Polygon Pictures

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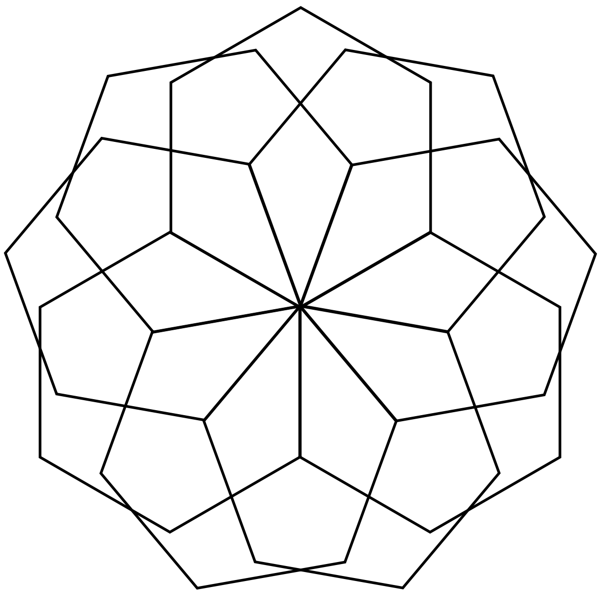
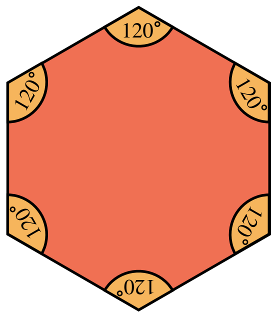
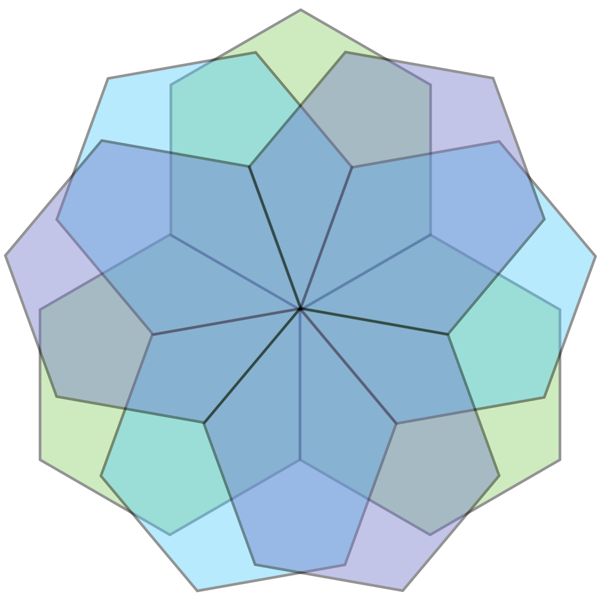
<u>Hexagon Pattern:</u>

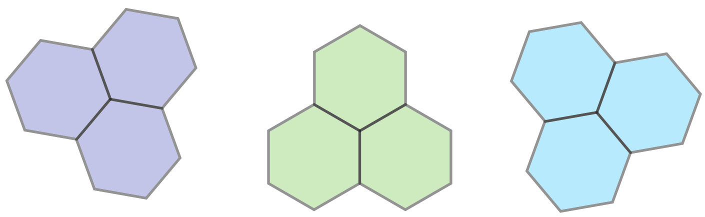


The Polygon used is a regular Hexagon (6 sided regular polygon).

Each vertex has an angle of 120˚







We can think of the figure as an overlap of three layers of 3 Honeycomb-like Hexagons. Each layer when overlapped can be viewed as the figure

Total Hexagons = $3(3) = 9$

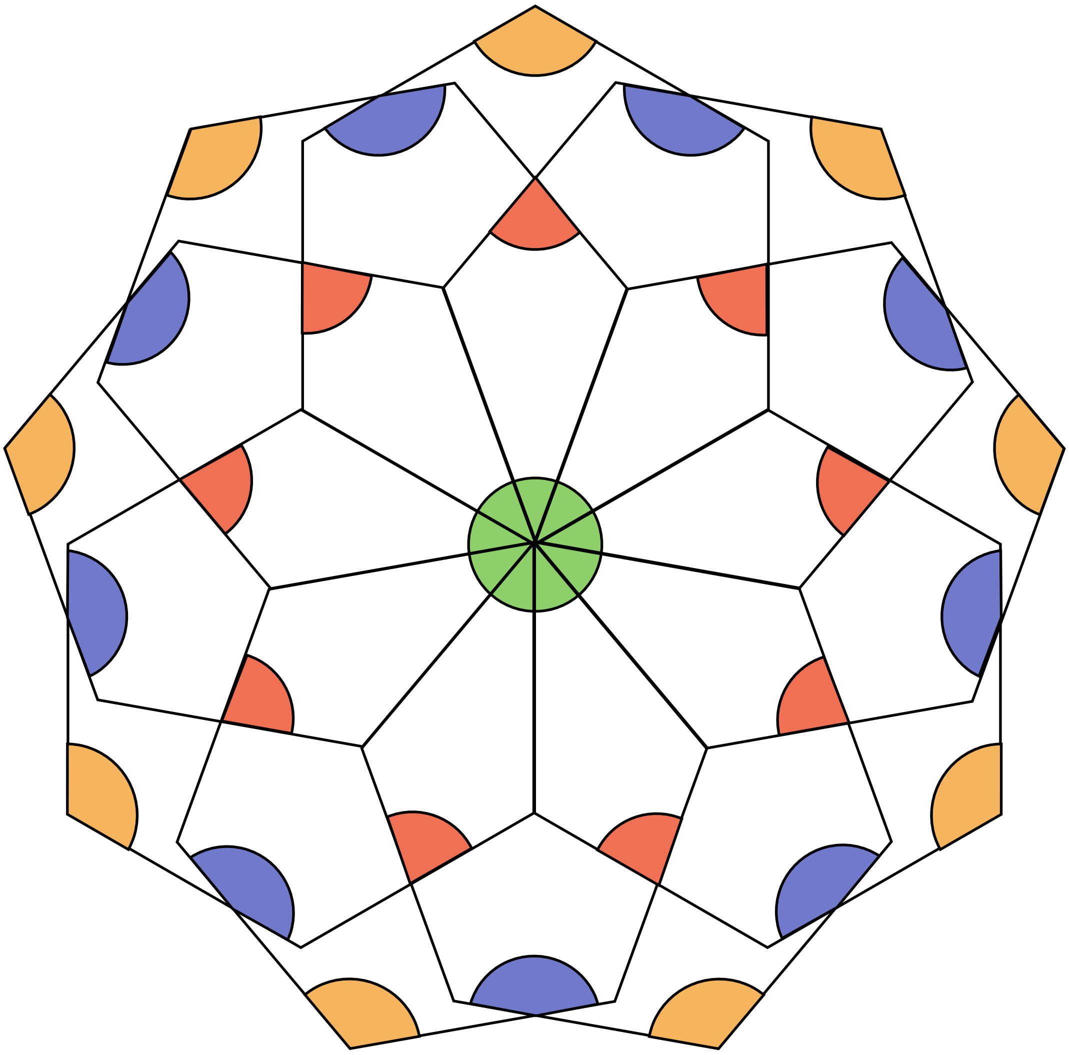


Fig. 1
Labelled angles for the diagram

From Fig. 1, we can see that:

$$\text{Orange Angle} = 120$$

because it is a part of the hexagon. Also:

$$9 \times \text{Green Angle} = 360$$

$$\text{Green Angle} = 40$$

The angle of rotation for each Hexagon is 40˚. For a total of 9 Hexagons, it is easy to verify that the total rotational angle is indeed 360˚

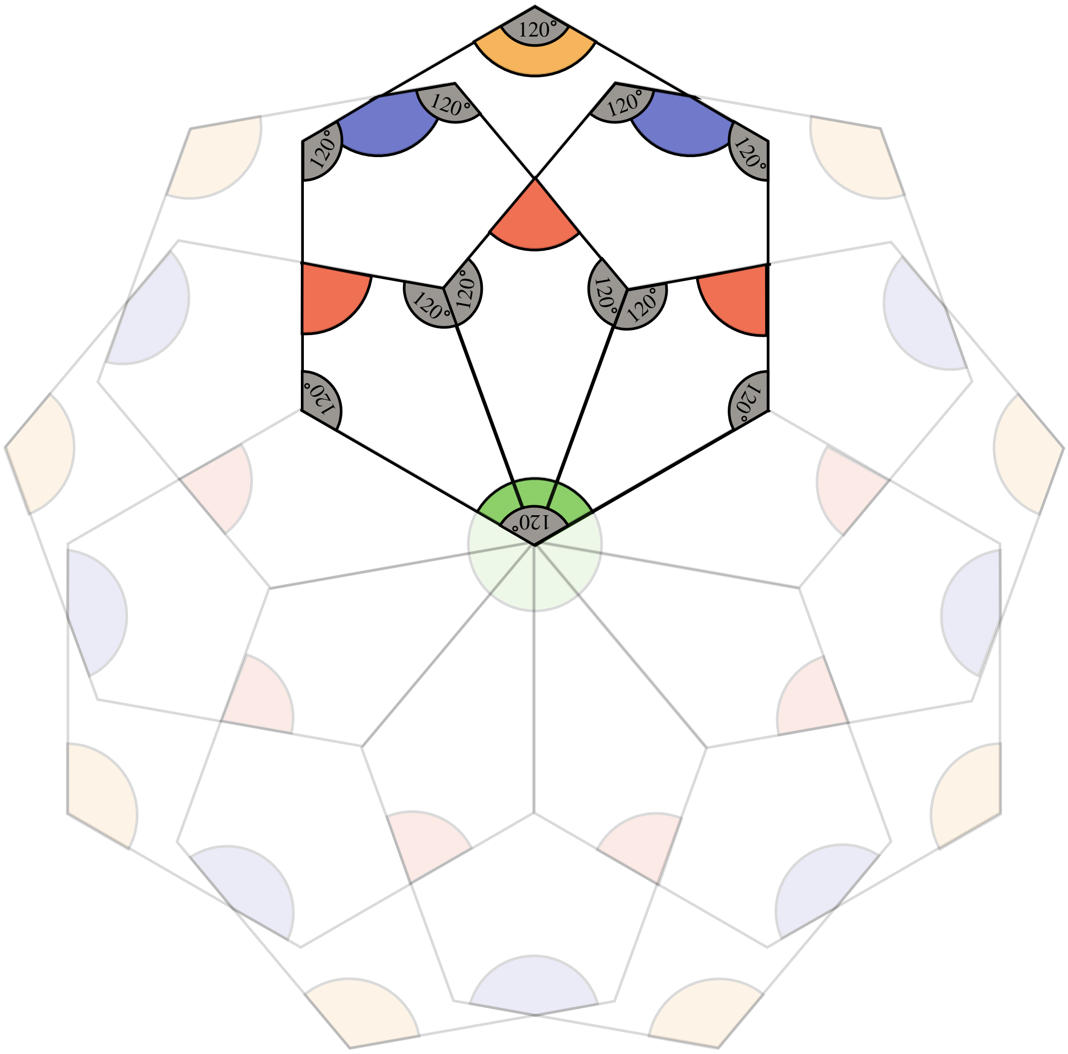


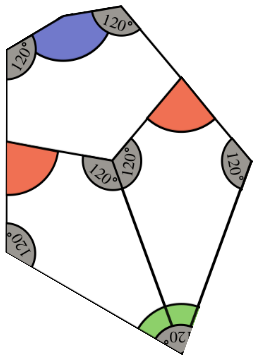
Fig. 2
Detailed look at the Hexagon

From Fig. 2, we can see that Red angle, Green angle and 2 Hexagonal angles form a quadrilateral:

$$360 = \text{Red Angle} + 120 + 120 + 40$$

$$360 - 280 = \text{Red Angle}$$

$$80 = \text{Red Angle}$$



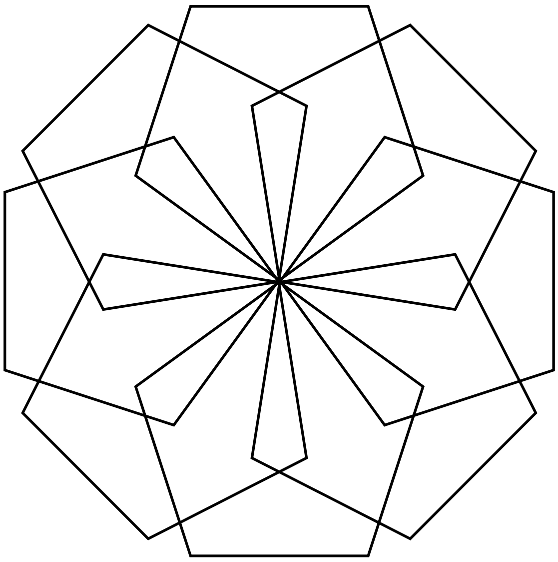
This Hexagon has 5 angles known and sixth Blue angle unknown. It can be found by summing the angles

$$720 = \text{Blue Angle} + (4 \times 120) + 80$$

$$720 = \text{Blue Angle} + 560$$

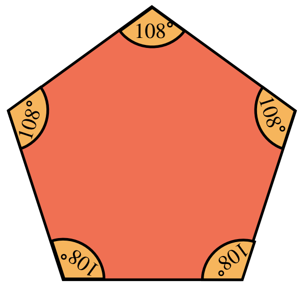
$$160 = \text{Blue Angle}$$

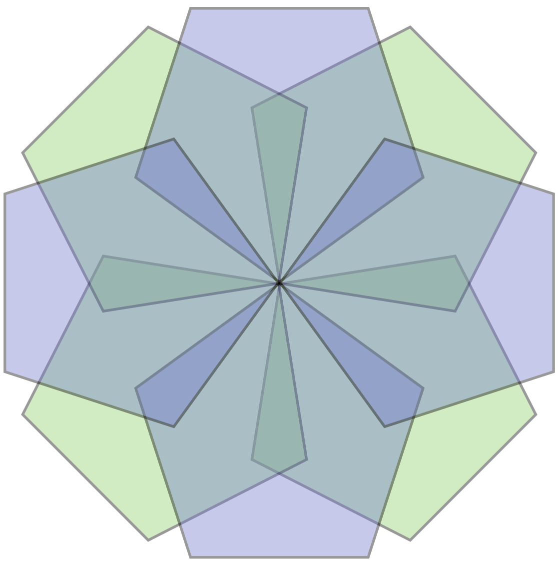
Pentagon Pattern:

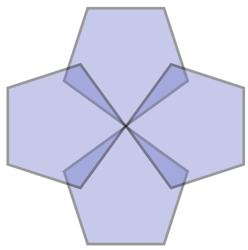


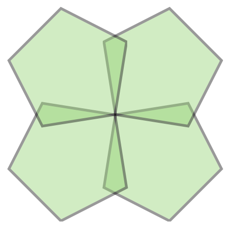
The Polygon used is a regular Pentagon (5 sided regular polygon).

Each vertex has an angle of 108˚









We can think of the figure as an overlap of two layers of 4 Pentagons. Each layer when overlapped can be viewed as the figure

Total Hexagons = $2(4) = 8$

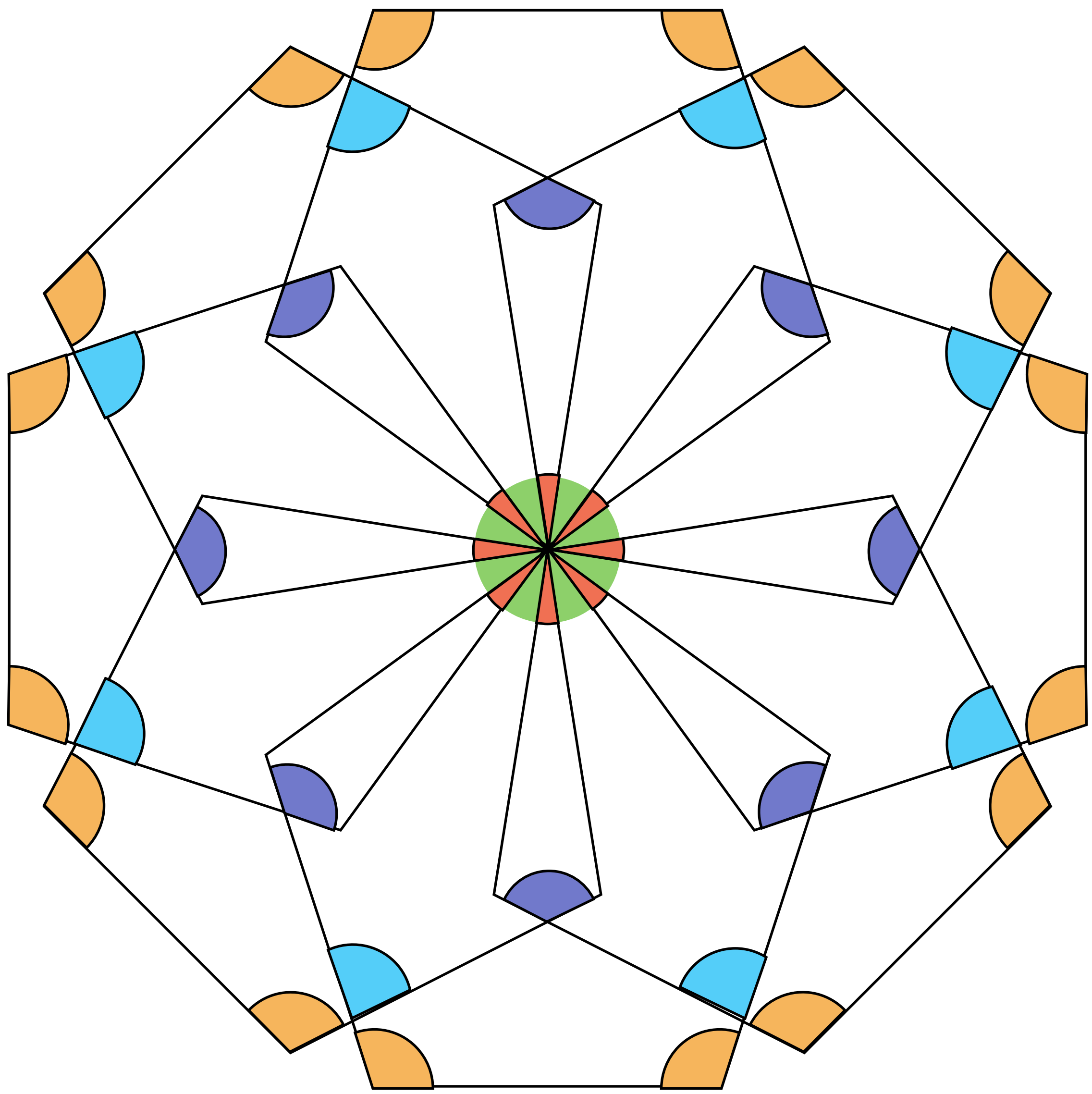


Fig. 3
Labelled angles for the pentagon

From Fig. 3, we can see that:

$$\text{Orange Angle} = 108^\circ$$

because it is a part of the pentagon. Also:

$$8 \times \text{Green Angle} + 8 \times \text{Red Angle} = 360$$

$$8 \times (\text{Green Angle} + \text{Red Angle}) = 360$$

$$\text{Green Angle} + \text{Red Angle} = 45^\circ$$

From the centre of the figure, we can also see that

$$2 \times \text{Green Angle} + 3 \times \text{Red Angle} = 108^\circ$$

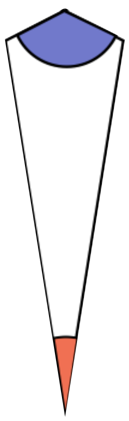
$$2 \times (\text{Green Angle} + \text{Red Angle}) + \text{Red Angle} = 108^\circ$$

$$2 \times (45) + \text{Red Angle} = 108^\circ$$

$$\text{Red Angle} = 108^\circ - 90^\circ$$

$$\text{Red Angle} = 18^\circ$$

$$\text{Green Angle} = 27^\circ$$

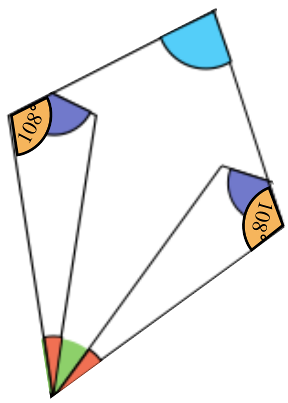


The quadrilateral shown aside has a sum of angles = 360

$$360 = 108 + 108 + 18 + \text{Blue Angle}$$

$$360 - 234 = \text{Blue Angle}$$

$$126 = \text{Blue Angle}$$



The large quadrilateral shown aside has a sum of angles = 360

$$360 = 108 + 108 + 2(18) + (18) + \text{Blue Angle}$$

$$360 - 279 = \text{Blue Angle}$$

$$81^\circ = \text{Blue Angle}$$

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