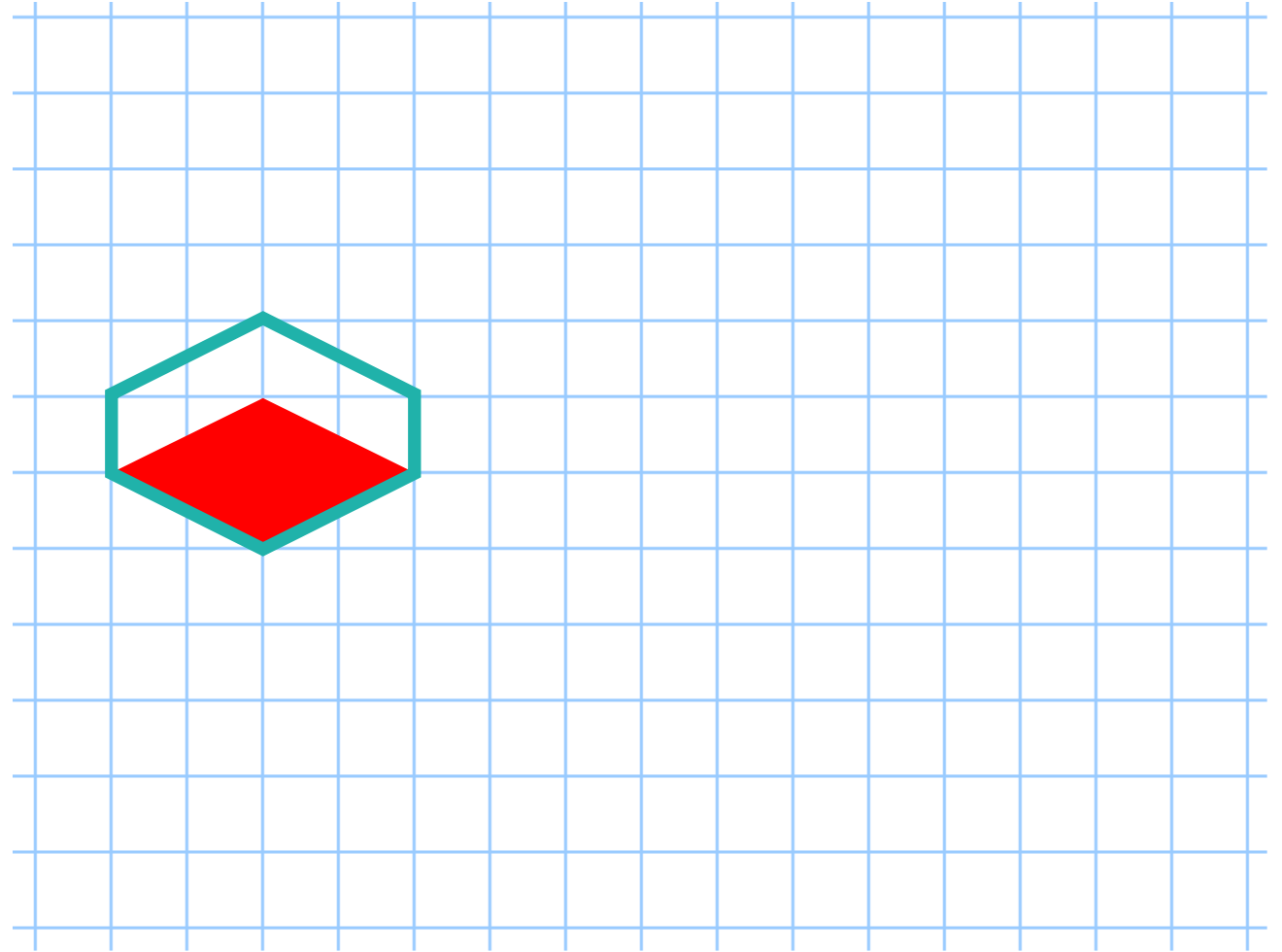
Kenia



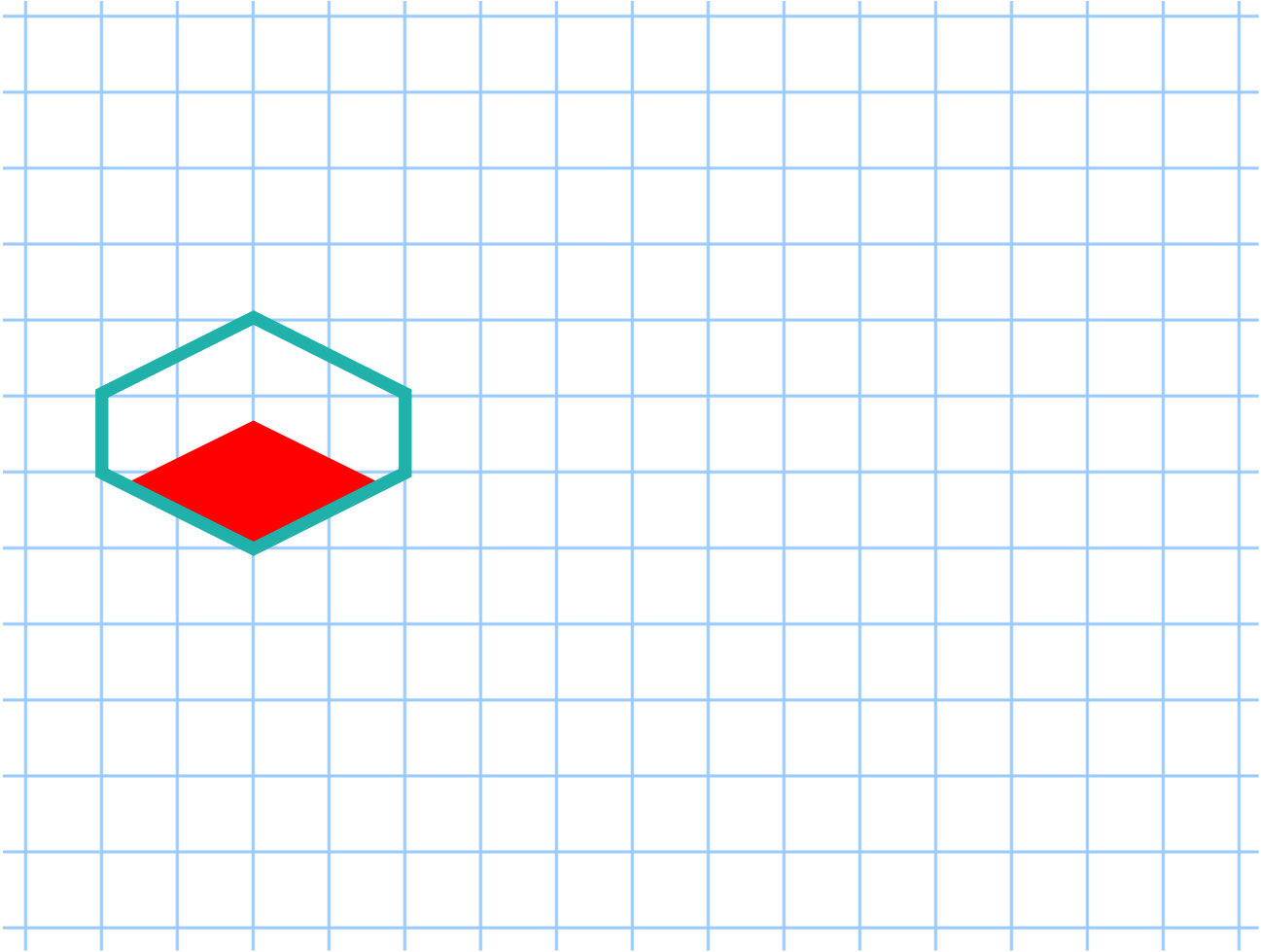
Kenia



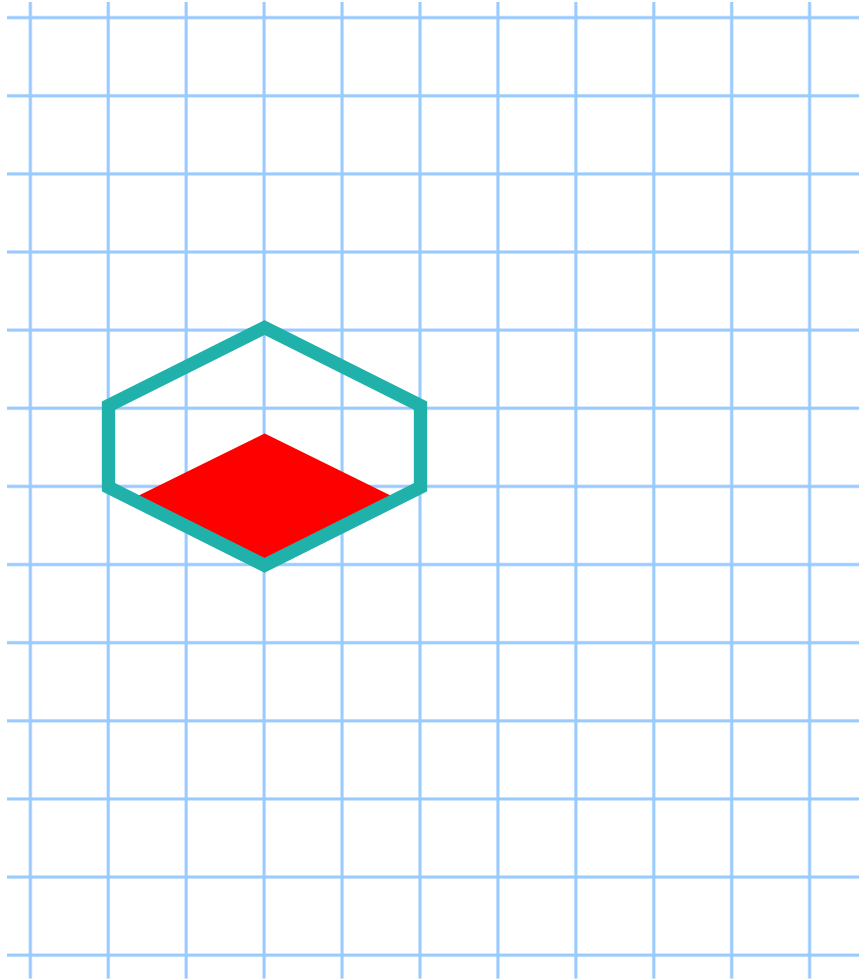
Kenia



Kenia

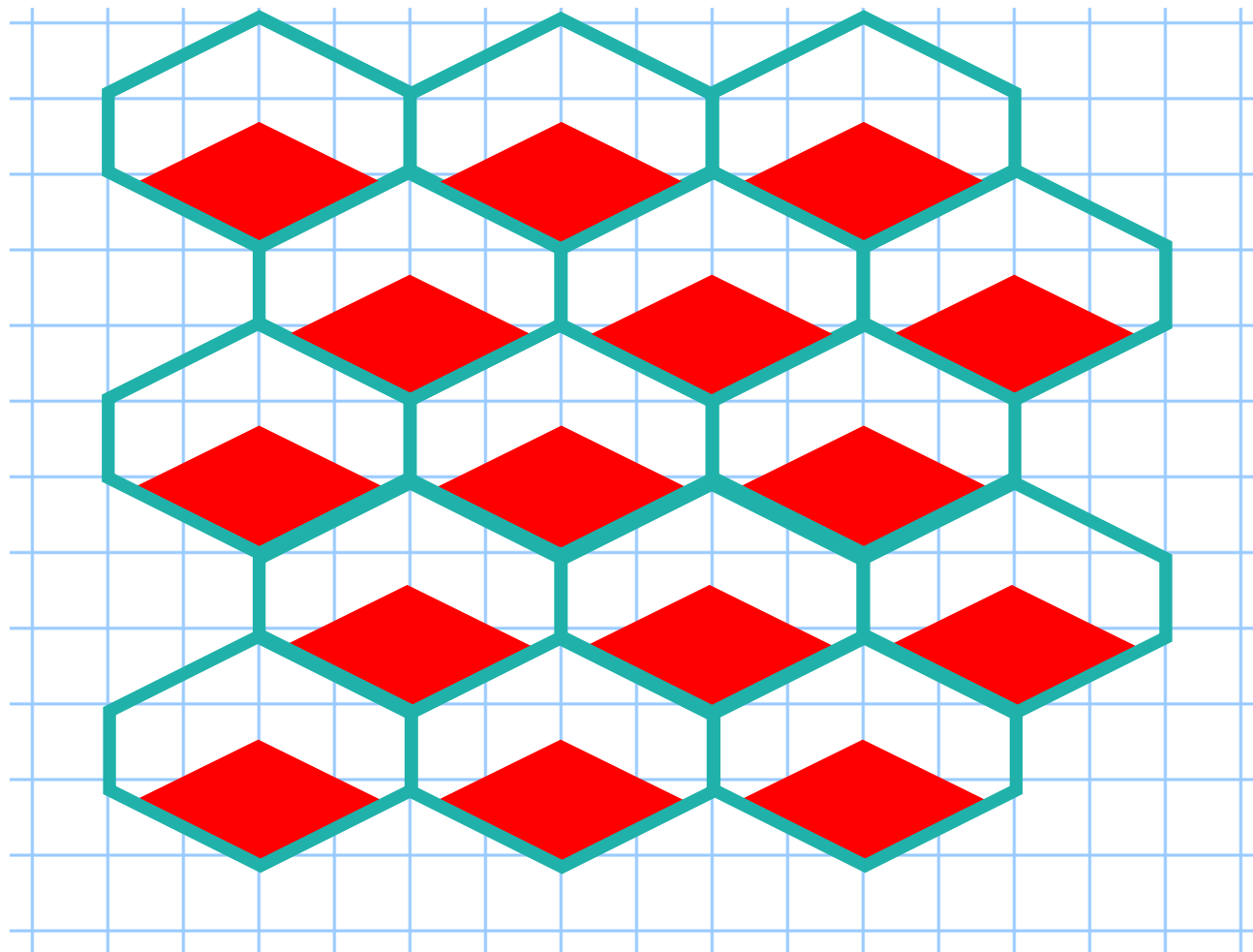


Kenia

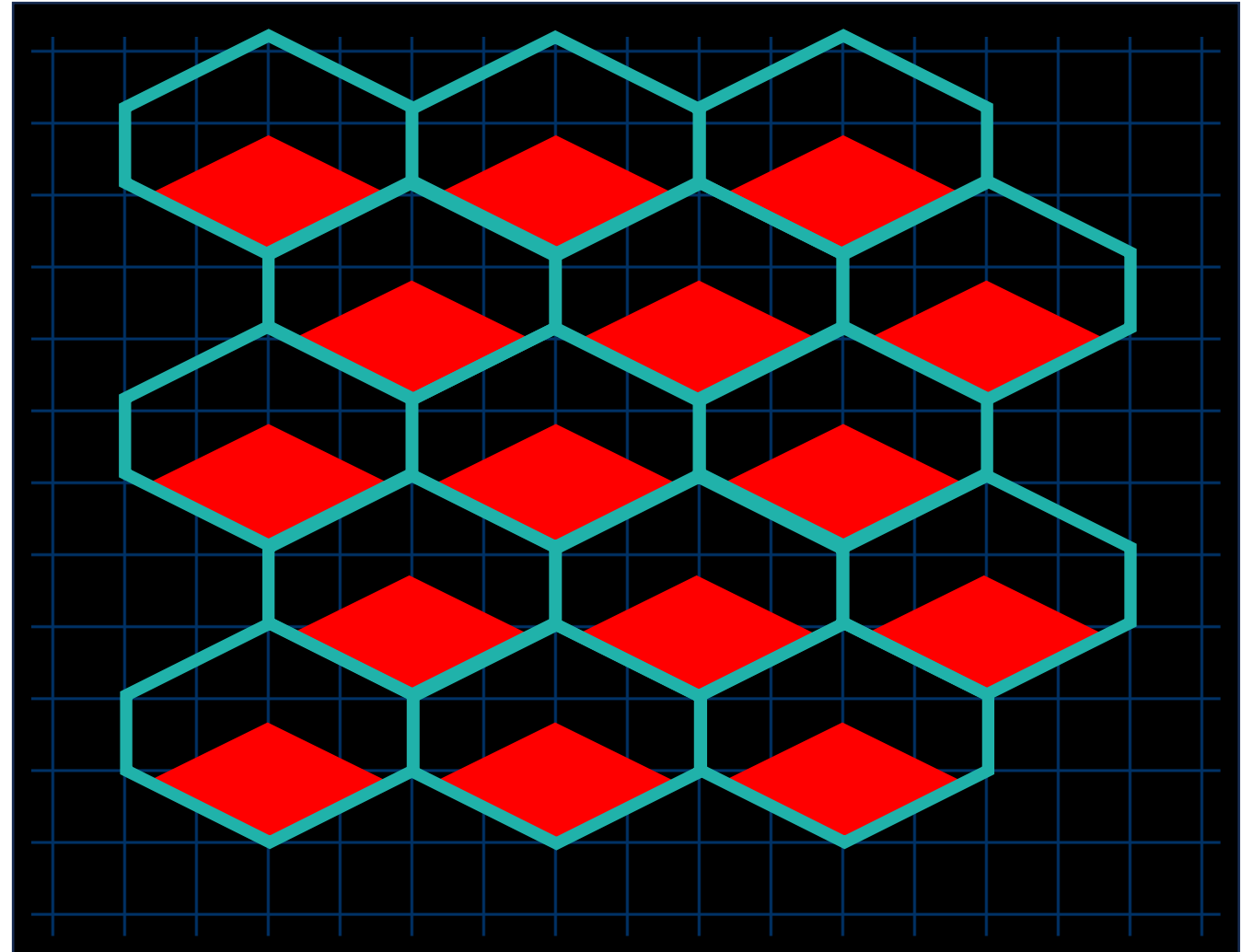


```
rood = (255,0,0)
groen = (32,178,170)
ruit = [(0,0), (2, 1), (0,2), (-2, 1), (0,0)]
zeshoek = [(0,0), (2,1), (2,2), (0,3), (-2,2), (-2,1), (0,0)]
f = sqrt(3)
a = 42
zeshoek = x_correctie(zeshoek)
zeshoek = vermenigvuldig(zeshoek,a)
ruit = x_correctie(ruit)
ruit = vermenigvuldig(ruit,0.8*a)
pensize(8)
dot(2000)
for j in range(-6,5):
    for i in range(-5,6):
        x = 2*f*i
        if j%2 == 0:
            x = x + f
        y = 2*j
        color(rood)
        vul(a*x, a*y, ruit)
        color(groen)
        teken(a*x, a*y, zeshoek)
```

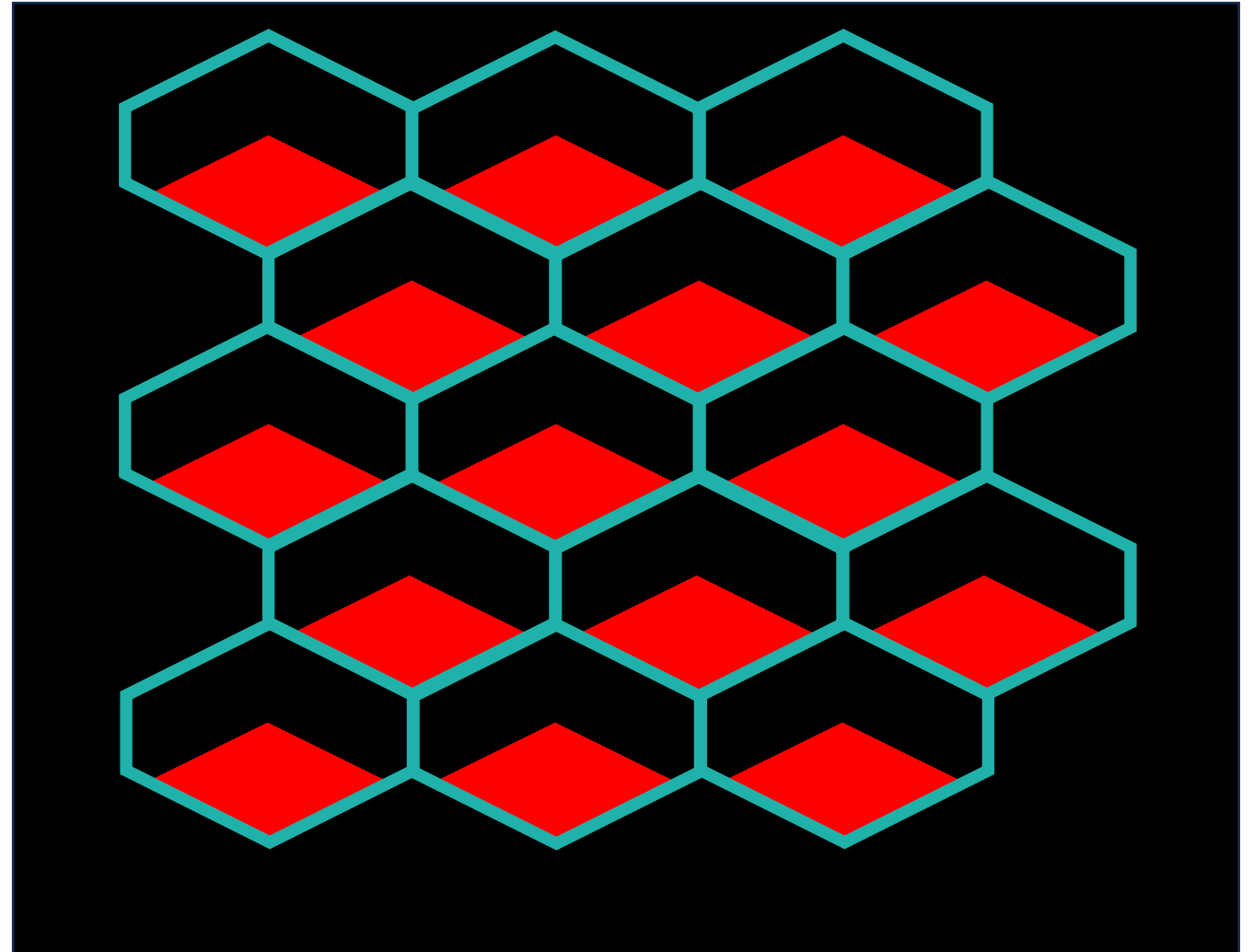
Kenia



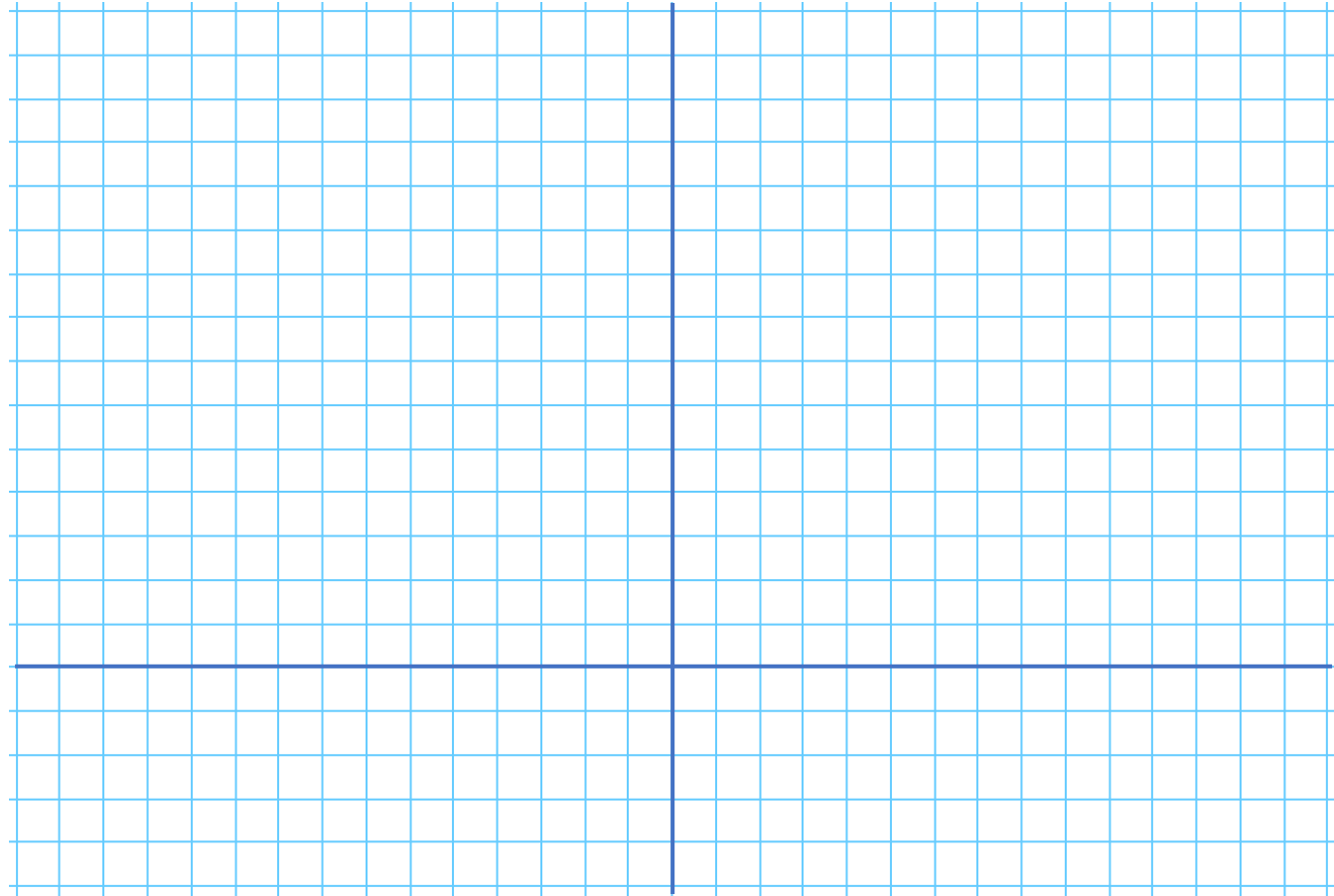
Kenia



Kenia



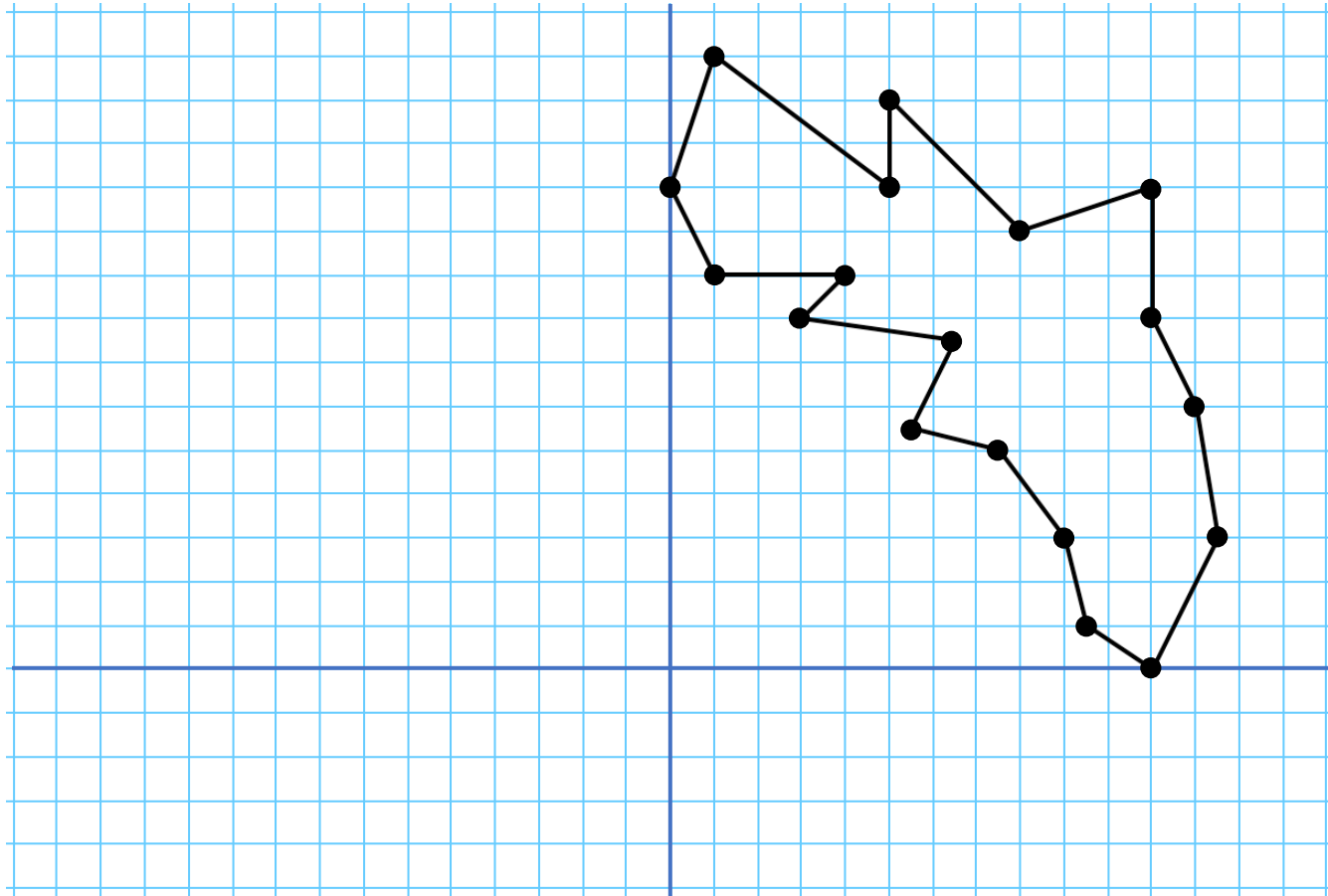
Vissen



Vissen

Conform de richtlijnen van de Escher Foundation
zijn alle illustraties uit de presentatie verwijderd

Vissen



```
vis = [ (11,0), (12.5,2.8), (12,6), (11,8), (11,11),  
        (8,10), (5,13), (5,11), (1,14), (0,11), (1,9),  
        (4,9), (3,8), (6.5,7.5), (5.5,5.5), (7.55,4.8),  
        (9,3), (9.5,1.2), (11,0)]
```

```
vis = vermenigvuldig(vis,28)
```

```
for j in range(8):
```

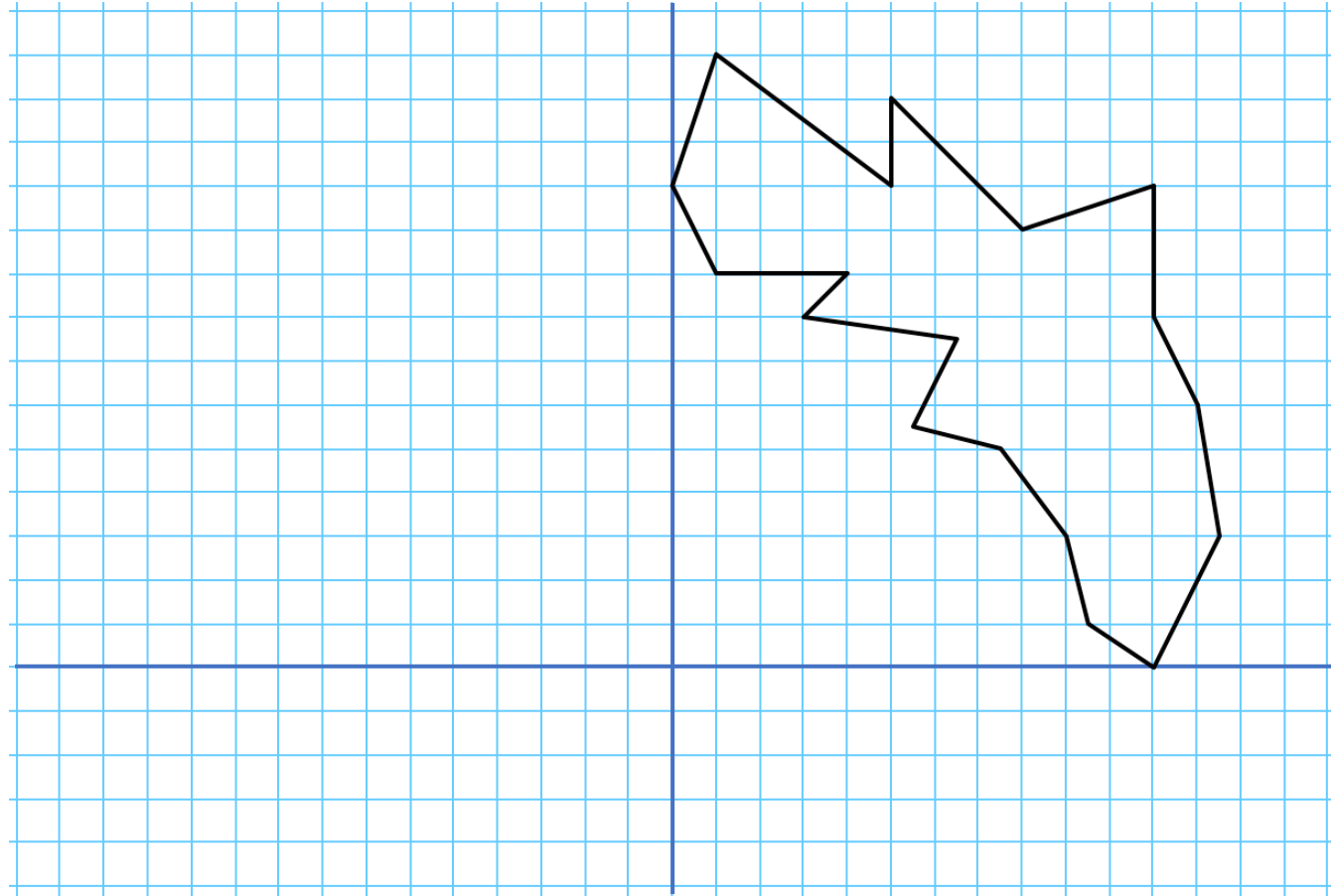
```
    for i in range(4):
```

```
        vul(0,0,vis)
```

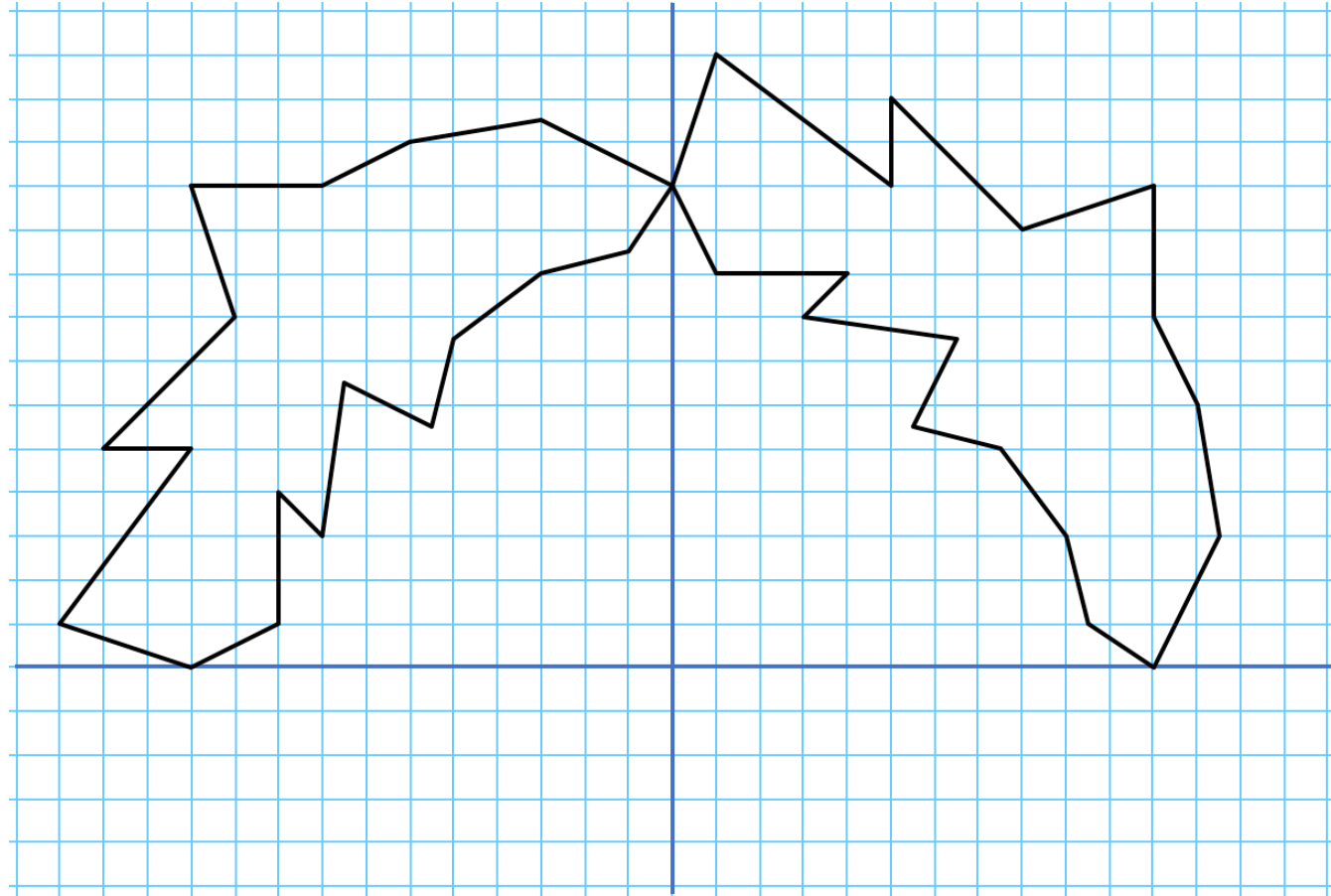
```
        vis = roteer(vis, 90)
```

```
    vis = vermenigvuldig(vis, 0.5)
```

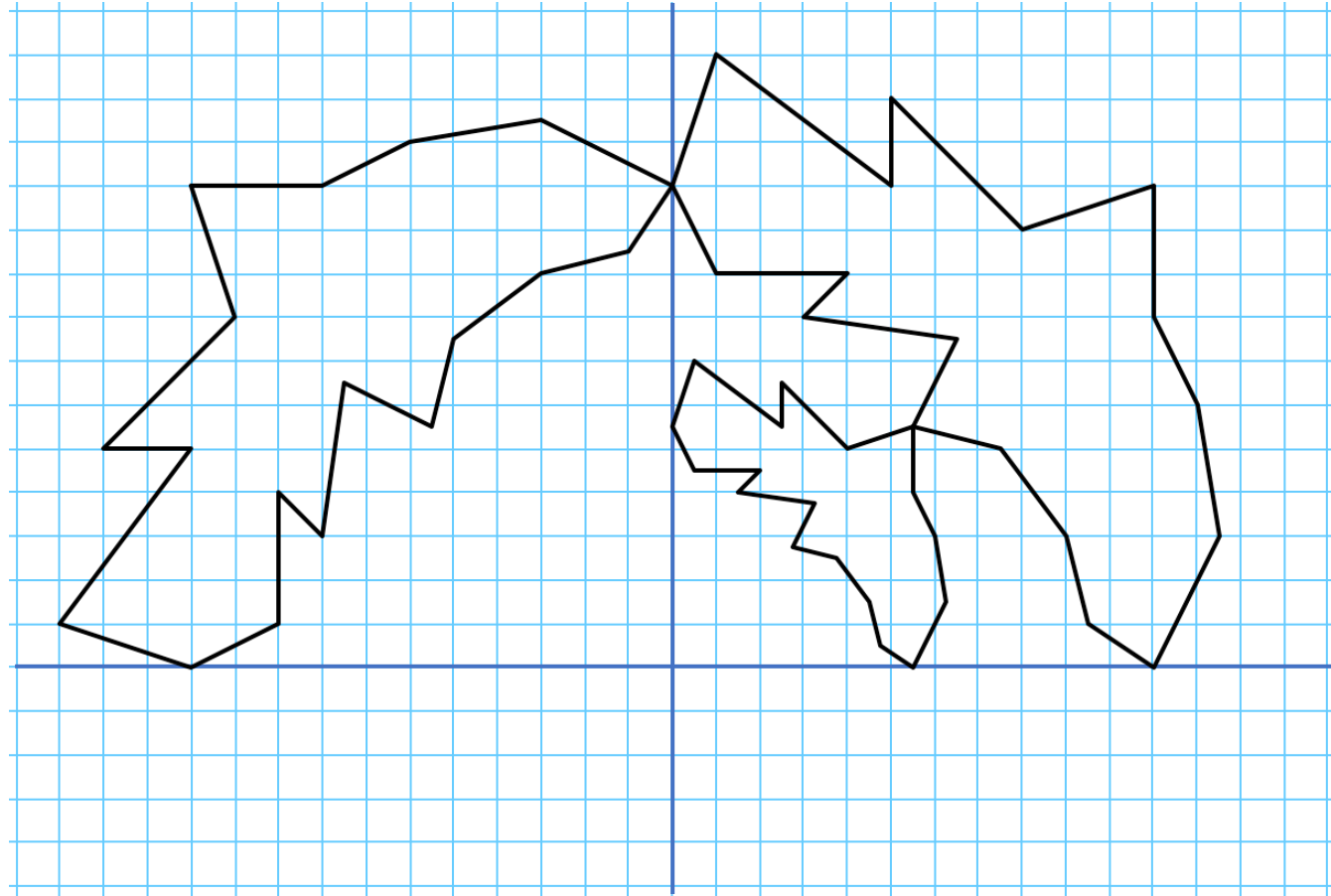
Vissen



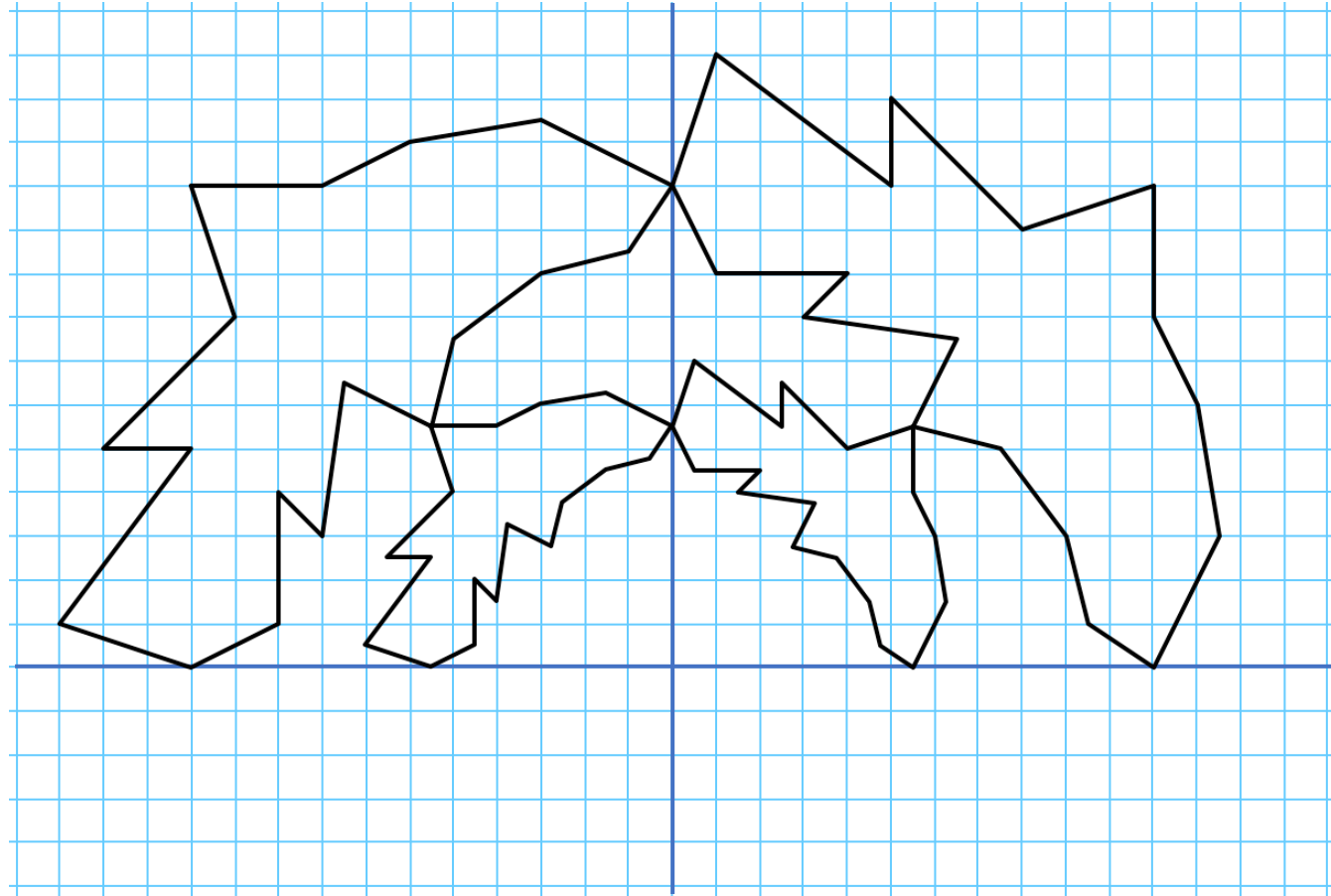
Vissen



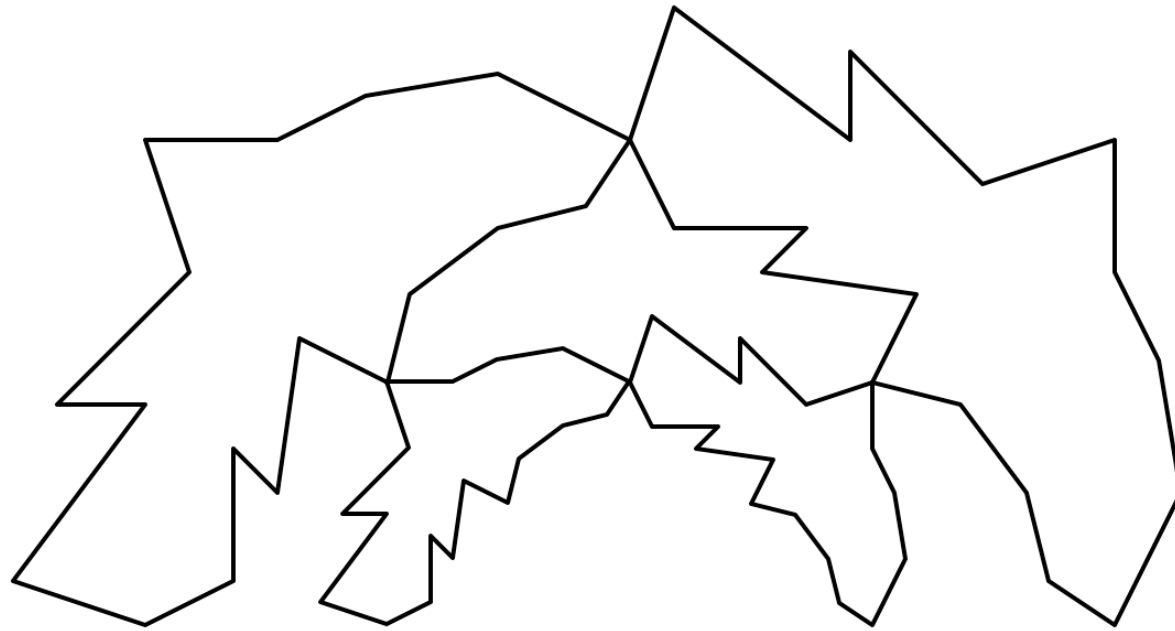
Vissen



Vissen



Vissen



Vissen

