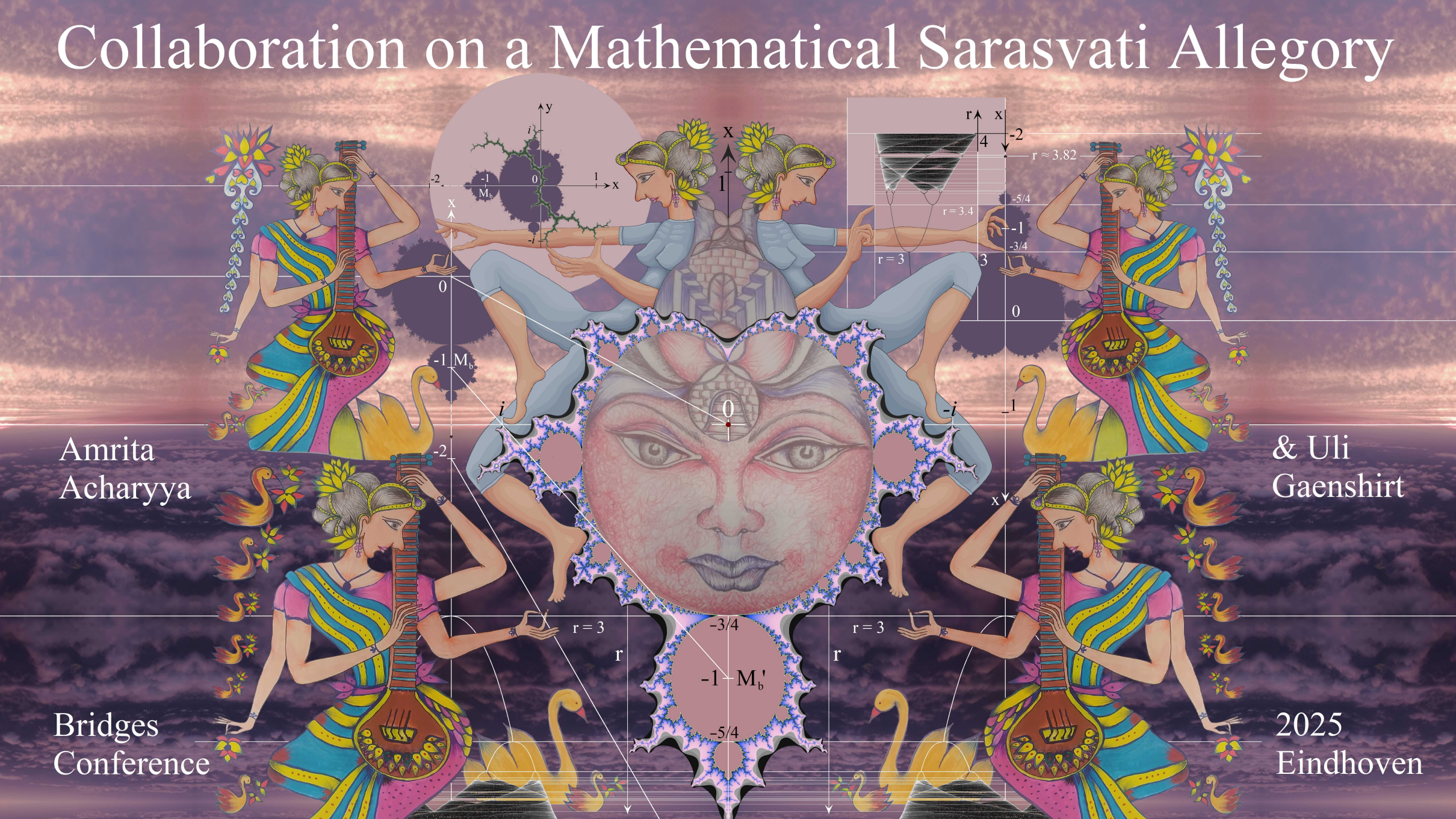
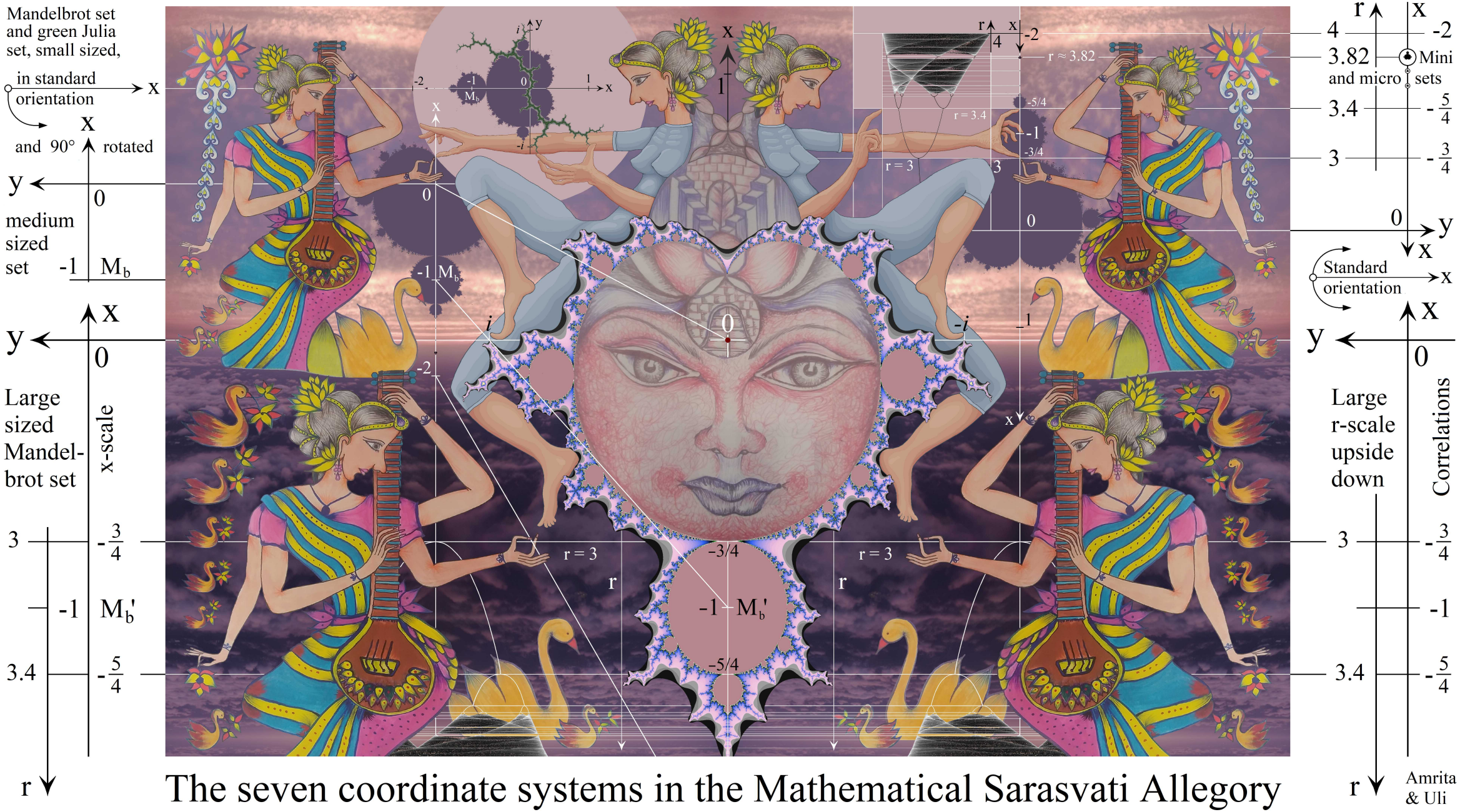
Collaboration on a Mathematical Sarasvati Allegory





The seven coordinate systems in the Mathematical Sarasvati Allegory

Coordinate system with cardioid

$x(A) = \frac{1}{2}\cos 0° - \frac{1}{4}\cos 0° = \frac{1}{4}$

$y(A) = \frac{1}{2}\sin 0° - \frac{1}{4}\sin 0° = 0$

$x(B) = \frac{1}{2}\cos 60° - \frac{1}{4}\cos 120° = \frac{3}{8}$

$y(B) = \frac{1}{2}\sin 60° - \frac{1}{4}\sin 120° = \frac{\sqrt{3}}{8}$

$x(C) = \frac{1}{2}\cos 120° - \frac{1}{4}\cos 240° = -\frac{1}{8}$

$y(C) = \frac{1}{2}\sin 120° - \frac{1}{4}\sin 240° = \frac{3\sqrt{3}}{8}$

$x(D) = \frac{1}{2}\cos 180° - \frac{1}{4}\cos 360° = -\frac{3}{4}$

$y(D) = \frac{1}{2}\sin 180° - \frac{1}{4}\sin 360° = 0$

$x(E) = \frac{1}{2}\cos 225° - \frac{1}{4}\cos 90° = -\frac{\sqrt{2}}{4}$

$y(E) = \frac{1}{2}\sin 225° - \frac{1}{4}\sin 90° = -\frac{\sqrt{2}+1}{4}$

$x(F) = \frac{1}{2}\cos 270° - \frac{1}{4}\cos 180° = \frac{1}{4}$

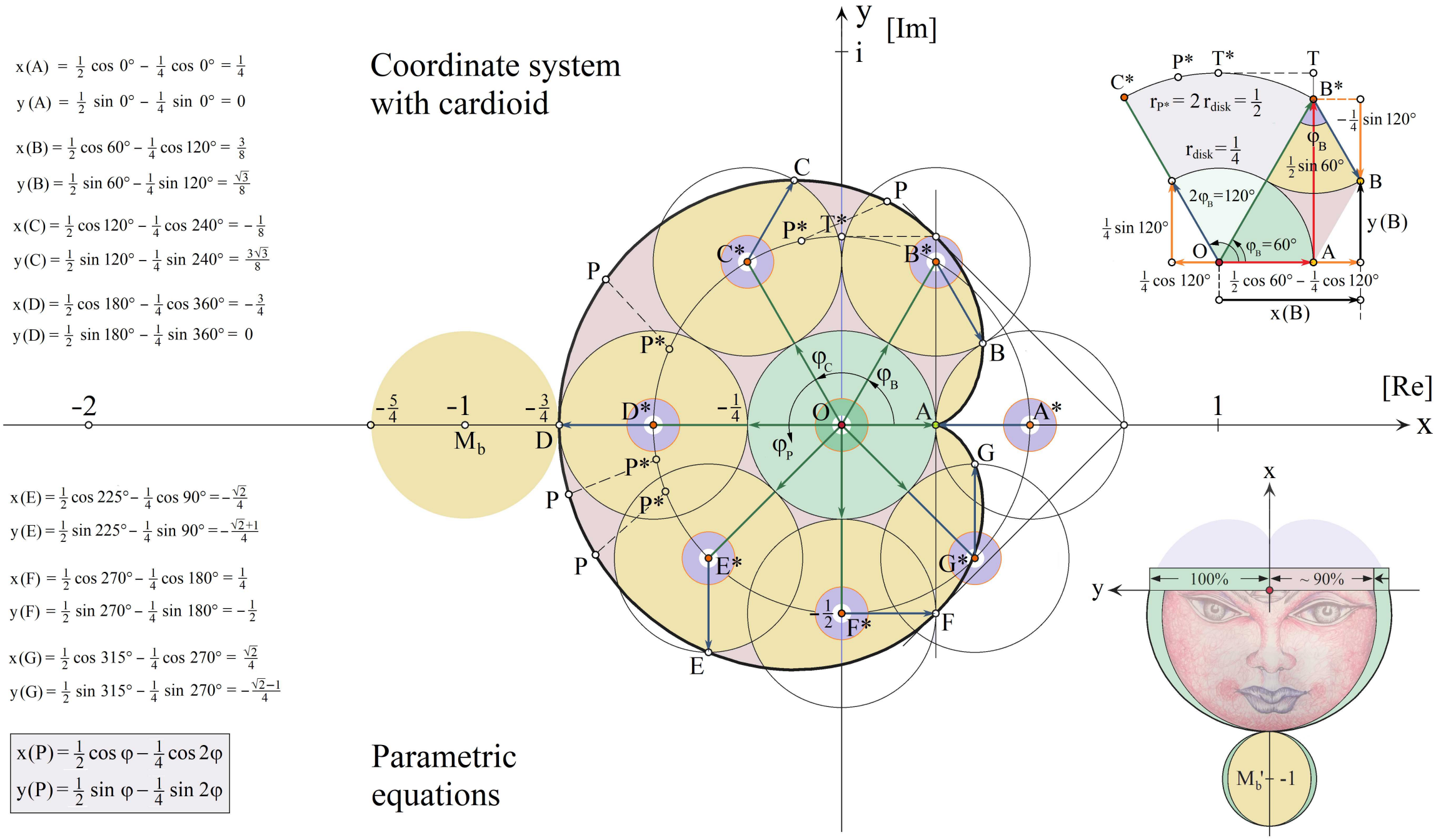
$y(F) = \frac{1}{2}\sin 270° - \frac{1}{4}\sin 180° = -\frac{1}{2}$

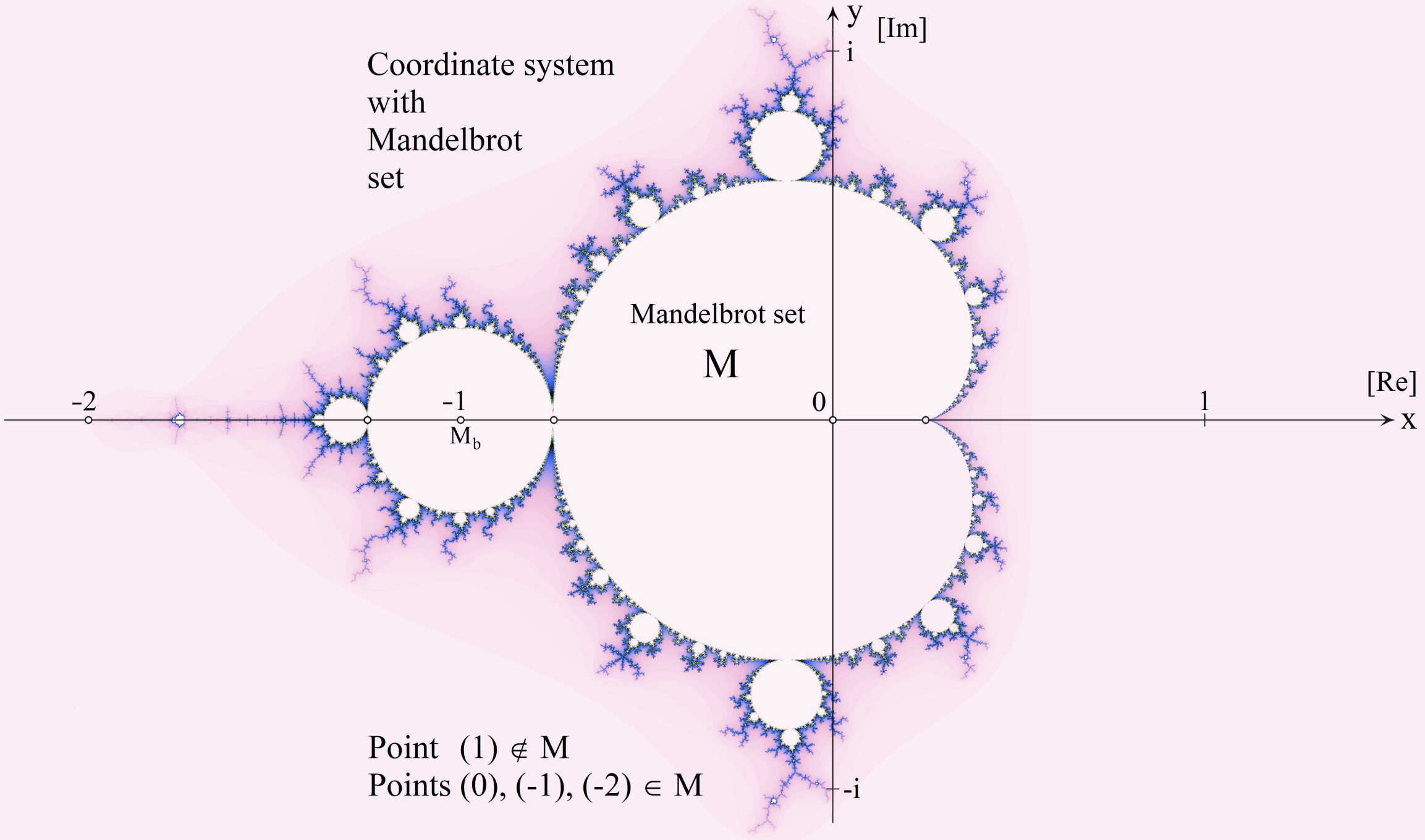
$x(G) = \frac{1}{2}\cos 315° - \frac{1}{4}\cos 270° = \frac{\sqrt{2}}{4}$

$y(G) = \frac{1}{2}\sin 315° - \frac{1}{4}\sin 270° = -\frac{\sqrt{2}-1}{4}$

$$x(P) = \frac{1}{2}\cos\varphi - \frac{1}{4}\cos 2\varphi$$
$$y(P) = \frac{1}{2}\sin\varphi - \frac{1}{4}\sin 2\varphi$$

Parametric equations




Coordinate system
with
Mandelbrot
set
y
i
[Im]
Mandelbrot set
M
-2
-1
M_b
0
1
[Re]
x
-i
Point (1) ∉ M
Points (0), (-1), (-2) ∈ M

Coordinate system with cardioid and Mandelbrot set

$x(A) = \frac{1}{2}\cos 0° - \frac{1}{4}\cos 0° = \frac{1}{4}$

$y(A) = \frac{1}{2}\sin 0° - \frac{1}{4}\sin 0° = 0$

$x(B) = \frac{1}{2}\cos 60° - \frac{1}{4}\cos 120° = \frac{3}{8}$

$y(B) = \frac{1}{2}\sin 60° - \frac{1}{4}\sin 120° = \frac{\sqrt{3}}{8}$

$x(C) = \frac{1}{2}\cos 120° - \frac{1}{4}\cos 240° = -\frac{1}{8}$

$y(C) = \frac{1}{2}\sin 120° - \frac{1}{4}\sin 240° = \frac{3\sqrt{3}}{8}$

$x(D) = \frac{1}{2}\cos 180° - \frac{1}{4}\cos 360° = -\frac{3}{4}$

$y(D) = \frac{1}{2}\sin 180° - \frac{1}{4}\sin 360° = 0$

$x(E) = \frac{1}{2}\cos 225° - \frac{1}{4}\cos 90° = -\frac{\sqrt{2}}{4}$

$y(E) = \frac{1}{2}\sin 225° - \frac{1}{4}\sin 90° = -\frac{\sqrt{2}+1}{4}$

$x(F) = \frac{1}{2}\cos 270° - \frac{1}{4}\cos 180° = \frac{1}{4}$

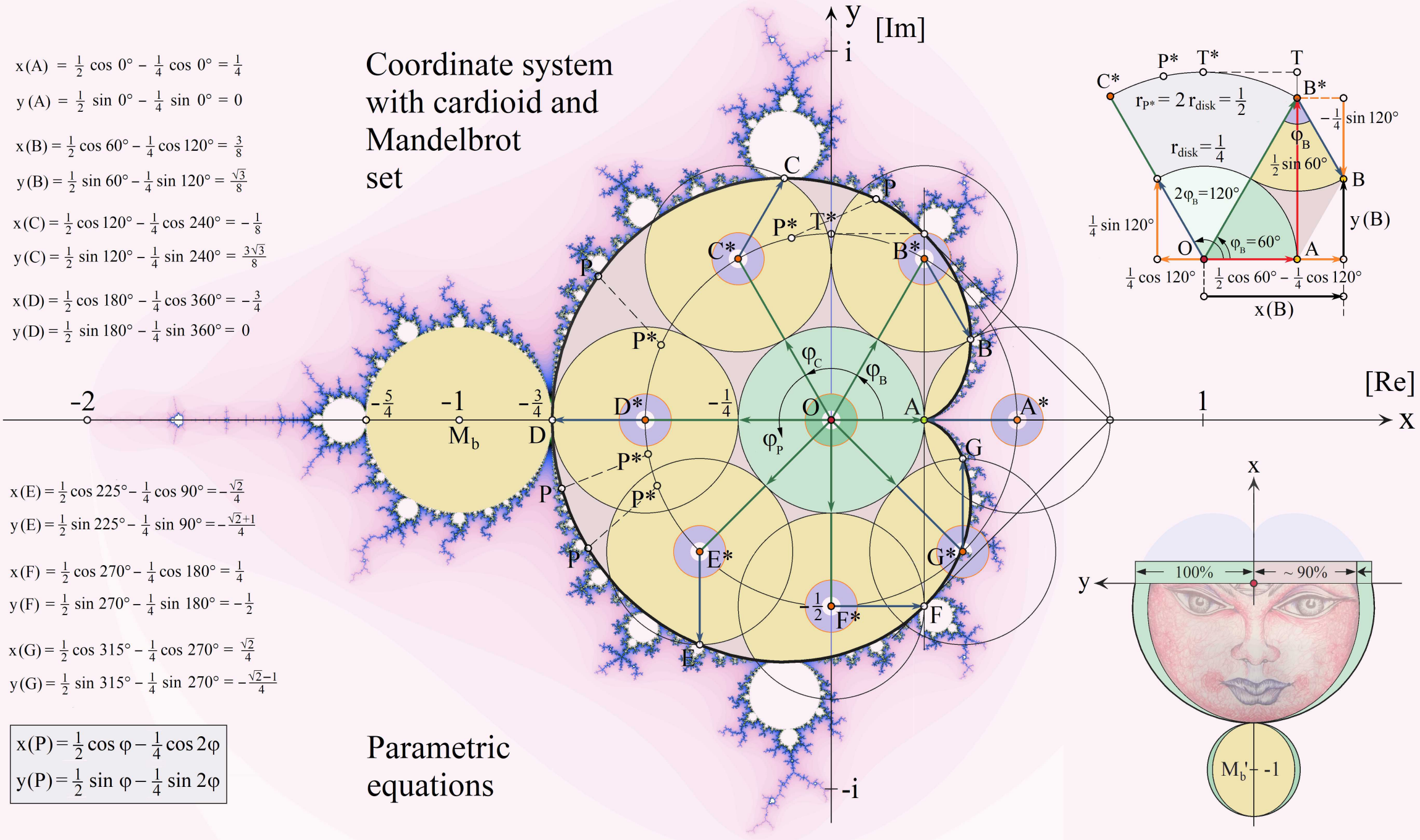
$y(F) = \frac{1}{2}\sin 270° - \frac{1}{4}\sin 180° = -\frac{1}{2}$

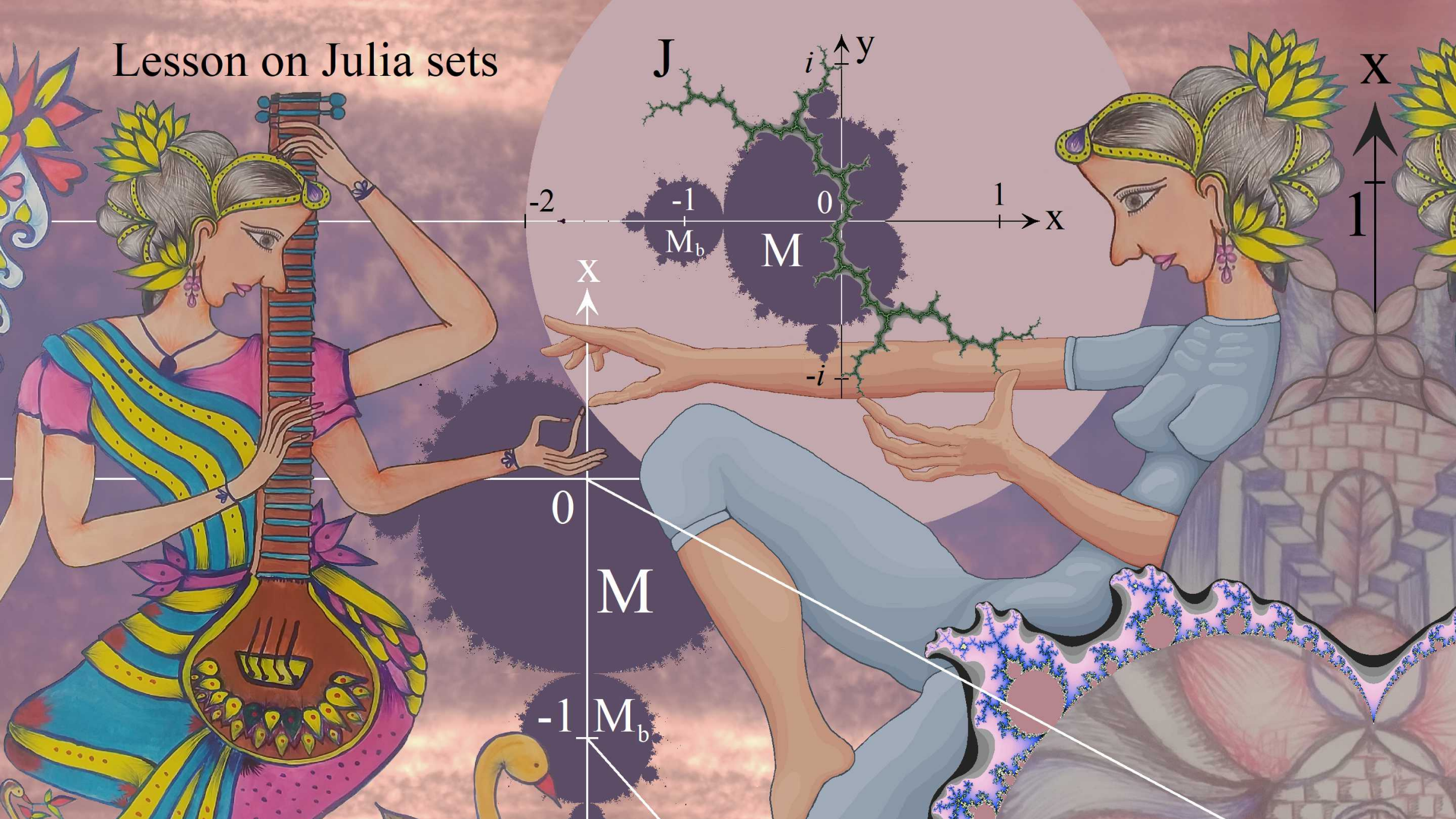
$x(G) = \frac{1}{2}\cos 315° - \frac{1}{4}\cos 270° = \frac{\sqrt{2}}{4}$

$y(G) = \frac{1}{2}\sin 315° - \frac{1}{4}\sin 270° = -\frac{\sqrt{2}-1}{4}$

$$x(P) = \frac{1}{2}\cos\varphi - \frac{1}{4}\cos 2\varphi$$
$$y(P) = \frac{1}{2}\sin\varphi - \frac{1}{4}\sin 2\varphi$$

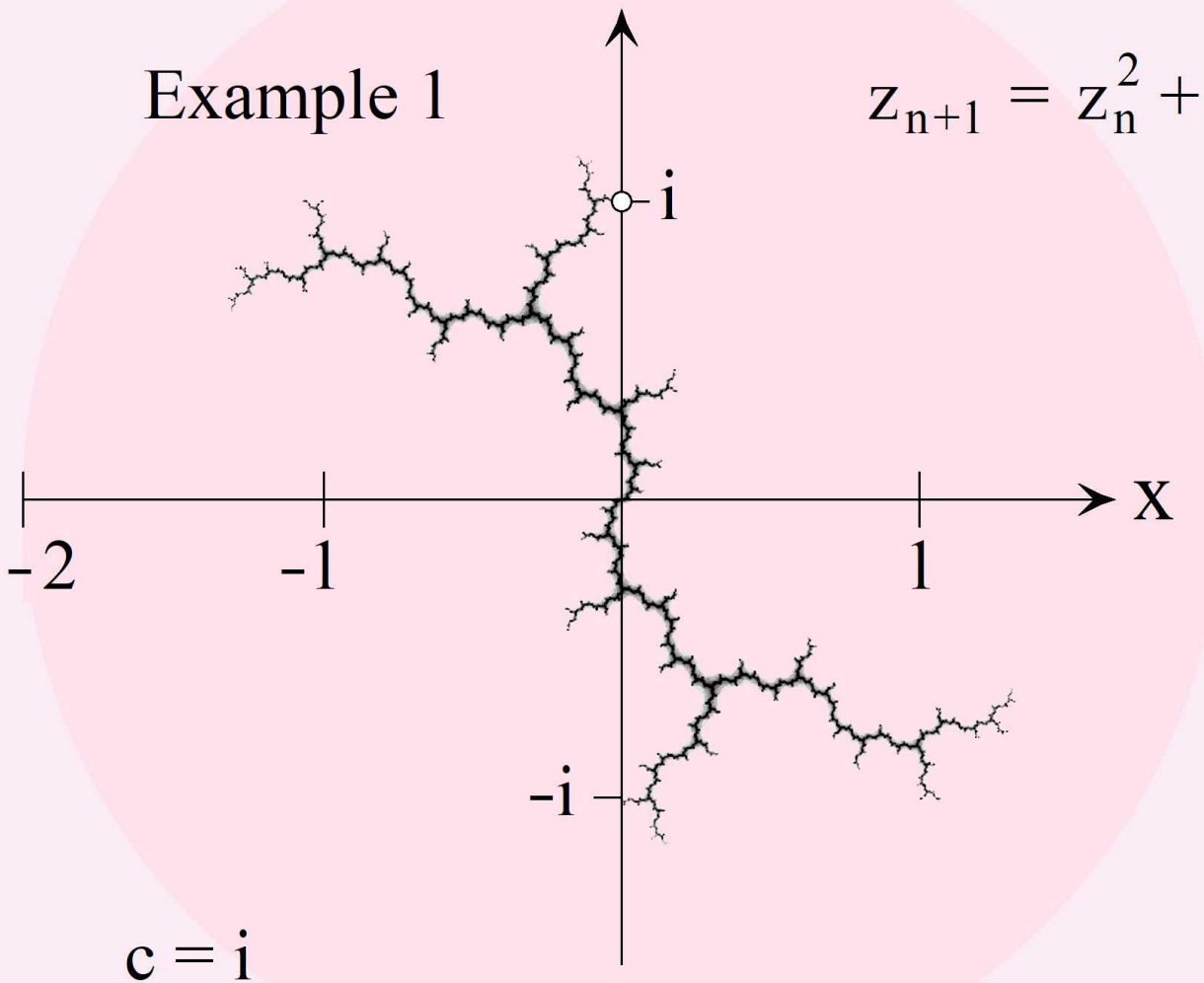
Parametric equations




Lesson on Julia sets
J
i
y
-2
-1
0
1
x
M_b
M
-i
x
0
M
-1
M_b
x
1

Julia sets

Example 1



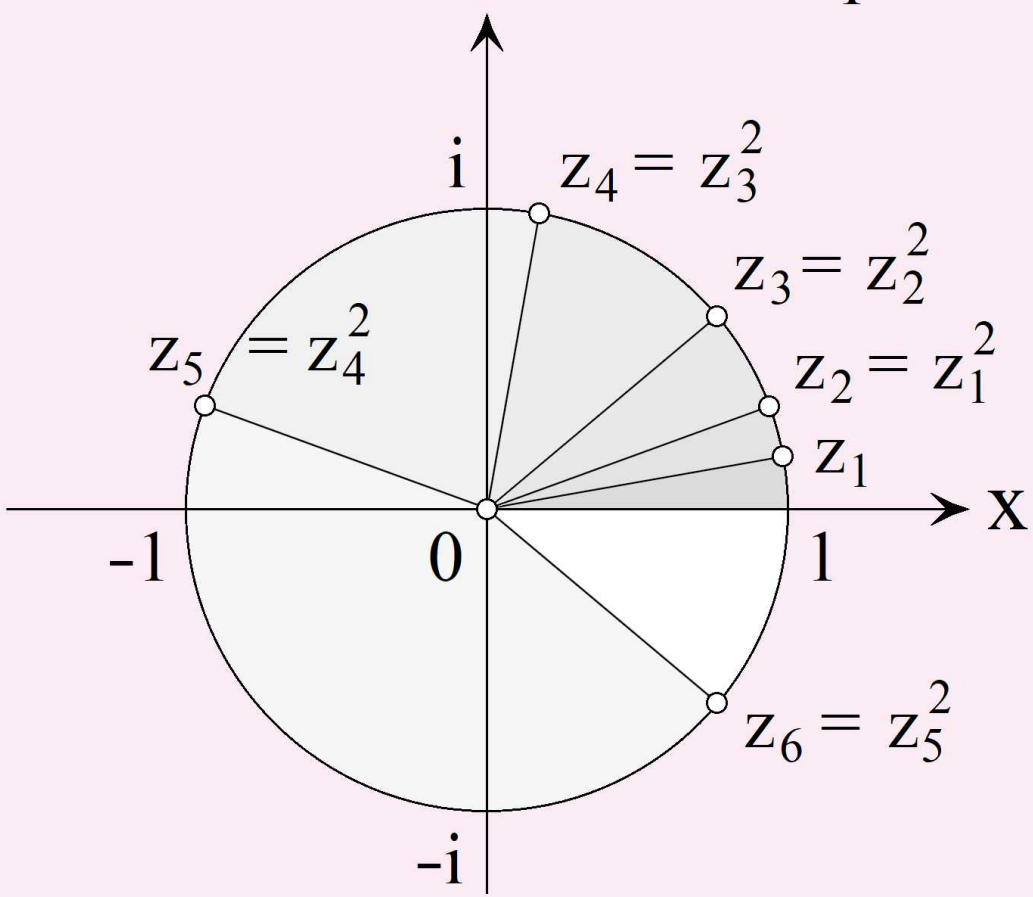
$c = i$

leads to a dendritic shape

Recursive equation:

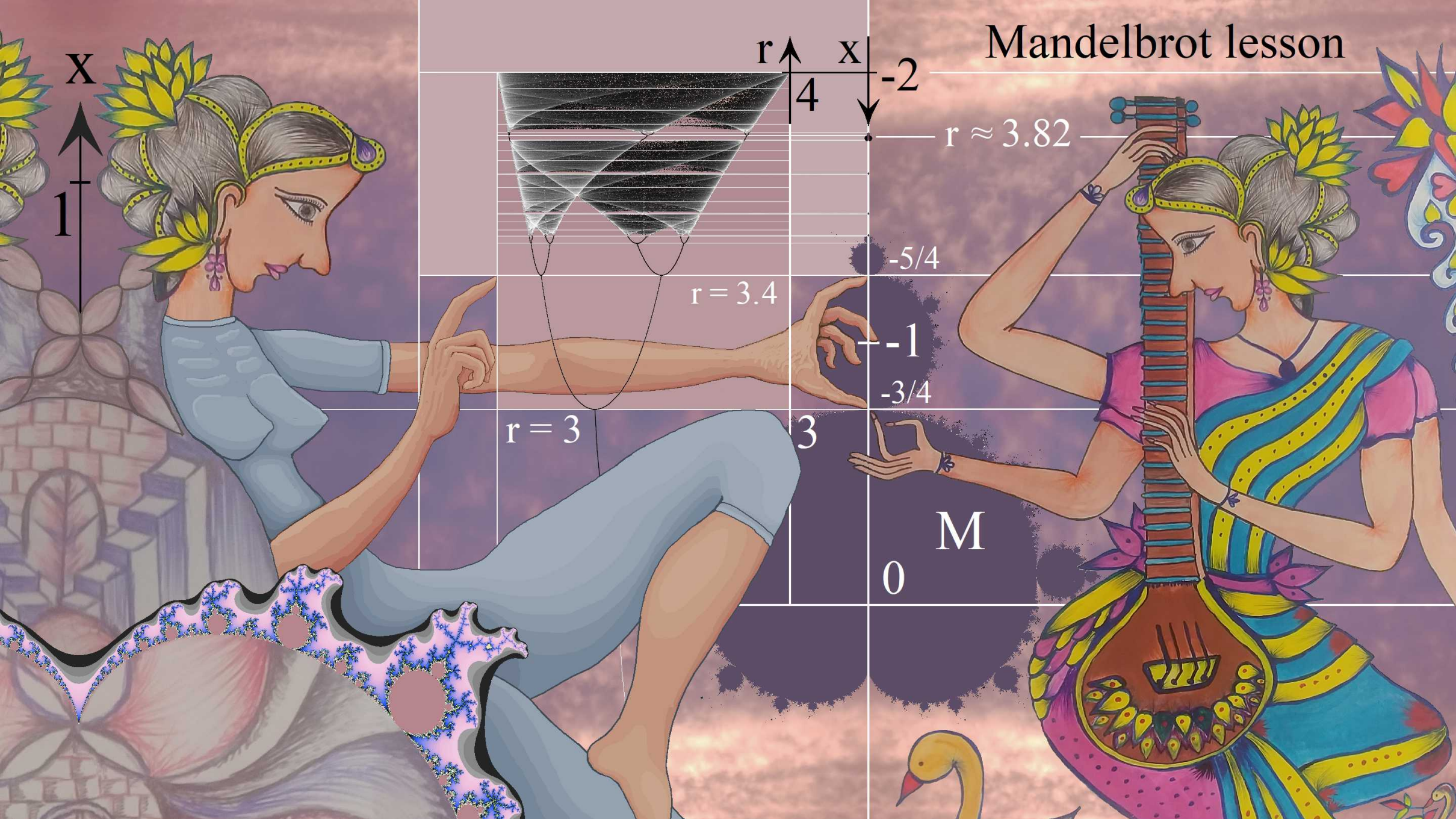
$$z_{n+1} = z_n^2 + c$$

Example 2

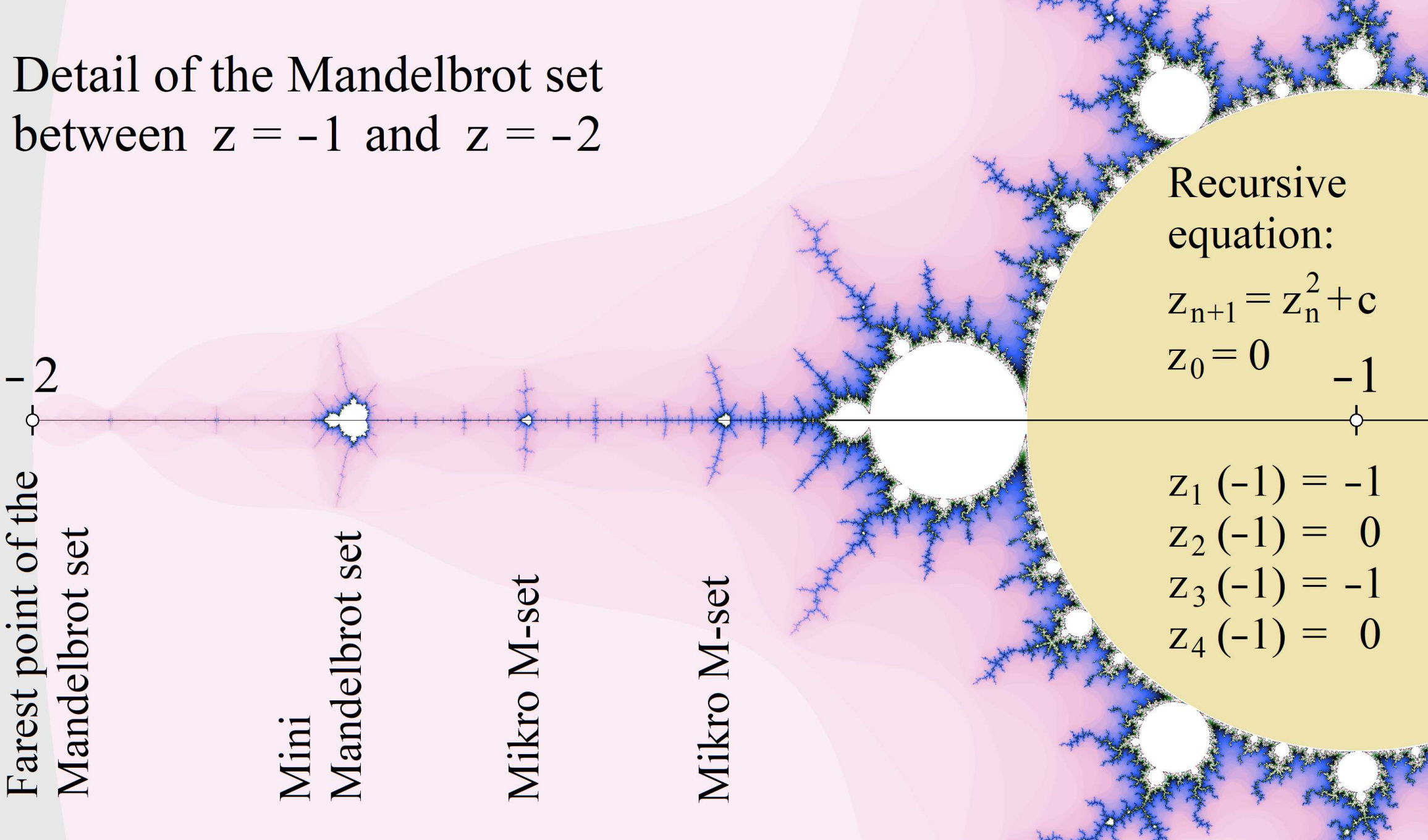


$c = 0$ with $z_{n+1} = z_n^2$

leads to the shape of a unit circle


Mandelbrot lesson
x
1
r
x
4
-2
r ≈ 3.82
-5/4
r = 3.4
-1
-3/4
r = 3
3
M
0

Detail of the Mandelbrot set between z = -1 and z = -2



Recursive equation:

$z_{n+1} = z_n^2 + c$

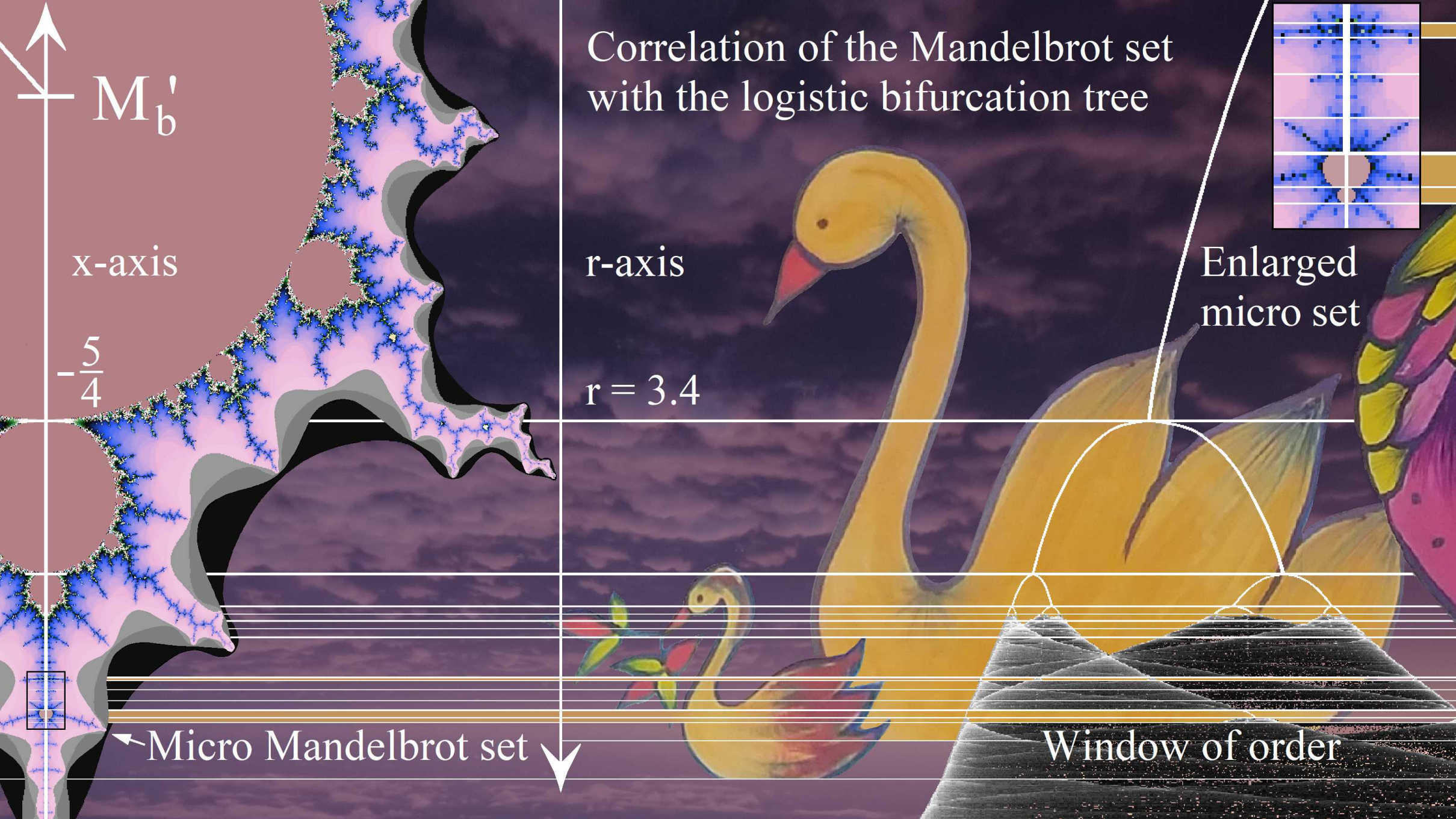
$z_0 = 0$

$z_1(-1) = -1$

$z_2(-1) = 0$

$z_3(-1) = -1$

$z_4(-1) = 0$


Correlation of the Mandelbrot set
with the logistic bifurcation tree
M_b'
x-axis
$-\frac{5}{4}$
r-axis
r = 3.4
Enlarged
micro set
Micro Mandelbrot set
Window of order


y
i
-2
-1
0
1
x
M_b
-i
x
1
r
x
4
-2
r ≈ 3.82
-5/4
r = 3.4
-1
-3/4
r = 3
3
0
-1 M_b
i
0
-i
1
-2
x
r = 3
r
-3/4
-1 M_b'
-5/4
r = 3
r

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