A Rational Story of Pi: From Asymmetrical Cut to Weighted Average

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In this work, we observe that the right triangle with integral side lengths possess an interesting feature that the slope of the bisector of each respective interior angle is a rational number, which is then used to design a new method to approximate the famous number Pi. On the unit circle, the algorithm cuts the ninety degree angle at center in a way that the slopes of each bisector central angle remain rational, so that the area is approximated by unequilateral n-polygons. This idea allows the flexibility to cut the angles in various but systematic ways with which a whole class of approximations to Pi can be developed. To justify the convergence of the algorithm, we formulate rational expressions for the upper bounds and the lower bounds of the approximation with much geometrical insights. Our algorithm was implemented by software with only arithmetic operations and the computational results show that our method is indeed correct and efficient.

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