

冪和の視覚化

鹿児島高専教授 (2019 年現在) 白坂繁先生が考えられた図をアニメーション化してみました。

立方和は、平方数になるかすぐに納得できますし、平方和も n , $n+1$ と $2n+1$ が出現する仕掛けが新鮮です。

高校数学における冪和

$$1^2 + 2^2 + 3^2 + \cdots + n^2$$

$$1^3 + 2^3 + 3^3 + \cdots + n^3$$

立方和

$k \times k^2$ の長方形を 4 つずつ上手く並べる。

立方和

立方和



立方和



立方和



立方和



立方和



立方和



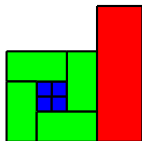
立方和



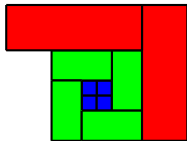
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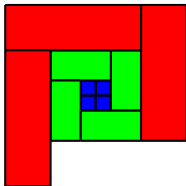
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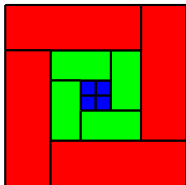
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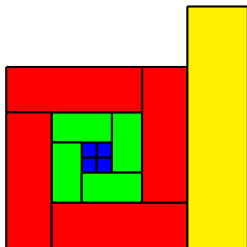
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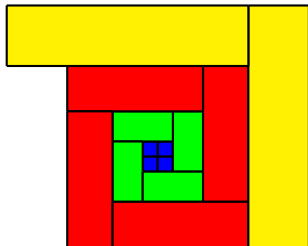
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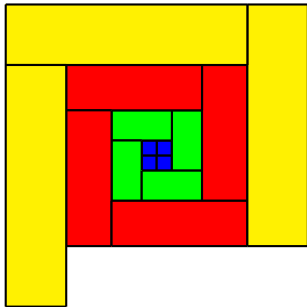
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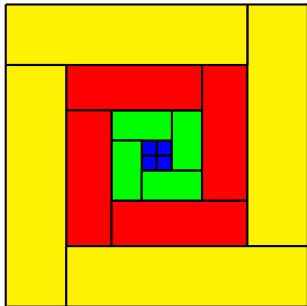
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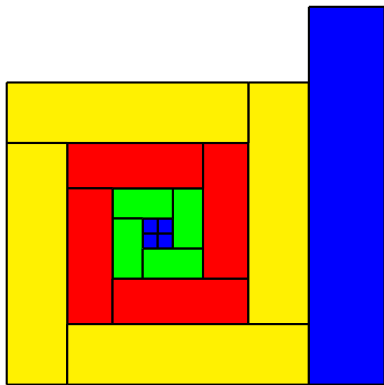
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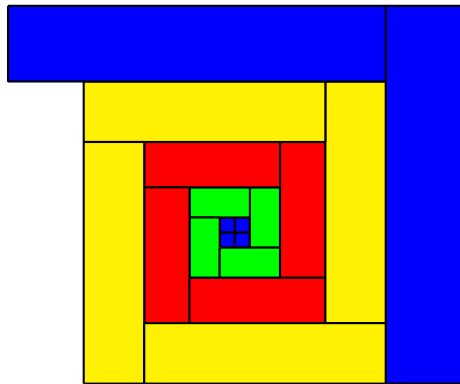
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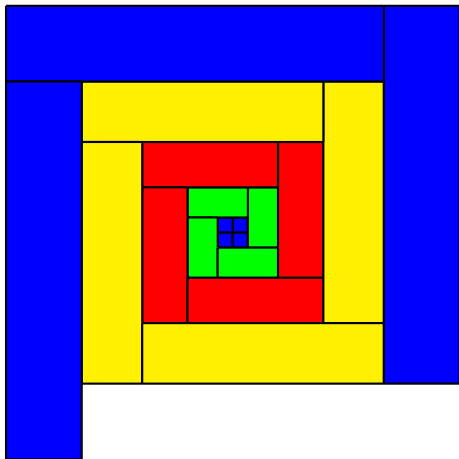
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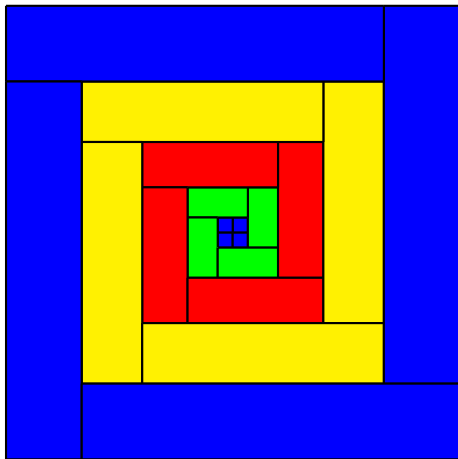
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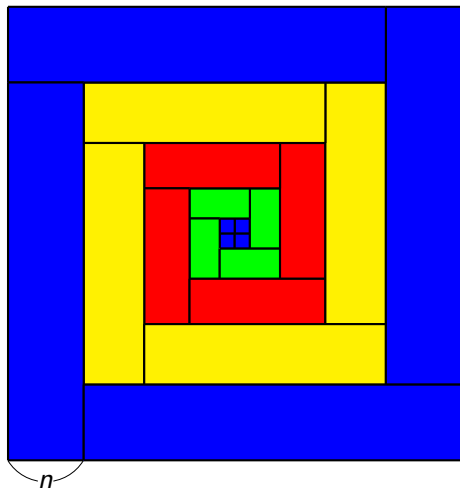
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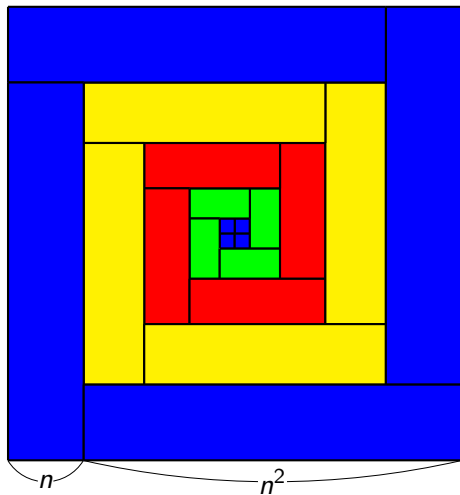
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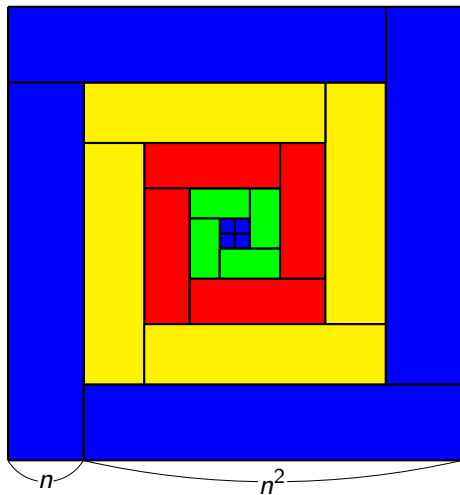
立方和



立方和



立方和



$$(n + n^2)^2 = 4 \times (1^3 + 2^3 + 3^3 + \dots + n^3)$$

平方和

$k \times k$ の正方形 4 つと $1 \times k^2$ の長方形 2 つずつを上手く並べる。

平方和



平方和



平方和



平方和



平方和



平方和



平方和



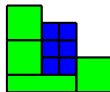
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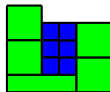
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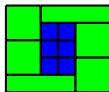
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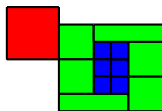
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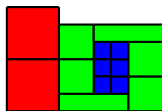
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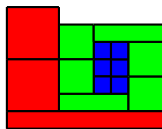
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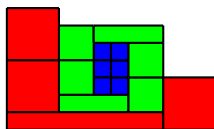
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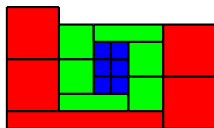
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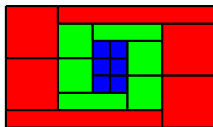
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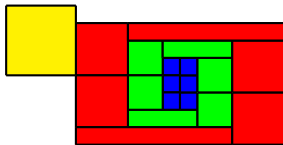
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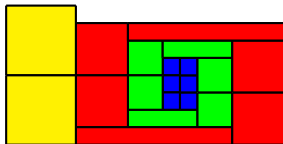
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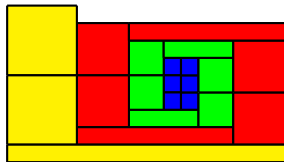
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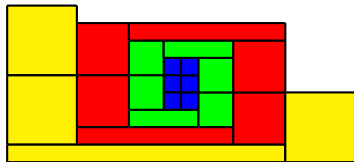
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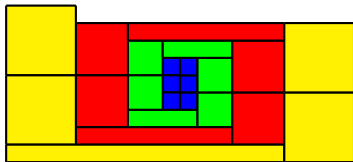
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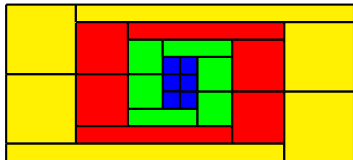
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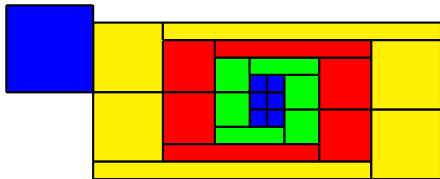
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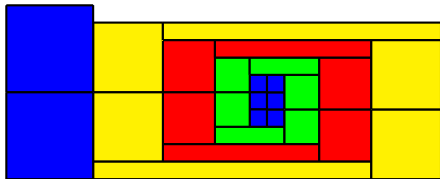
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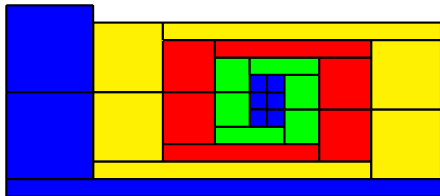
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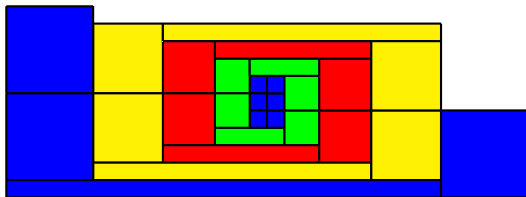
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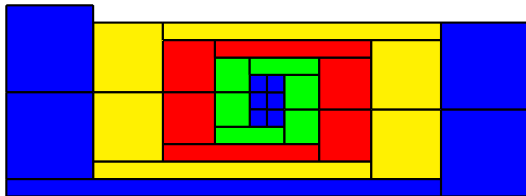
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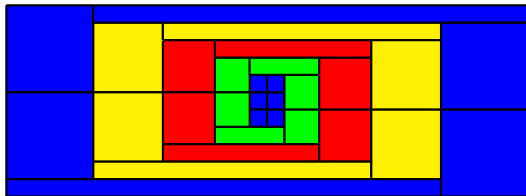
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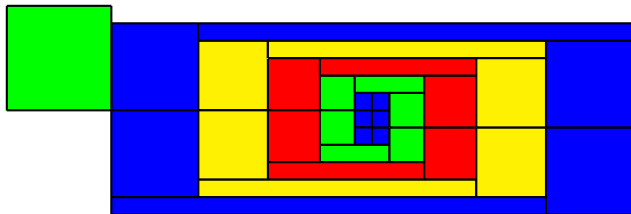
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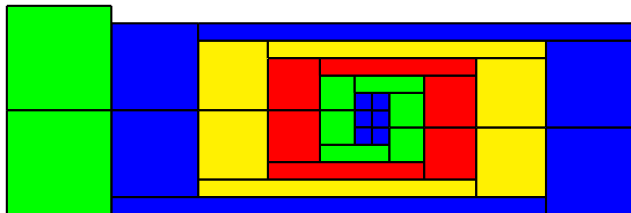
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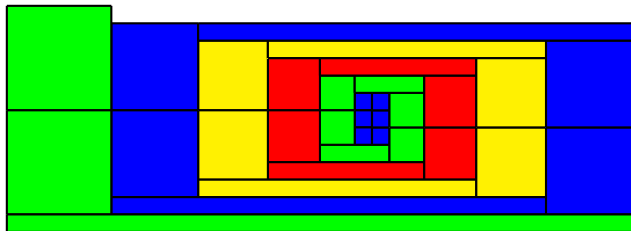
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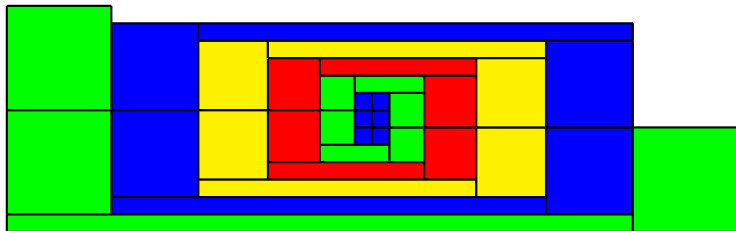
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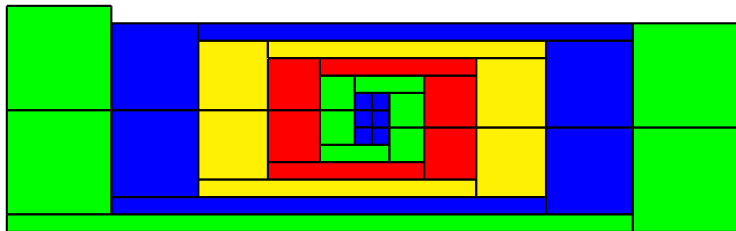
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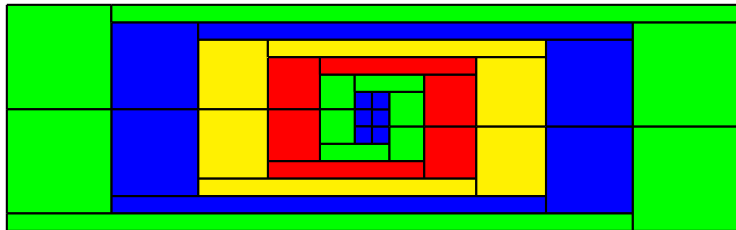
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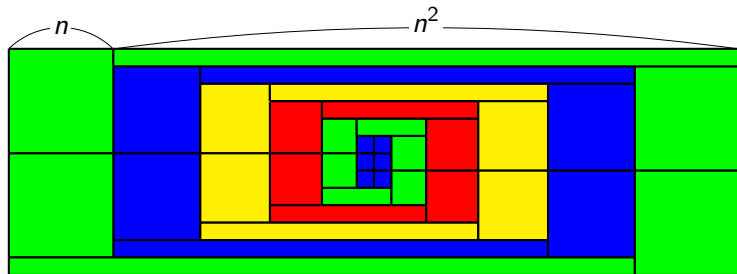
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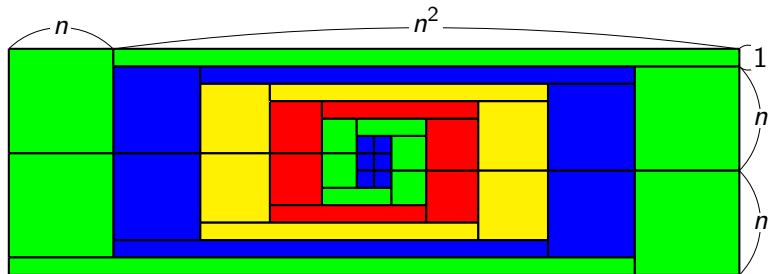
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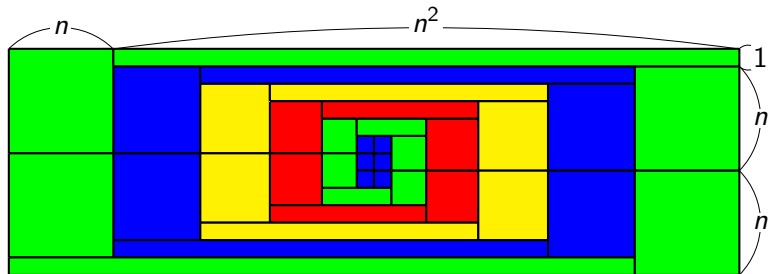
平方和



平方和



平方和



$$(n + n^2)(2n + 1) = 6 \times (1^2 + 2^2 + 3^2 + \dots + n^2)$$