Complex numbers

$$c = \underbrace{a}_{\text{real part}} + i\underbrace{b}_{\text{imaginary part}} \qquad i^2 = -1$$

Adding: add the real parts and add the imaginary parts

$$(1+2i) + (3-4i) = (1+3) + (2-4)i$$
$$= 4 - 2i$$

Multiplying: use FOIL, remembering $i^2 = -1$

$$(1+2i)\cdot(3-4i) = 1\cdot 3 + 1\cdot(-4i) + (2i\cdot 3) + (2i)\cdot(-4i)$$
$$= 3 - 4i + 6i + 8$$
$$= 11 + 2i$$

$$z_0 = x_0 + iy_0$$
$$z_1 = z_0^2 + c$$
$$= (x_0 + iy_0)^2 + (a + ib)$$
$$= x_0^2 - y_0^2 + 2x_0y_0 i + a + ib$$
$$= (x_0^2 - y_0^2 + a) + (2x_0y_0 + b)i$$
$$z_2 = z_1^2 + c$$
$$z_3 = z_2^2 + c$$
$$\vdots$$

Mandelbrot formula

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