Math 113 Quiz # 6

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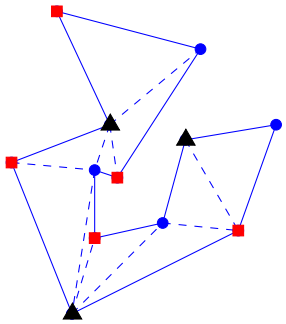
Using what you have learned answer the following questions. Show all work if you want partial credit. If a specific method is mentioned, make sure you show that you are using that method.

(1) (6 points) Suppose the gallery has following polygon shape. To guard the gallery when it is closed, you need some surveillance system.
   (a) How many cameras (cameras that can capture video at 360 degrees angle) need to be installed to cover all of your gallery?
   (b) Could you use 3-coloring of the vertices of a triangulated polygon to give the position of the cameras ?

Solution. From the Art Gallery Theorem, we get the upper bounded of the number is

$$N_{\max} = \begin{cases} \frac{V}{3} & \text{if the quotient is integer} \\ round\left(\frac{V}{3}\right) & \text{if the quotient is not integer} \end{cases}$$

So, the $n_{\max} = \frac{12}{3} = 4$. But we only need 3 cameras to cover all of the gallery (see 3-coloring of the vertices of a triangulated polygon).



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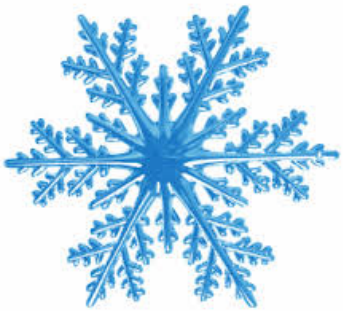
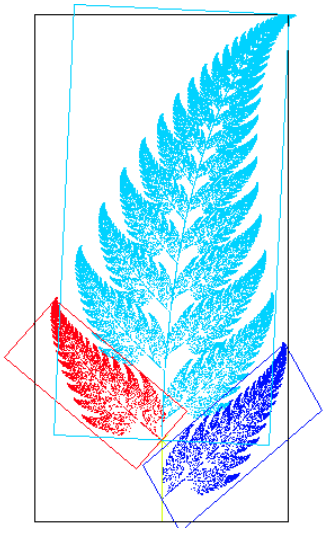
(2) (4 points) Please write down the corresponding type of the symmetry?





1: reflection 2: reflection or rotation 3: scaling

(3) (Bonus 2 points) Please write down the details of how to derive the value of Golden Ratio. (mathematical formula and solving process.)

Solution.

$$\phi = 1 + \frac{1}{\phi} \to \phi^2 - \phi - 1 = 0$$

$$\phi = \frac{1 \pm \sqrt{5}}{2} (\phi > 0)$$

$$\phi = \frac{1 + \sqrt{5}}{2}$$

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