摺紙數學

摺紙公理
古希臘3大難題
(1)3等分角
(2)倍立方
尺規VS摺紙
畢氏螺線

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摺紙公理

1.給定兩點P1、P2，僅有一條摺痕同時過這兩點

2.給定兩點P1、P2，僅有一種方法把折到上

3.給定兩直線L1、L2，可以把L1折到L2 上

4.給定一點P1和一條直線L1，僅有一種方法過P1折出L1的垂線

5.給定兩點P1、P2和一條直線L1，可以沿過P2 的直線將P1折到L1上

6.給定兩點P1、P2和兩直線L1、L2，可以一次將P1、P2分別折到L1、L2上

7.給定一點P1和兩直線L1、L2可以沿著L2的垂線將P1折到L1上

尺規 VS 摺紙

正式的尺規做圖，只能用圓規及直尺，兩者均無刻度

尺規作圖相當於在解二次方程式。而摺紙幾何可以做到滑動(相當於有刻度的直尺)如前面的定理六，就是運用滑動，摺紙幾何相當於在解三次方程式

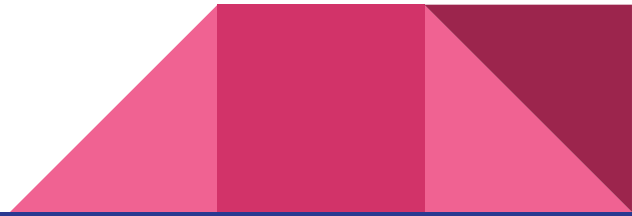
摺紙幾何的能力要＞尺規作圖

古希臘3大難題

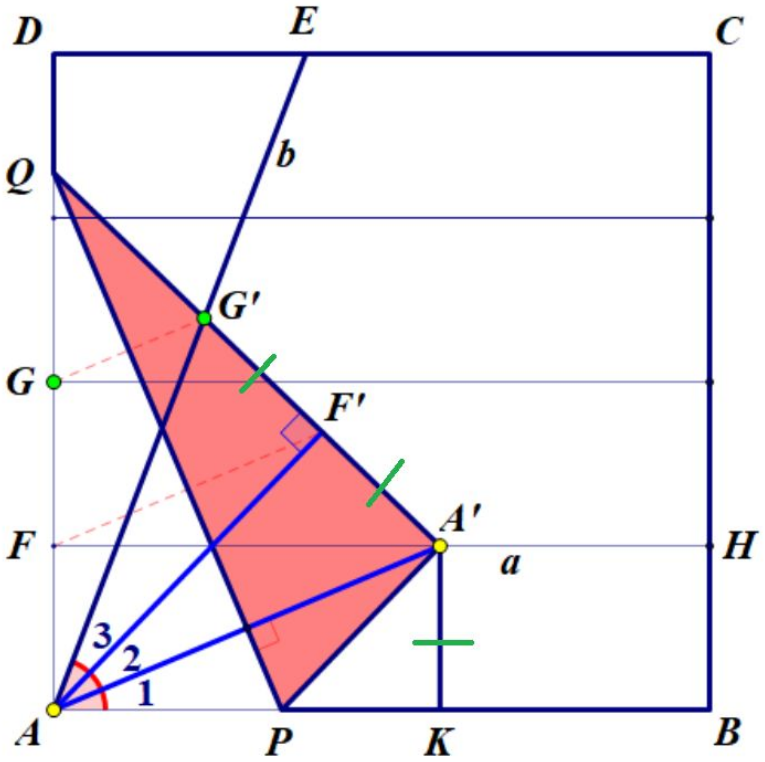
1: "3等分角"

2: "化圓為方"

3: "倍立方"



3等分角



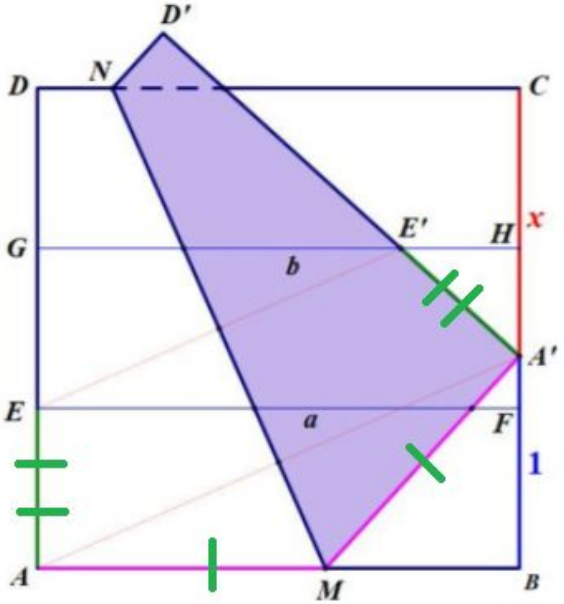
AA'K≅AA'F'(SAS) ⇒ ∠1=∠2

A’F’=F’G’ 、AF'⊥A'G'⇒ ∠2=∠3

倍立方

$$x^3 = 2a^3$$

$$x = \sqrt[3]{2}\,a$$



$$BM^2 = A'M^2 - 1^2$$

$$= (x+1-BM)^2 - 1$$

$$= x^2 + 2x + 1 - 2(x+1)\cdot BM + BM^2 - 1$$

$$BM = \frac{x^2+2x}{2x+2}$$

$$A'M = \frac{x^2+2x+2}{2x+2}$$

$$A'H = x - CH = x - \frac{x+1}{3} = \frac{2x-1}{3}$$

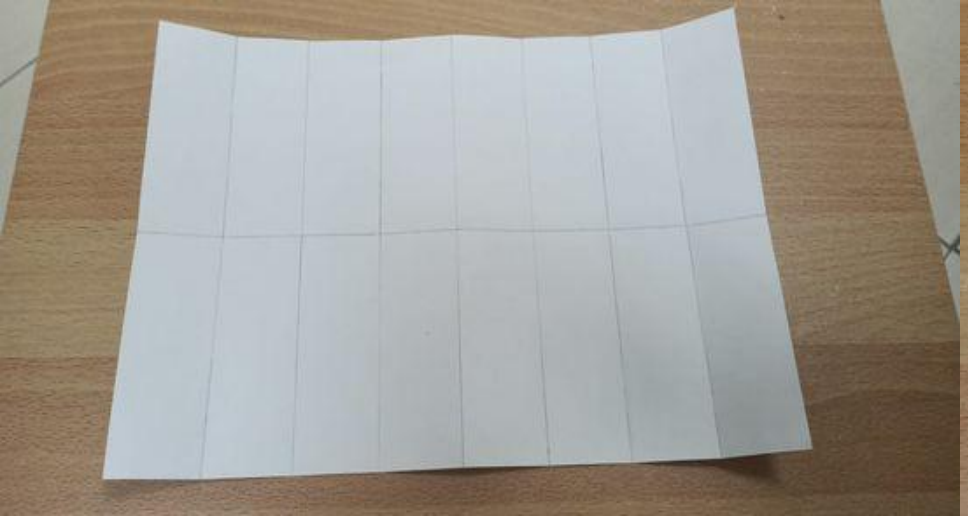
$$\frac{A'M}{BM} = \frac{A'E'}{A'H}$$

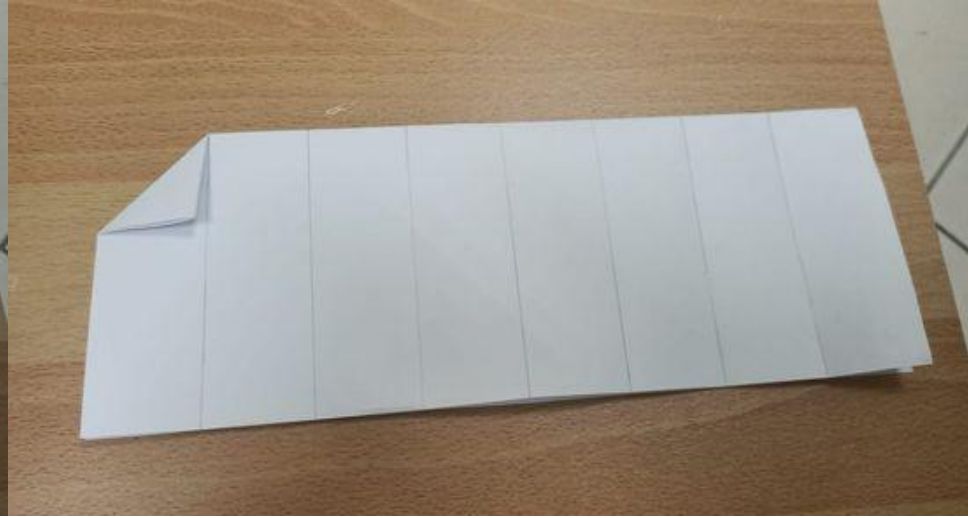
$$A'M \cdot A'H = BM \cdot A'E'$$

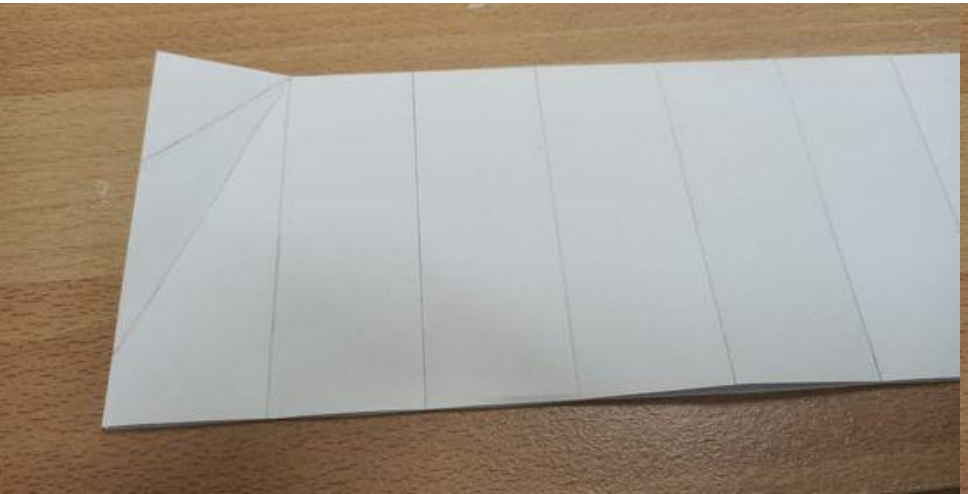
$$\frac{x^2+2x+2}{2x+2}\cdot\frac{2x-1}{3} = \frac{x^2+2x}{2x+2}\cdot\frac{x+1}{3}$$

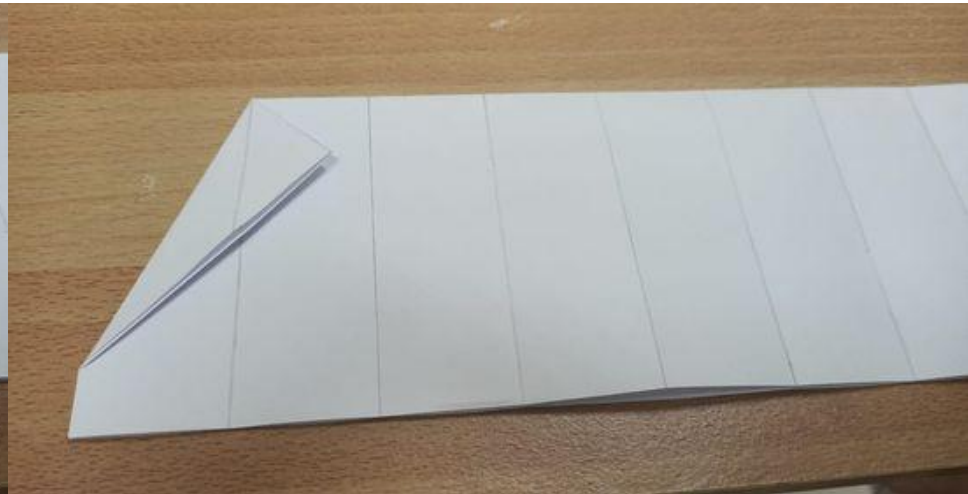
$$x = \sqrt[3]{2}$$

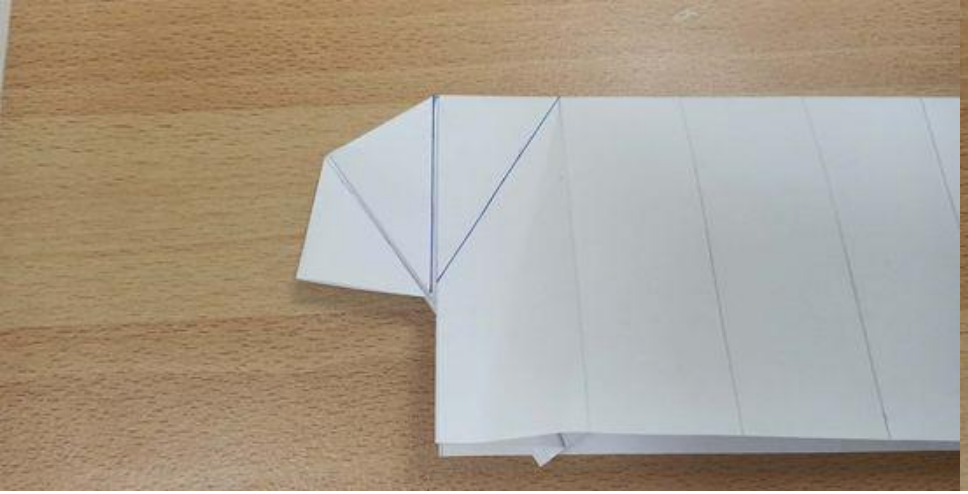
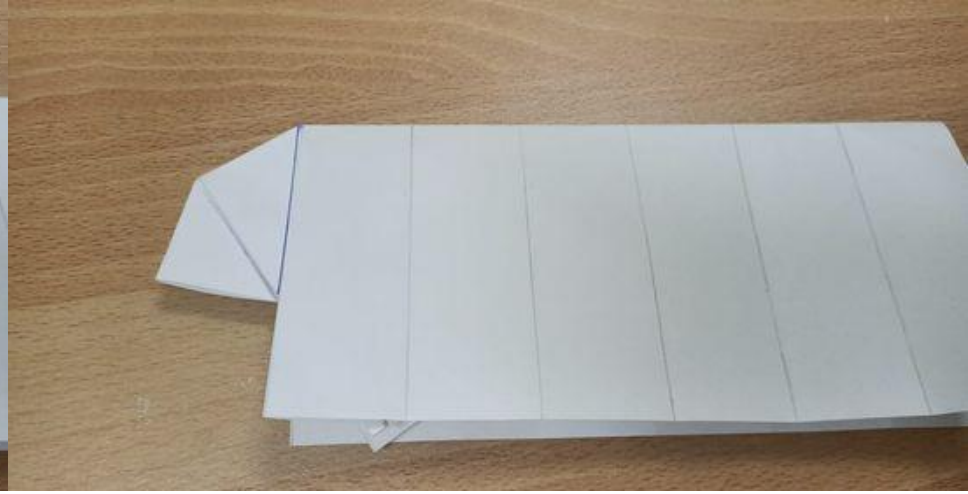
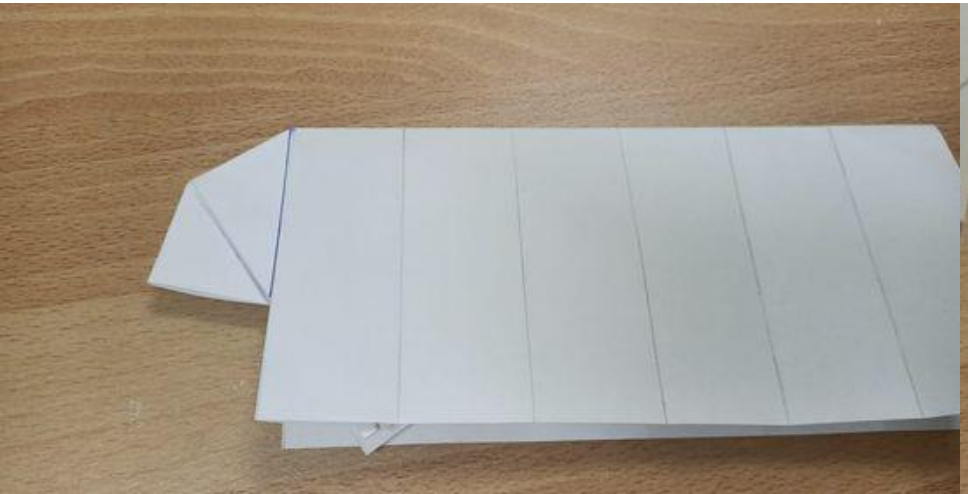
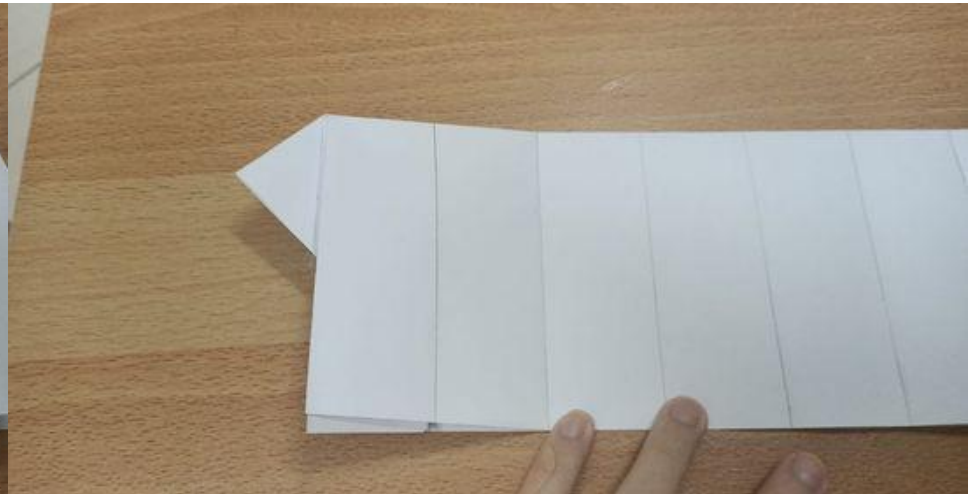
畢氏螺線

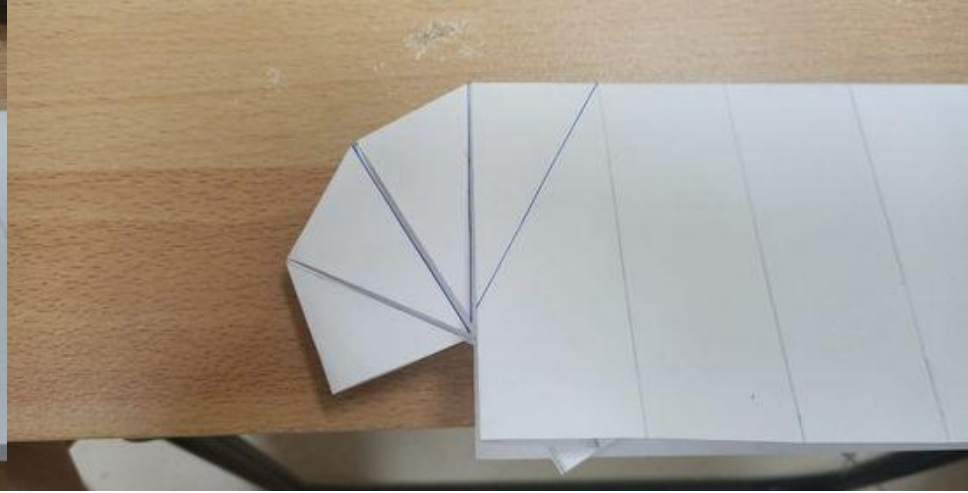










資料來源:

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倍立方
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三等分角