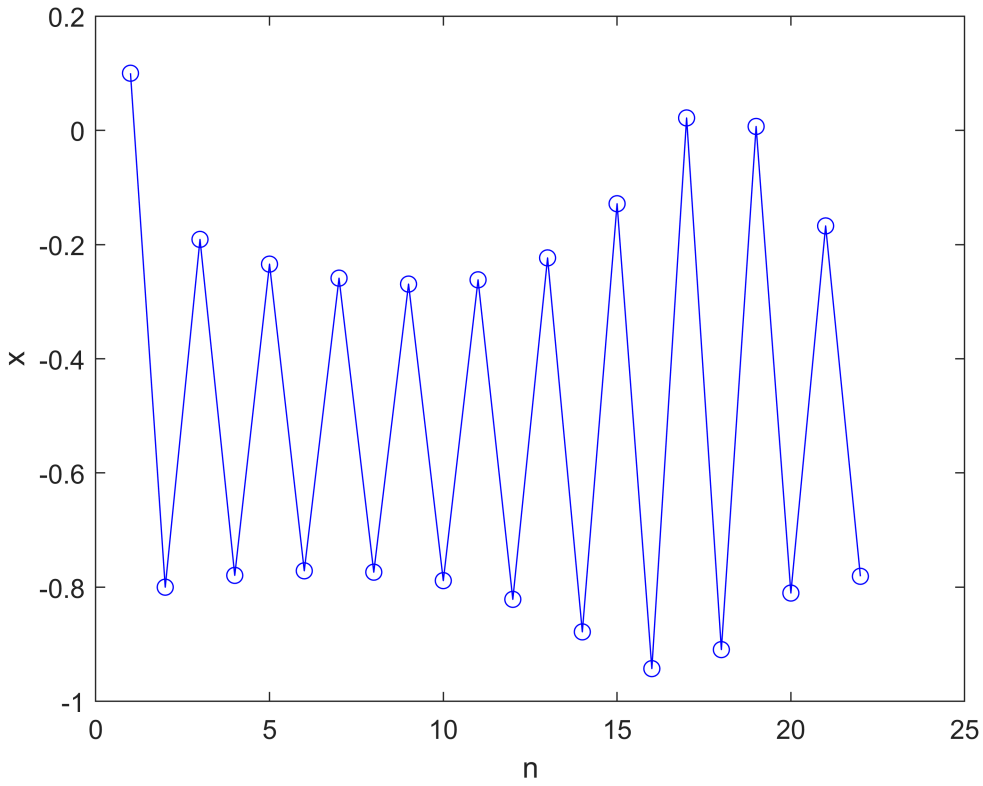
```
% Day 2 - Project Julia
```

(a) & (b)

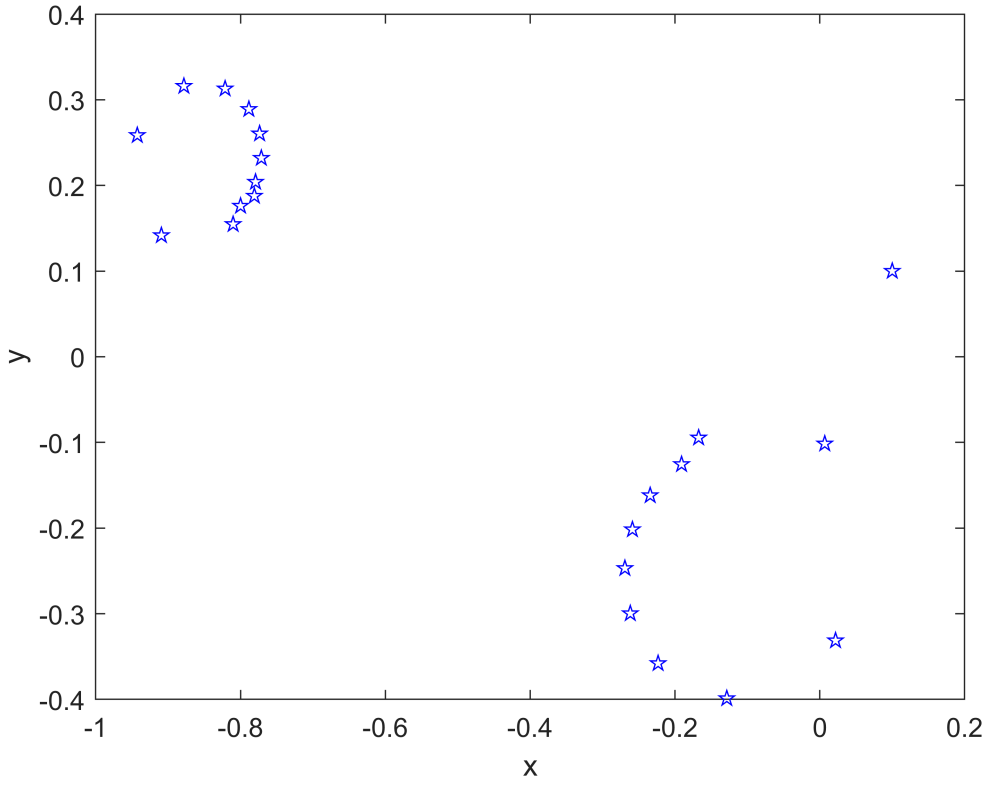
```
c = -0.8; d = 0.156;
% c = .95; d = 0.275;
x(1) = 0.1; y(1) = 0.1;

for n=1:21
    x(n+1) = x(n)^2 - y(n)^2 + c;
    y(n+1) = 2 * x(n) * y(n) + d;
end
figure;
plot(1:22,x,'-ob')
xlabel('n'); ylabel('x')
```



(c)

```
figure;
plot(x,y,'pb')
xlabel('x'); ylabel('y')
```

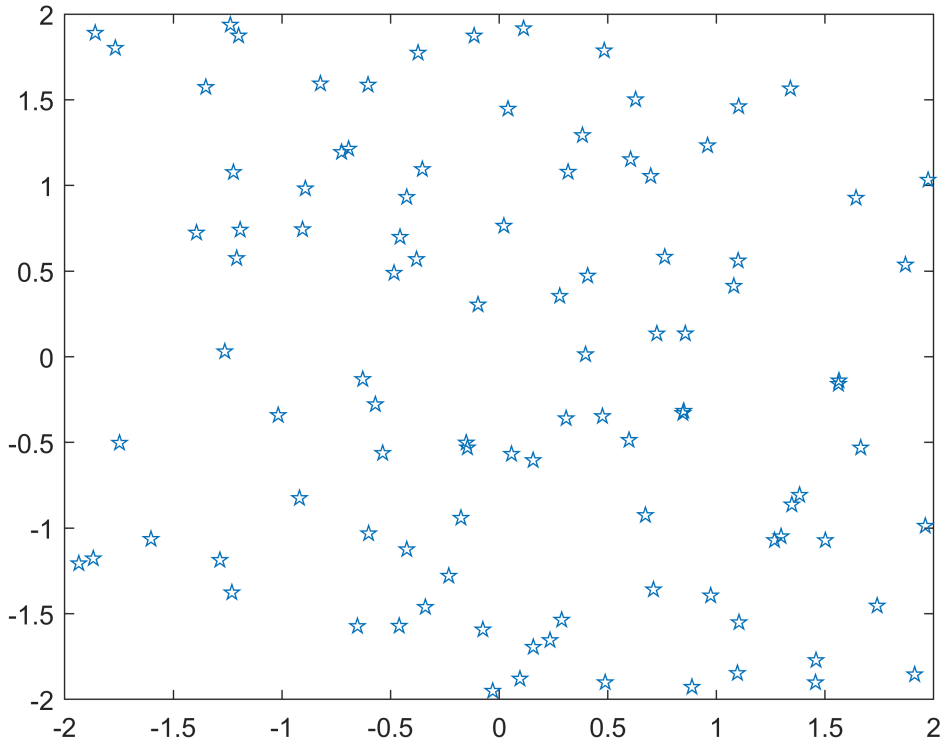


(d)

```
NSP = 100; % 100 Starting Points
a = -2; b = 2;
xStart = (b-a)*rand(NSP,1) + a; % vector of NSP random #s on [a,b]
yStart = (b-a)*rand(NSP,1) + a;
% check = [min(xStart) max(xStart) min(yStart) max(yStart)]
```

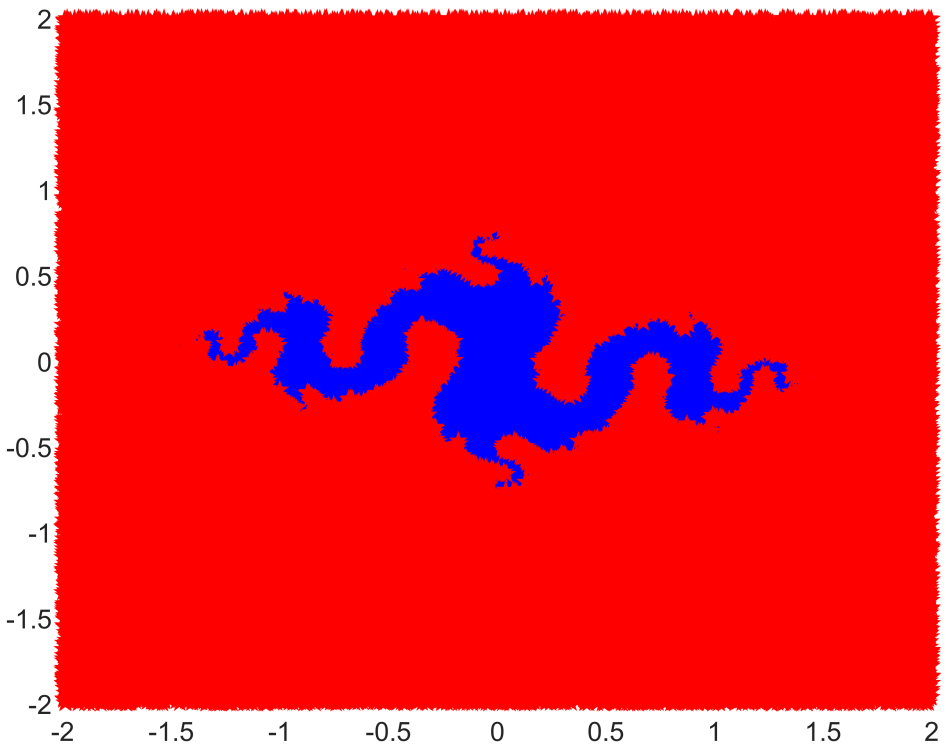
(e)

```
figure;clf;
plot(xStart,yStart,'p')
```



(f)

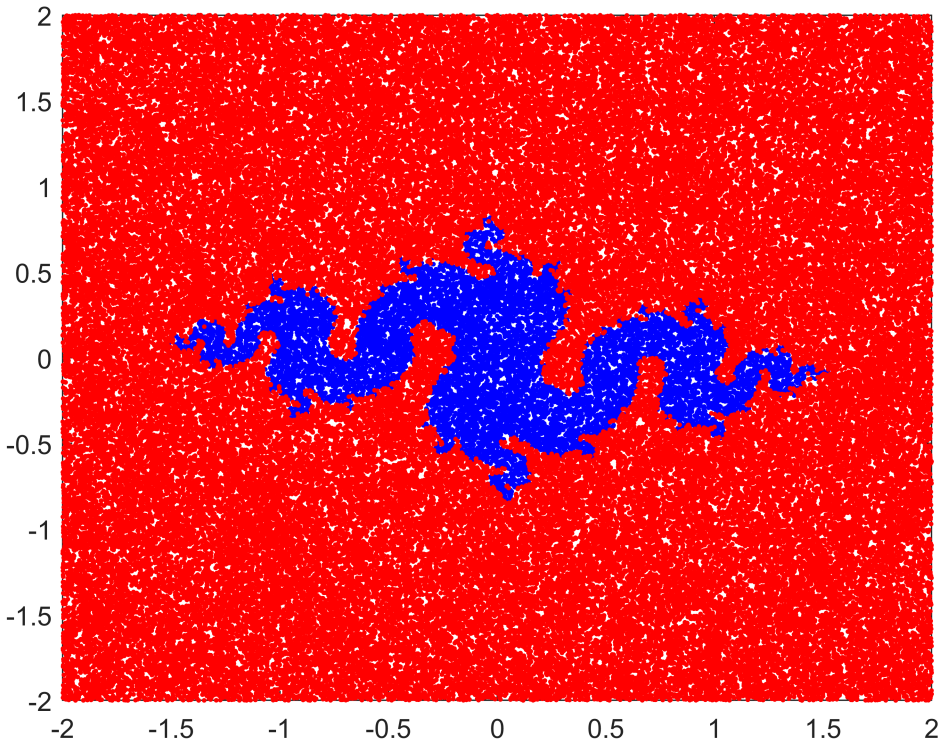
```
kin = 1; kout = 1; % starting 2 vectors who will count who's in/out
for i = 1:NSP
    x(1) = xStart(i); y(1) = yStart(i);
    for n=1:21
        x(n+1) = x(n)^2 - y(n)^2 + c;
        y(n+1) = 2 * x(n) * y(n) + d;
    end
    if abs(x(22)) < b && abs(y(22)) < b
        Xin(kin) = x(1);
        Yin(kin) = y(1);
        kin = kin + 1;
    else
        Xout(kout) = x(1);
        Yout(kout) = y(1);
        kout = kout + 1;
    end
end
figure;clf;
plot(Xin,Yin,'pb', 'MarkerFaceColor','b');
hold on;
plot(Xout,Yout,'pr','MarkerFaceColor','r');
hold off;
```



(g)

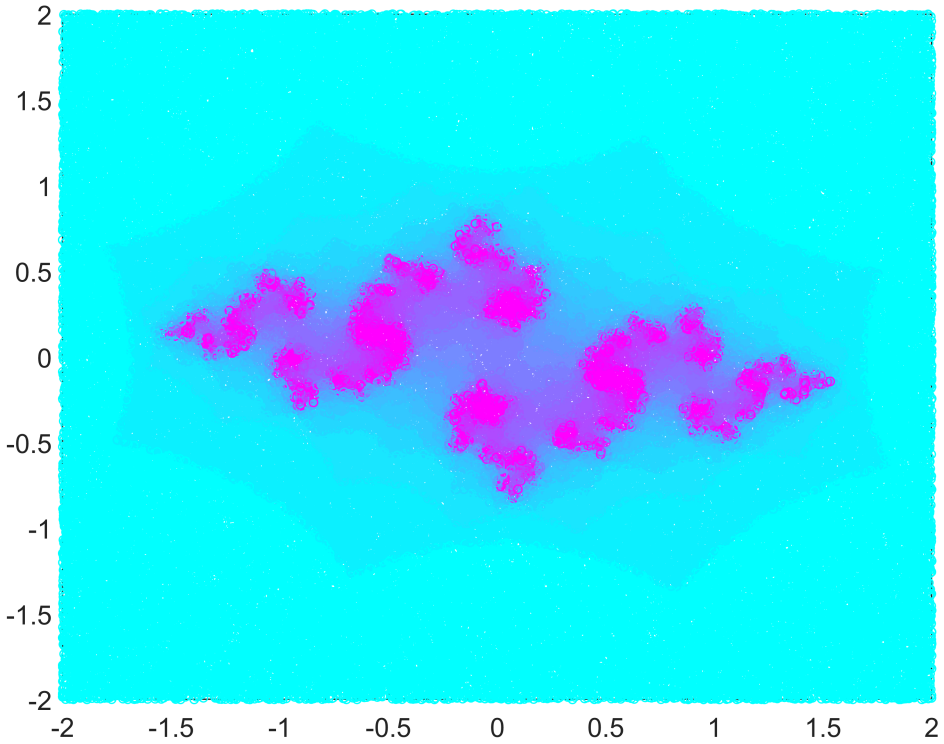
```
NSP = 1e5; % 100,000 Starting Points
a = -2; b = 2;
xStart = (b-a)*rand(NSP,1) + a; % vector of NSP random #s on [a,b]
yStart = (b-a)*rand(NSP,1) + a;
kin = 1; kout = 1; % starting 2 vectors who will count who's in/out
x = zeros(1,22); y = zeros(1,22); % creating these now saves comp run time later
for i = 1:NSP
    x(1) = xStart(i); y(1) = yStart(i);
    for n=1:21
        x(n+1) = x(n)^2 - y(n)^2 + c;
        y(n+1) = 2 * x(n) * y(n) + d;
    end
    if abs(x(22)) < b && abs(y(22)) < b
        Xin(kin) = x(1);
        Yin(kin) = y(1);
        kin = kin + 1;
    else
        Xout(kout) = x(1);
        Yout(kout) = y(1);
        kout = kout + 1;
    end
end
figure;
plot(Xin,Yin,'.b');
hold on;
```

```
plot(Xout,Yout,'.r');
hold off;
```



(h) & (i) Bonus

```
c = -0.836; d = exp(1)/10;
NSP = 1e5; % 1,000,000 Starting Points
a = -2; b = 2;
xStart = (b-a)*rand(NSP,1) + a; % vector of NSP random #s on [a,b]
yStart = (b-a)*rand(NSP,1) + a;
exitTime = zeros(1,NSP); % creating this now saves time later (o.w. exitTime keeps changing siz
for i = 1:NSP
    x = zeros(1,22); y = zeros(1,22); % creating these now saves comp run time later
    x(1) = xStart(i); y(1) = yStart(i);
    for n=1:21
        x(n+1) = x(n)^2 - y(n)^2 + c;
        y(n+1) = 2 * x(n) * y(n) + d;
        if abs(x(n+1)) > b || abs(y(n+1)) > b || n == 21
            exitTime(i) = n+1;
            break
        end
    end
end
figure;clf; hold on; box on;
scatter(xStart,yStart,10,exitTime);
colormap cool;
```


2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2