ATM *MANDELBROT SET SUMMARY*

How The Mandelbrot Set is Constructed:

1. One at a time, each point (or computer screen *pixel*) in the complex plane becomes the seed to be iterated through the function: $\mathbf{x_{next} = x^2 + s}$
(where **s** is the seed)

Example s = seed = **-1 + .5i**

(constant s)

x_1 =(**-1+.5i**)^2 + -1+.5i = **-.25 - .5i**
x_2 = (**-.25-.5i**)^2 + -1+.5i = **-1.19 + .75i**
x_3 = (**-1.19 + .75i**)^2 + -1 +.5i = **-.152 + -1.28i**
x_4 = (**-.152 + -1.28i**)^2 + -1 +.5i = **-2.62+.89i**
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2. For each seed, there are 2 possible **fates** for the **orbit**:
   a) the orbit will tend to infinity
   b) the orbit will not tend to infinity (usually tending toward an attractor)

3. To determine whether an orbit will eventually take off to infinity, you look at the **magnitude** of each iteration in the orbit. (||a+bi|| = the magnitude of a+bi)

For the example above (s = seed = -1 + .5i):

x_0: $\| 1 + .5i \|$ **= 1.12**
x_1: $\| .25 \quad .5i \|$ **= .56**
x_2: $\| 1.19 + .75i \|$ **= 1.41**
x_3: $\| .152 \quad 1.28i \|$ **= 1.29**
x_4: $\| 2.62 + .89i \|$ **= 2.77 . . .**

4. FACT: If any iteration of the orbit grows to have a **magnitude greater than 2**, the orbit will approach infinity.

5. How does each point get assigned a **color**?
If the orbit doesn't tend toward infinity, color the **seed** *black*.
If the orbit does tend toward infinity, assign the seed a color *based on the number of iterations it took to reach 2.*

For the example above, the orbit took 4 iterations to grow to a magnitude beyond 2. "4 iterations" would have a particular color assigned to it and any other point that took exactly 4 iterations would be assigned the same color.

The **Mandelbrot Set** is the set of black points. The outside of the border of the M-Set is made up of the infinitey complex colored regions.