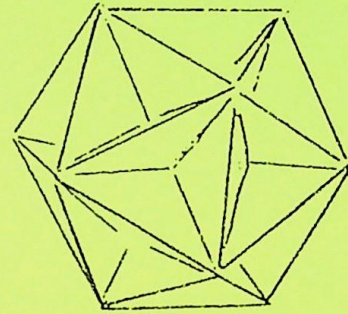
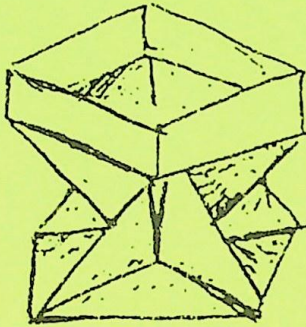


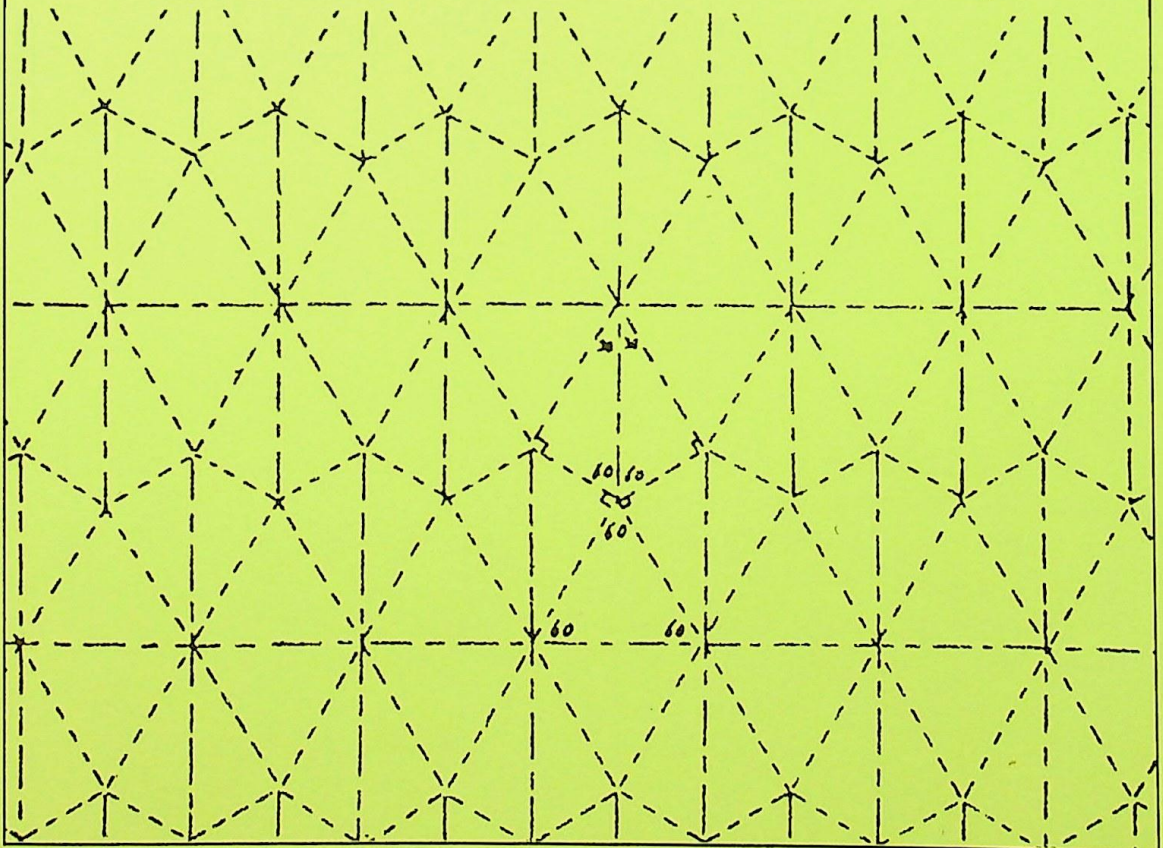
創造性を開発する

ねじり折り

(3)



藤本修三 著



この度、藤本修三先生にご了解をいただいて、手元にありました先生手作りのねじり
折り3冊を増刷させていただきました。

「ねじり折り3」の元本はB6版1ヶ所綴じで表紙がありませんでしたので、B5版
に拡大し表紙をつけて「ねじり折り3」にしました。

この冊子をお譲り下さった竹野みち子先生、増刷に当たってご助言下さった丹羽兌子
先生にお礼申し上げます。

2007年1月

〒444-0826 岡崎市若松町萱林22-1

斎藤 聰子

折り図製作番号順

NO 1. } 3角スケルトンの折り方

2 }

3 } 4角スケルトン、コンビポート、

4 }

5 } 5角スケルトンコンビポート

6 }

7 } 6角スケルトンコンビポート

8 }

9 } 7角スケルトンコンビポートの分割と角度の取り方

10 } " 角度の取り方

11 8角スケルトンコンビポートの作り方要点 7角コンビポート

12 } 花びん

13 }

14 連続スケルトン (3角と4角)

15 5角、

17 6角、7角 } 折り線

18 正20面体

19 } 正12面体

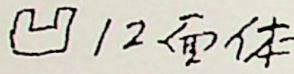
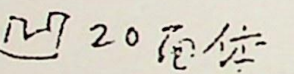
20 }

21 } 菱形12面体

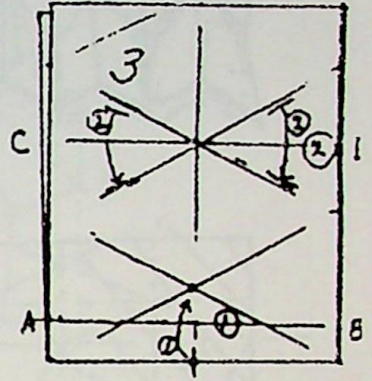
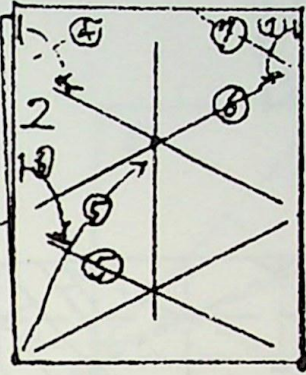
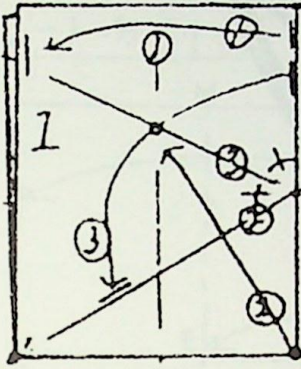
22 }

23 } 等稜14面体 A-1

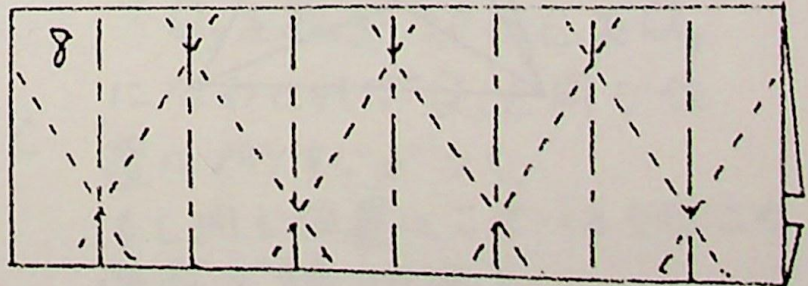
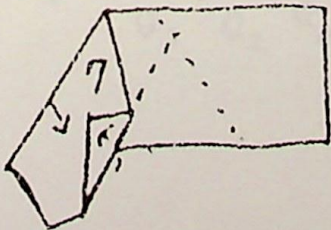
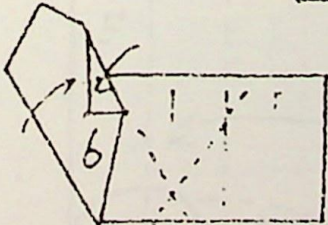
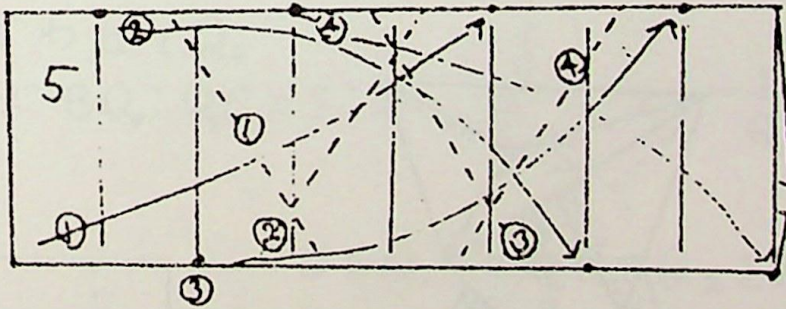
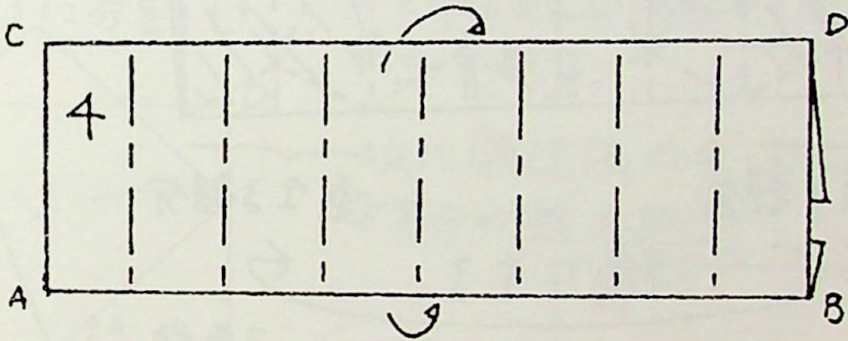
24 }

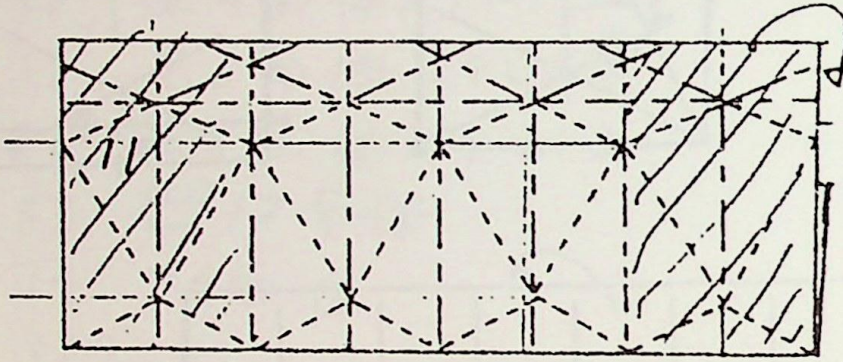
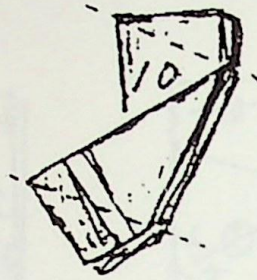
- 25 等積14面体 A-2.
- 26 " " B-1, B-2.
- 27. 正4面体
- 28 正6面体.
- 29 正8面体
- 30. 正4面体スケルトン
- 31 正6面体 スケルトン
- 32 正8面体 スケルトン
- 33.  12面体
- 34 24面体
- 35 }  20面体
- 36 }
- 37 垂直互面を持つ4面体
- 38 60° の面を持つ4面体
- 39 . 32面体 (3角と5角)
- 40
- 41 32面体 (5角と6角)
- 42
- 43 3角の箱
- 44 4角の箱
- 45 5角の箱
- 46 6角の箱
- 47 } 7角 (47-1, 47-2.)
- 47-1 }
- 47-2 }

3角スケルトンの折り方



横に2つ折り



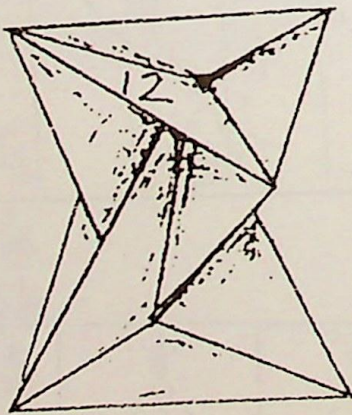


重なった部分

重なった部分

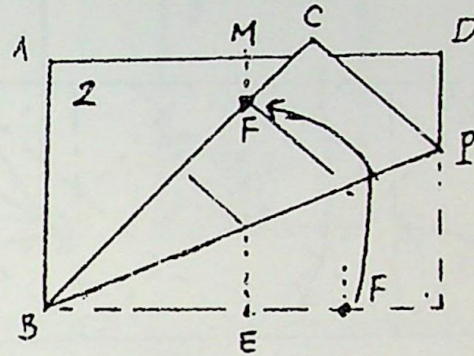
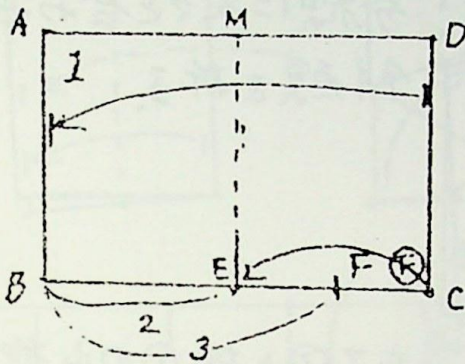
輪にする

三角柱筒



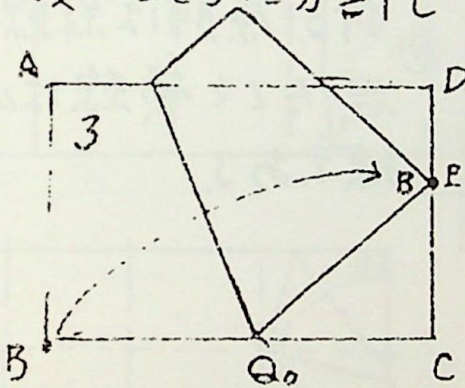
1. 紙面を5等分する ルート分割法と漸近法併用

ルート分割法



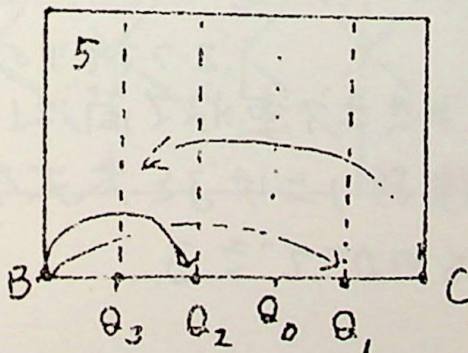
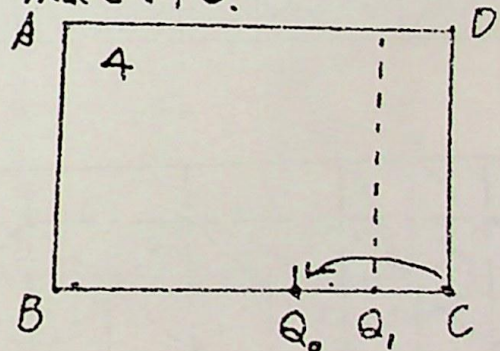
横に2と3に分割し

FをME線上に合わせ
P点を取る。

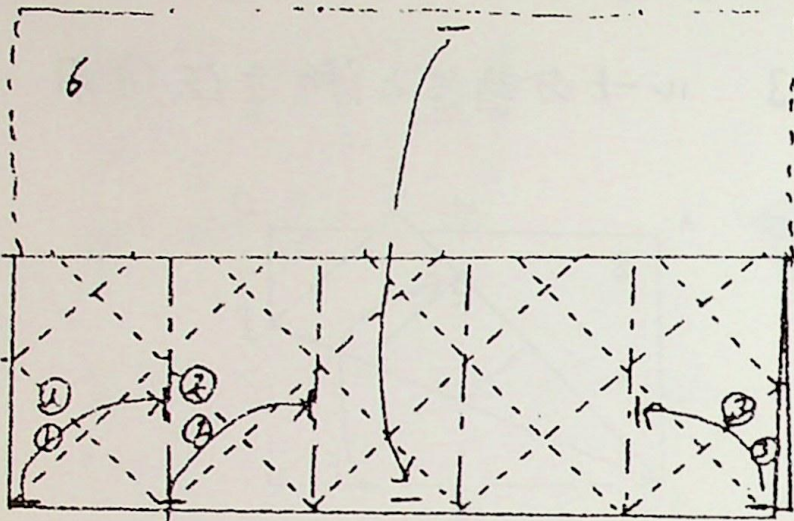


次に漸近法の手法により
5等分の線E折す。

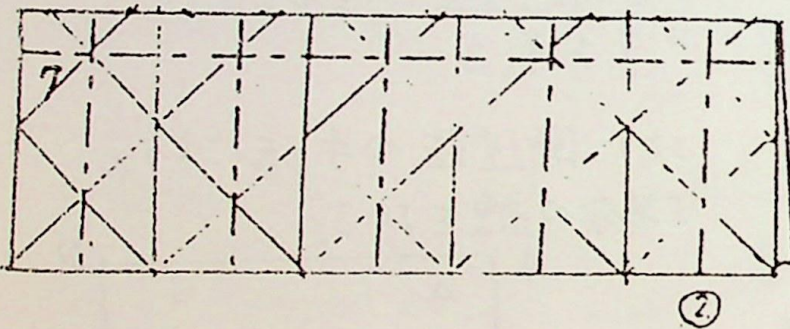
BをPに合わせ
点を取れば $BQ_0:Q_0C=3:2$
である。



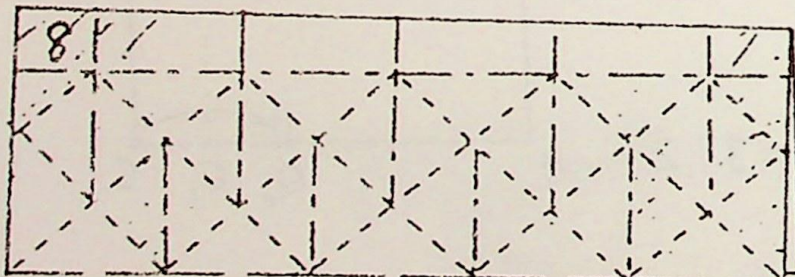
Bを Q_1 に合わせ
次に Q_2 にBをもう一度
合わせ
て Q_3 を取る。次にCを
 Q_3 に合わせれば" Q_0 と
同じ位置に折りすじが
つく。もし同じ位置に
こえないときはこの
過程で誤りがある。



5等分したものを2つに折りつきに①のように5等分線に次々と合わせて斜線を折る。

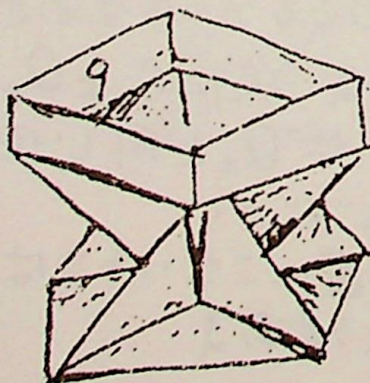


たて②と横①の山線を折る。原則は斜線は①谷、たてと横線は山線である。



折り上げたときの折りすじを示している。重なる部分を「で」示している。

4角柱管

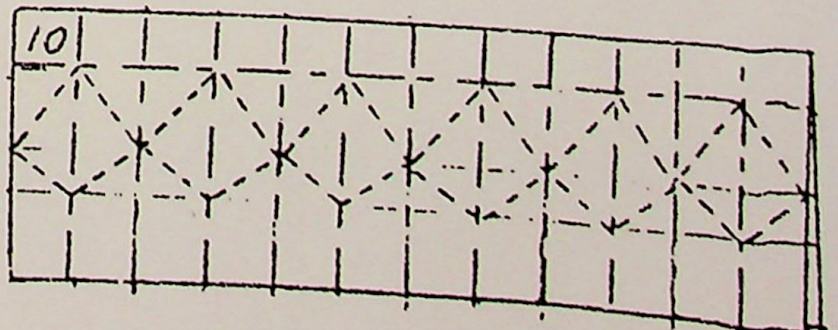
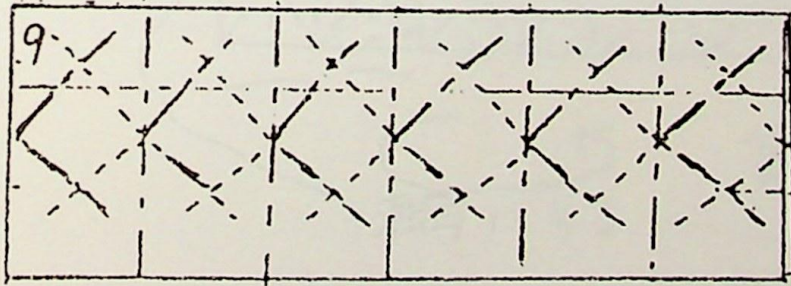
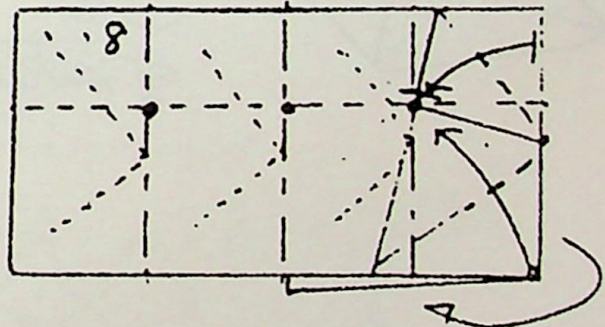
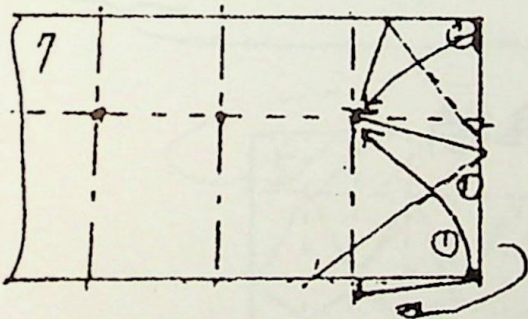
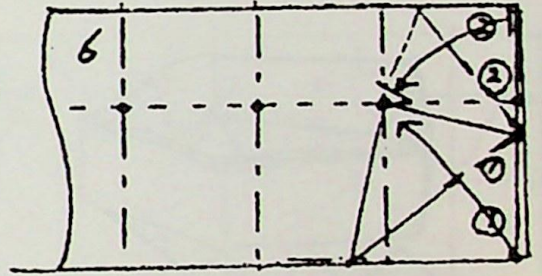
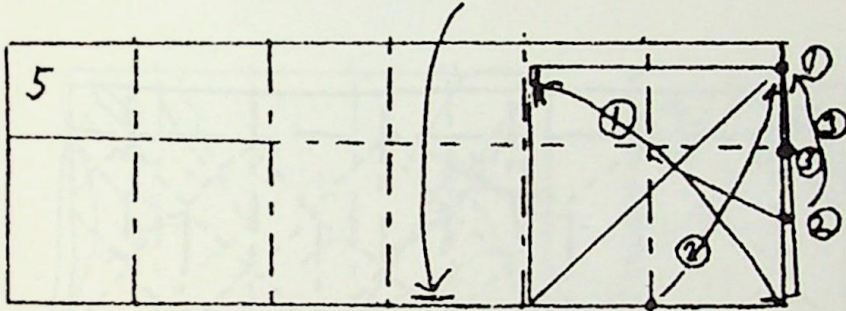
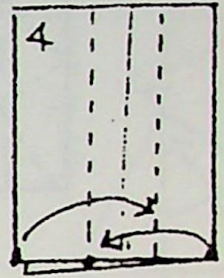
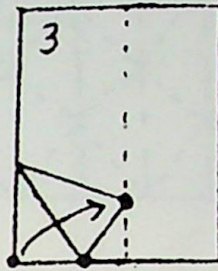
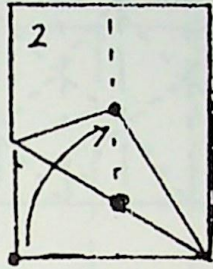
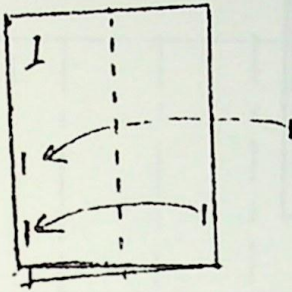


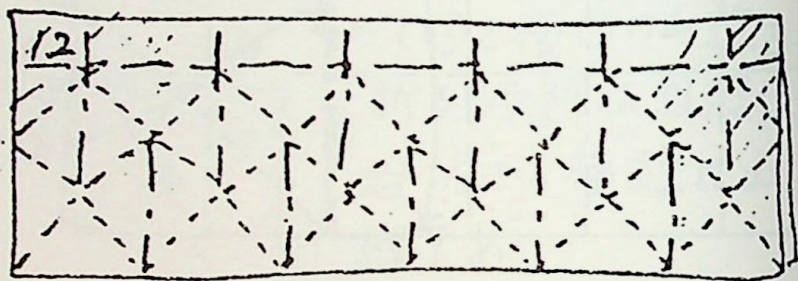
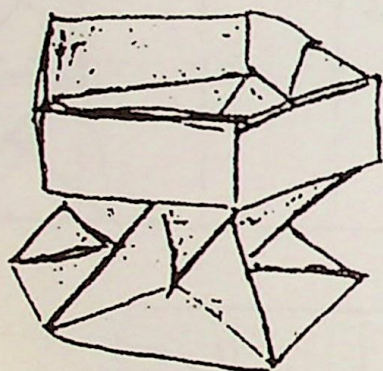
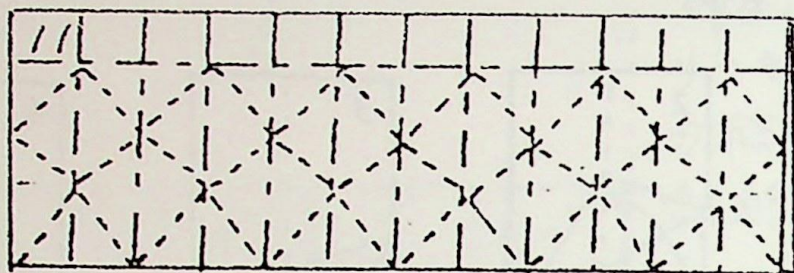
2つ折りのときまず重ねて筒にして後折り上げると大丈なものができる。

5用スケルトンコンポート

N05

紙面を5等分する。

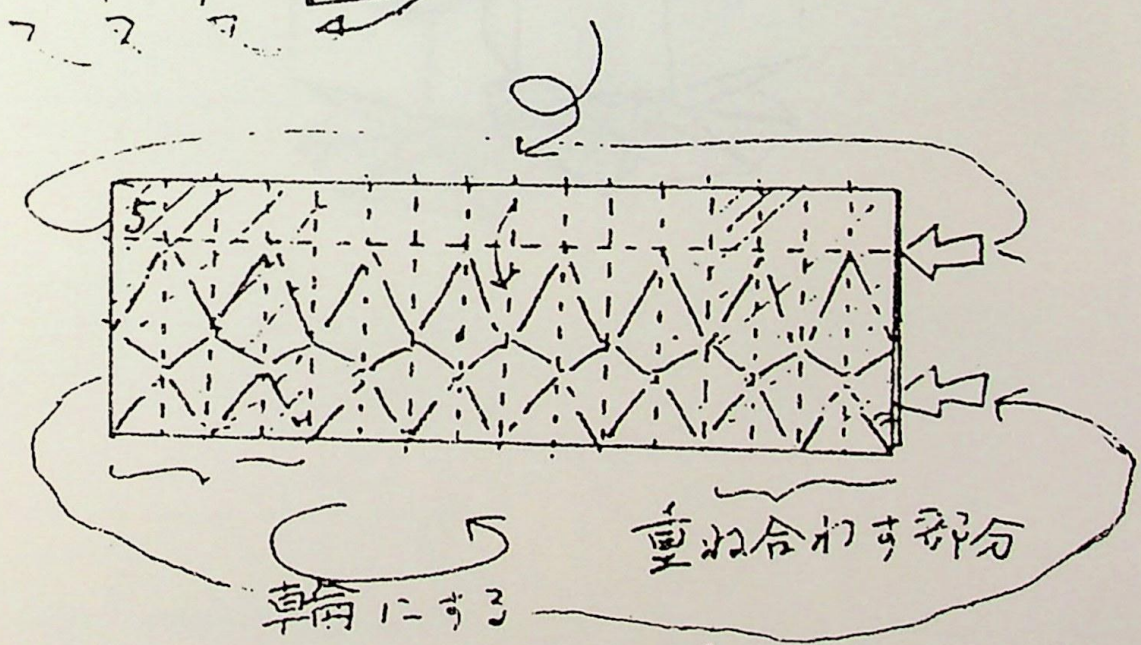
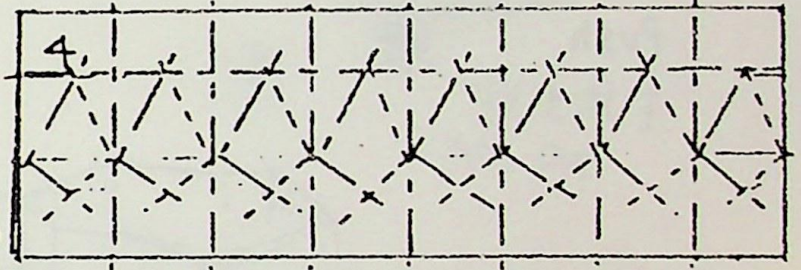
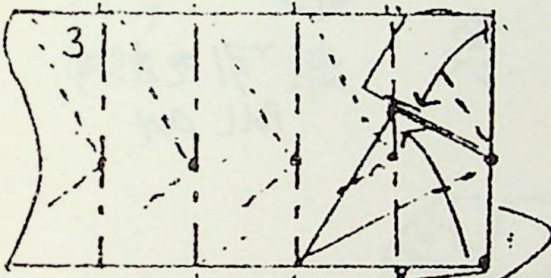
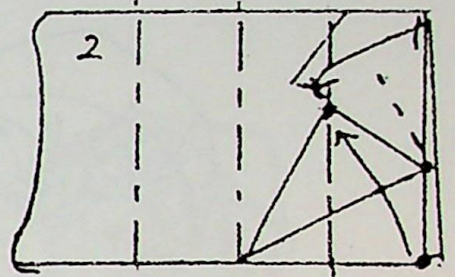
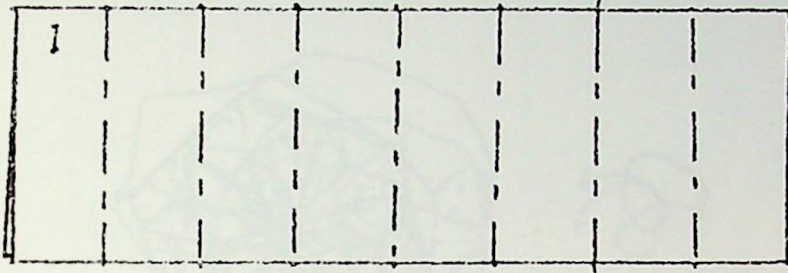




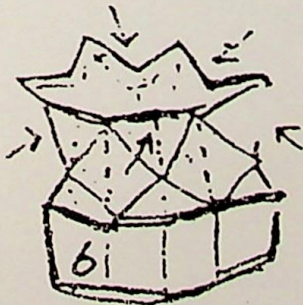
重收合的奇
五角挂筒

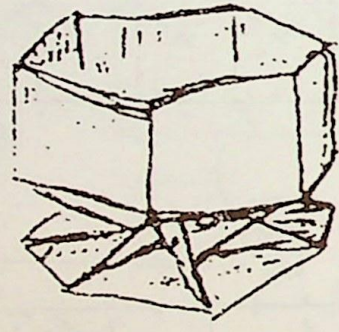
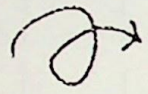
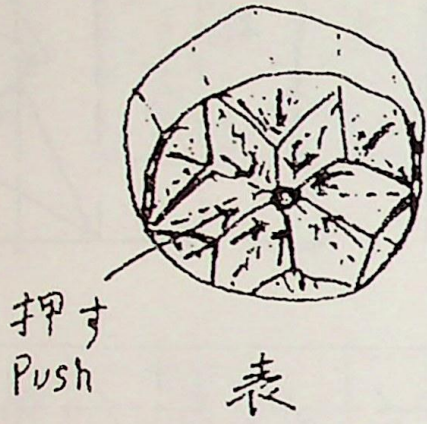
六角スケルトン・コニポート

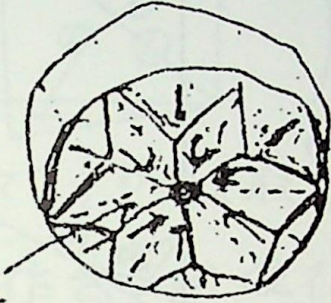
8等分して2つ折りにする。



六角柱筒

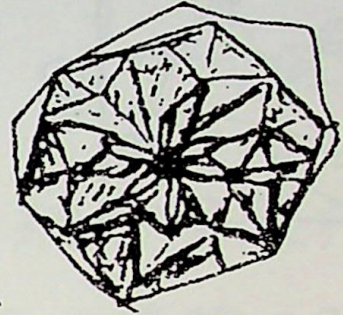
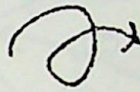






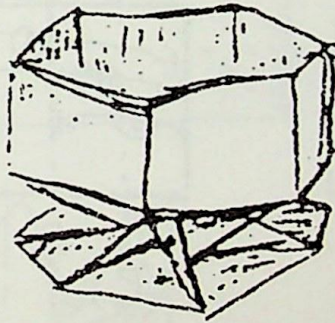
押す
Push

表



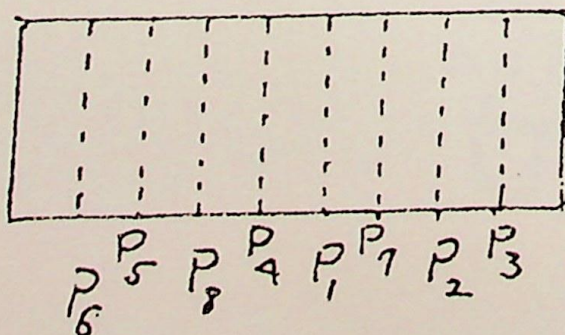
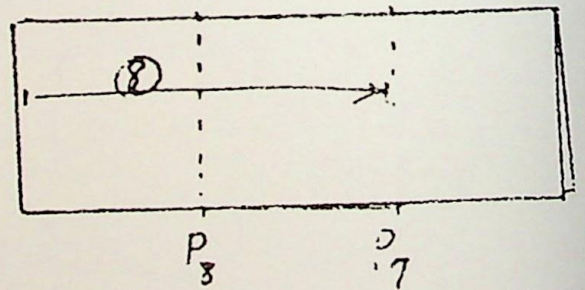
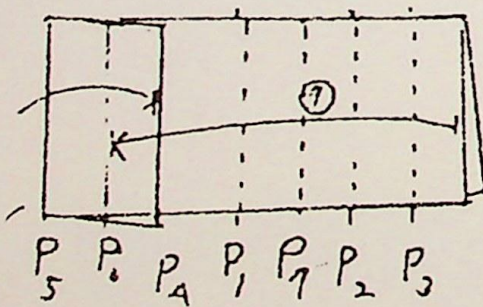
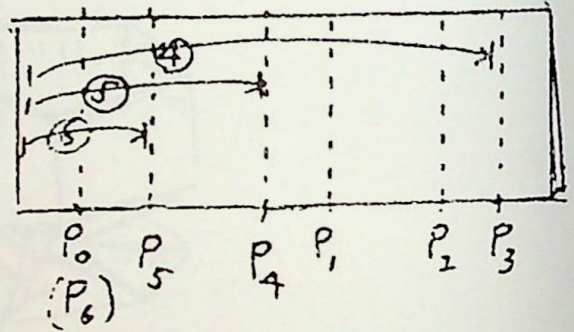
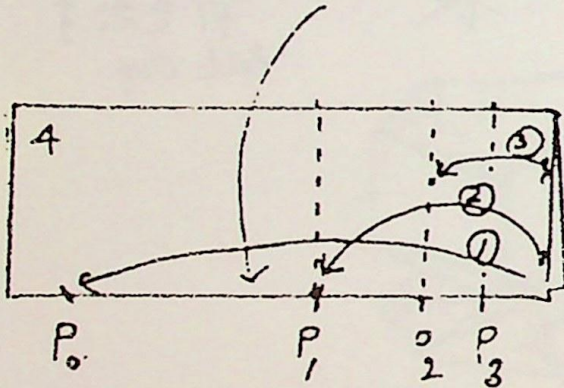
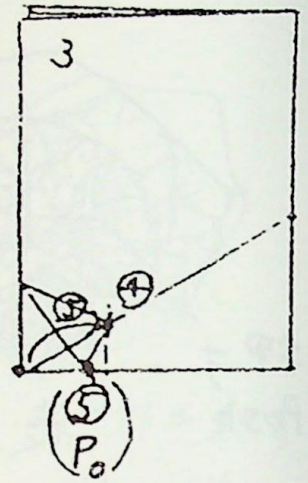
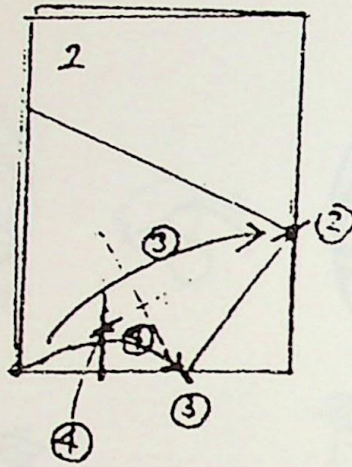
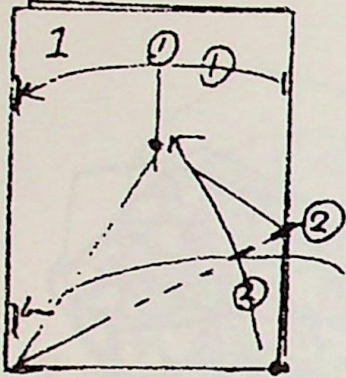
裏

引き出す
Pull out



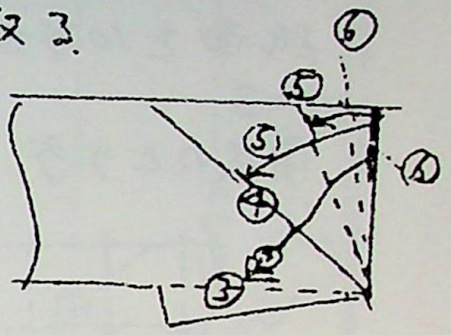
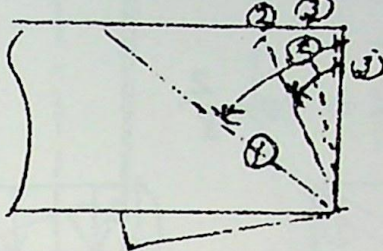
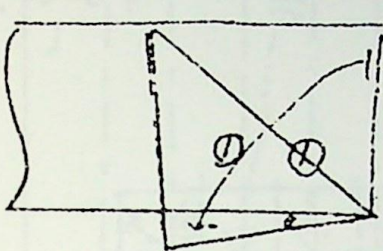
7角ステルトンコンホートの分割と角度の取り方

紙面を9等分する。



角度の取り方

漸近法で直角を7等分し $\frac{2}{7} \times 90^\circ$ を取る。

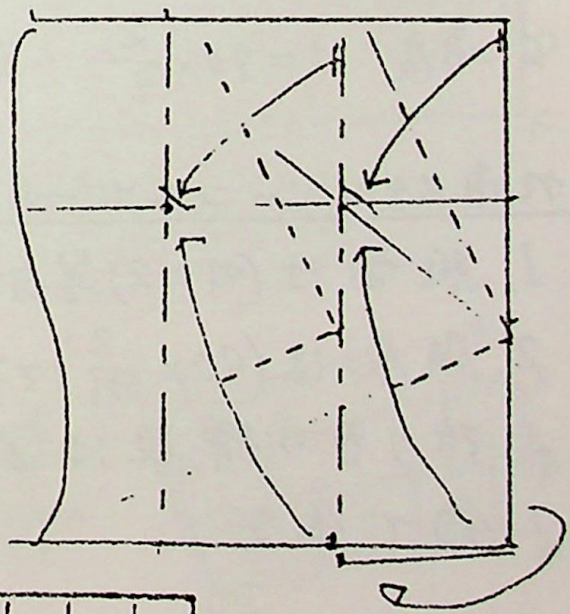
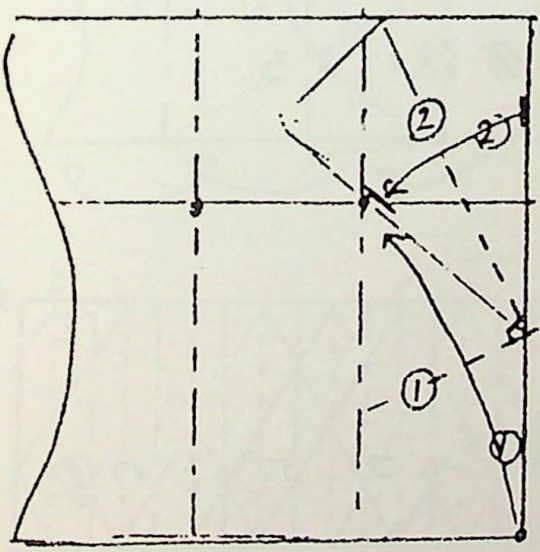
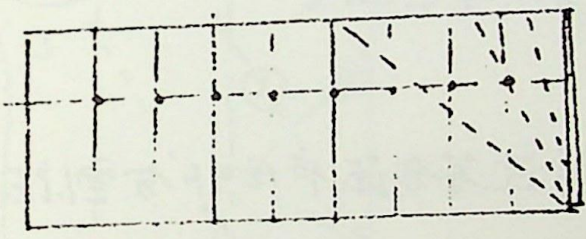


目分量で $\frac{1}{7}$ の角を取る 1回

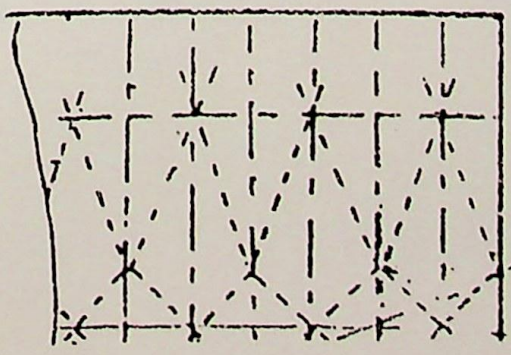
2回

この操作を2回位行くと次の折り線が固定する

• 交点で横線を引く



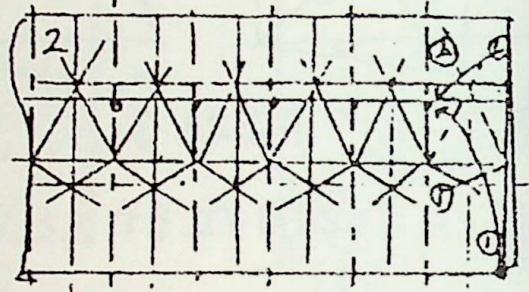
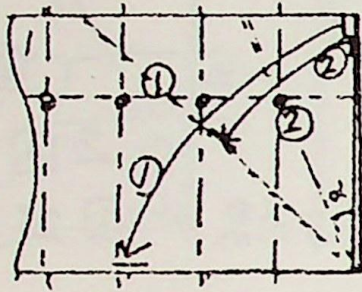
6角スケルトンコンポート
と同じようにして
完成する。



7角星紙

8角スケルトン・コンビポート作り方の要点.

1. 紙面を10等分する. これは6角スケルトンのときの5等分より作る.
2. 角度のとり方 $\alpha = 90 \times \frac{2}{8}$



その他は6角スケルトン・コンビポートと同じ.

9角スケルトン・コンビポート

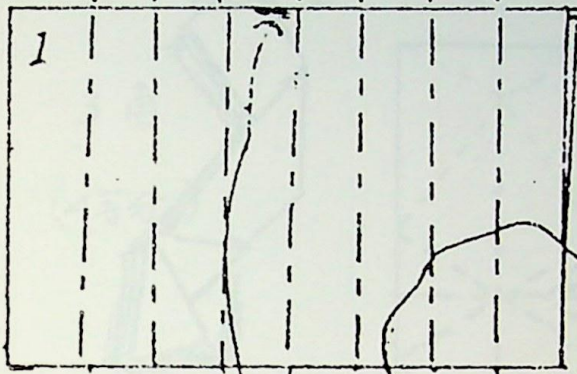
1. 紙面を11等分する. 漸近等分法やルート分割法を使用
2. 角度 $\alpha = 90 \times \frac{2}{9}$... 漸近等分法による.

n角スケルトン・コンビポート

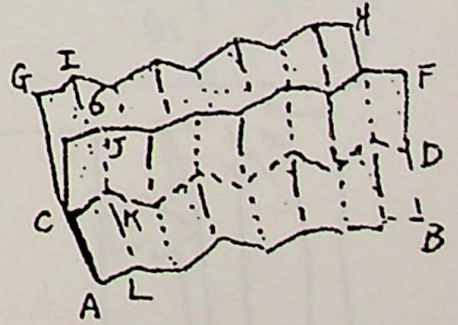
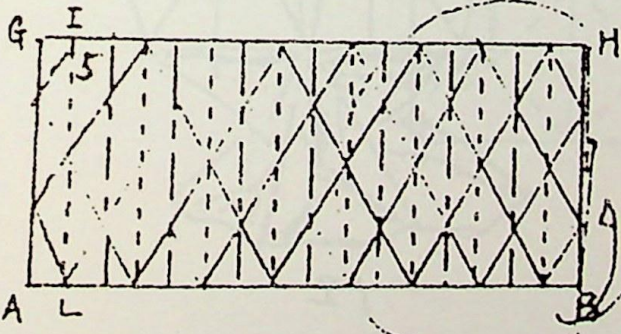
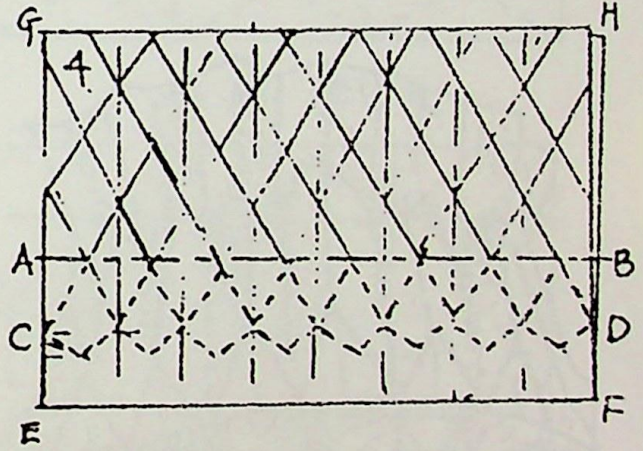
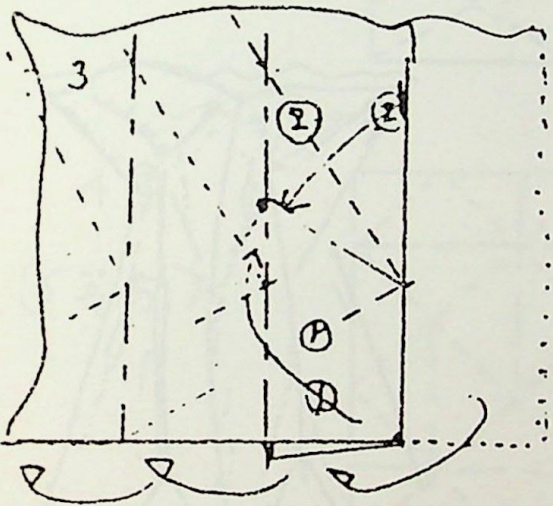
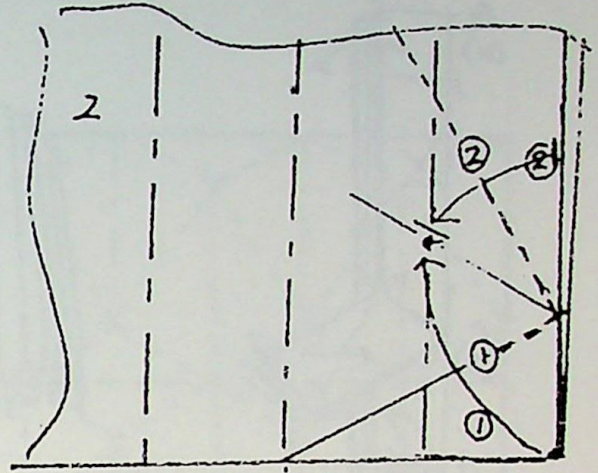
1. 紙面は $(n+2)$ 等分する.
2. 角度は $(90 \times \frac{2}{n})$ である
3. 折り方の標準は6角スケルトン・コンビポートの要領で作る.

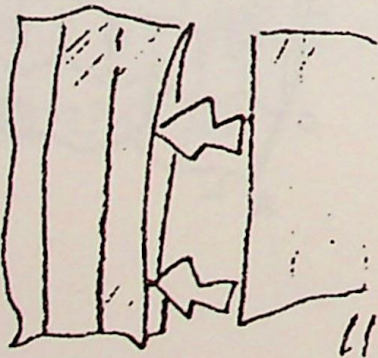
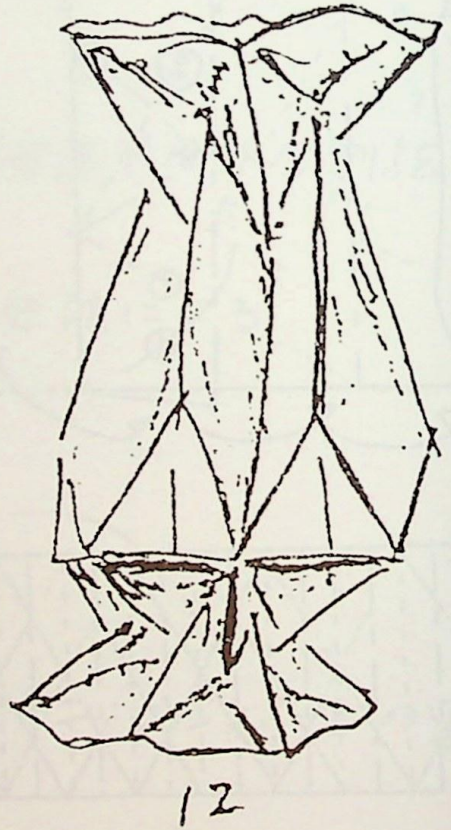
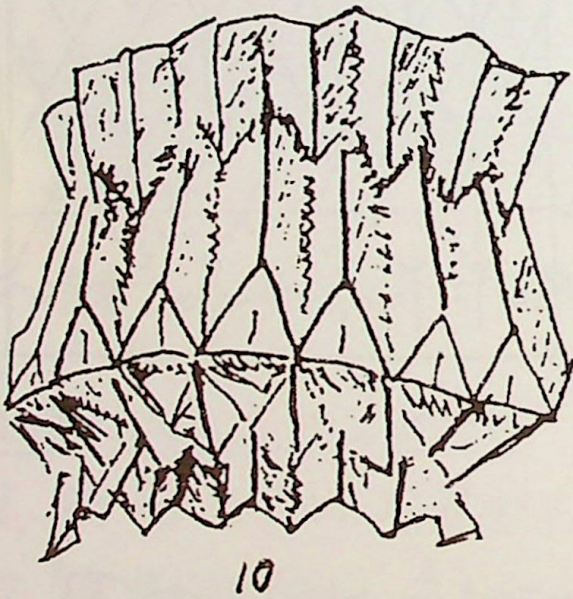
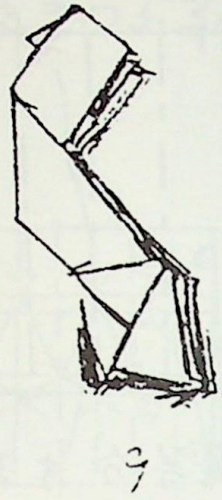
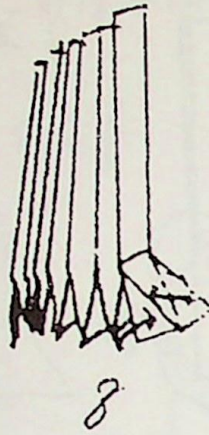
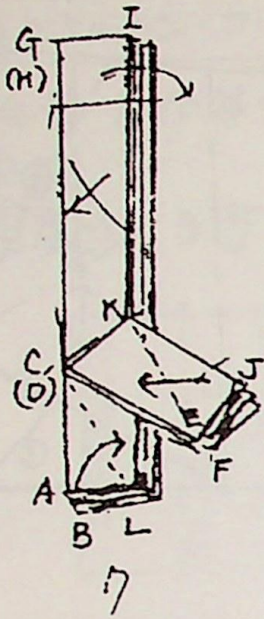
花びら (6回)

No12



8等分する



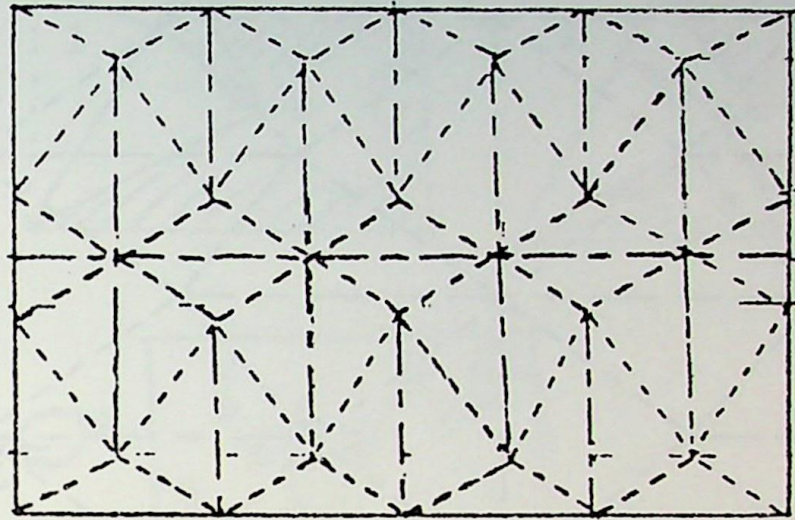


重ね方 六角柱

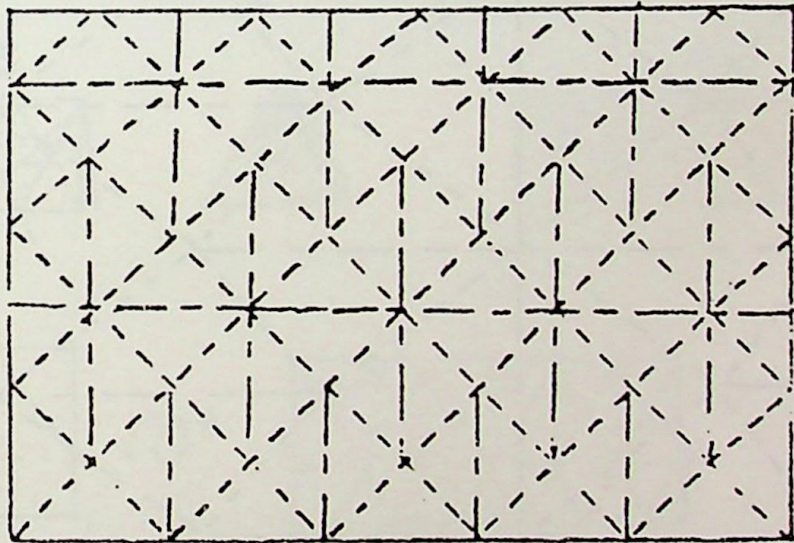
スケルトンの応用

連続スケルトン

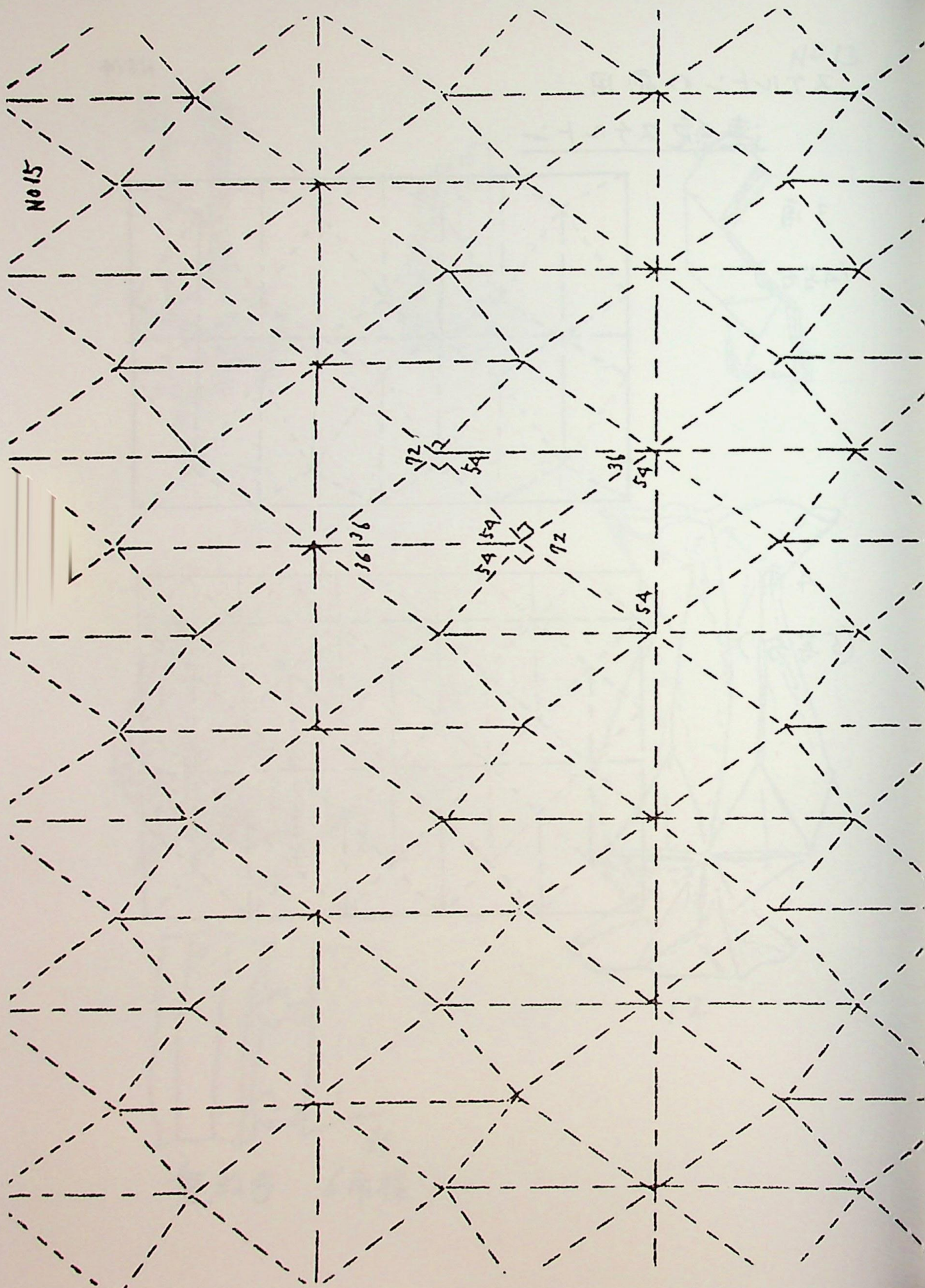
3角
(4等分)



4角
(5等分)



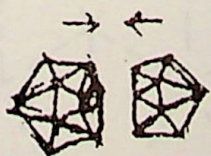
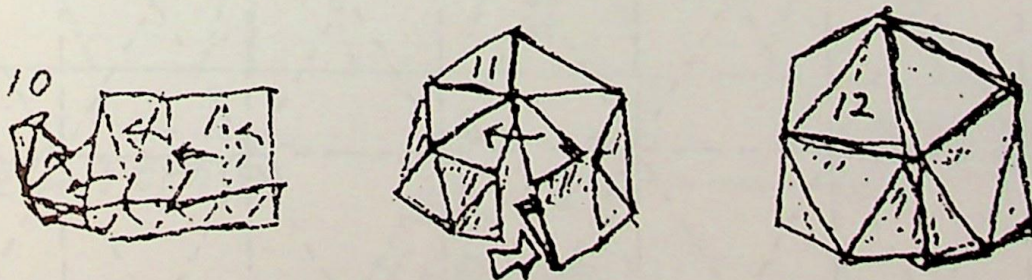
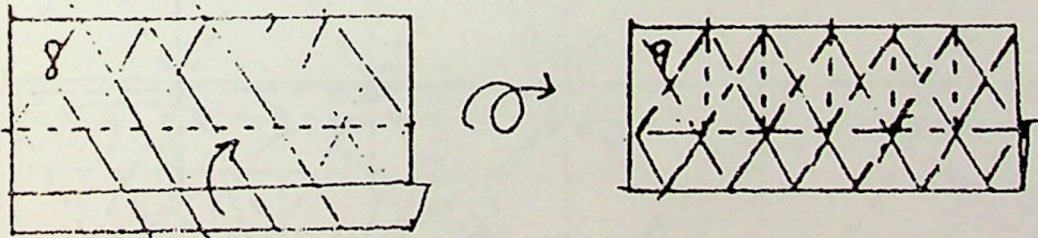
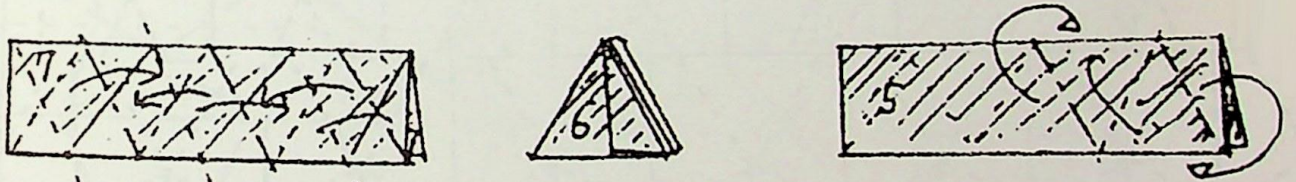
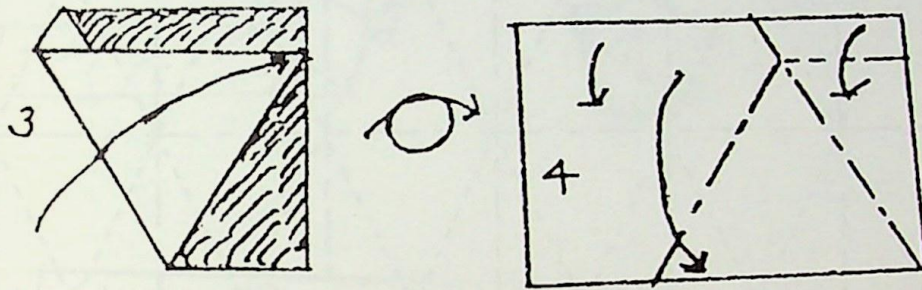
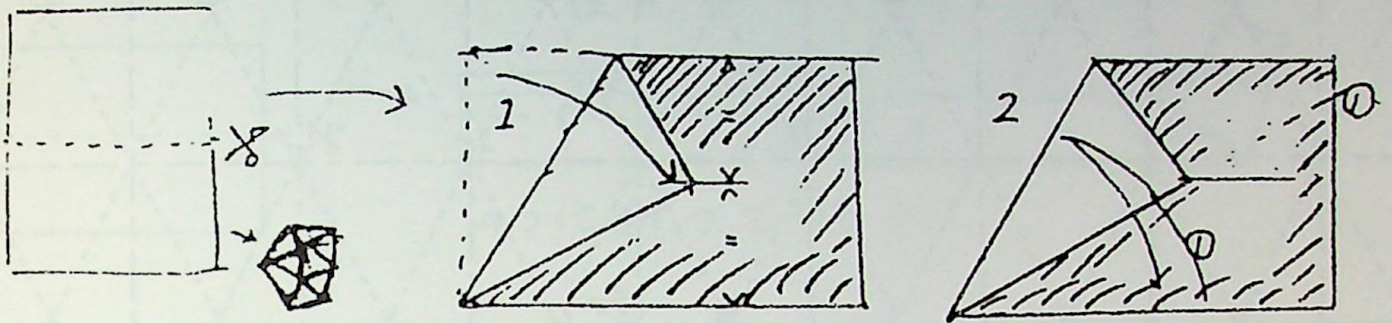
No 15



正20面体の折り方

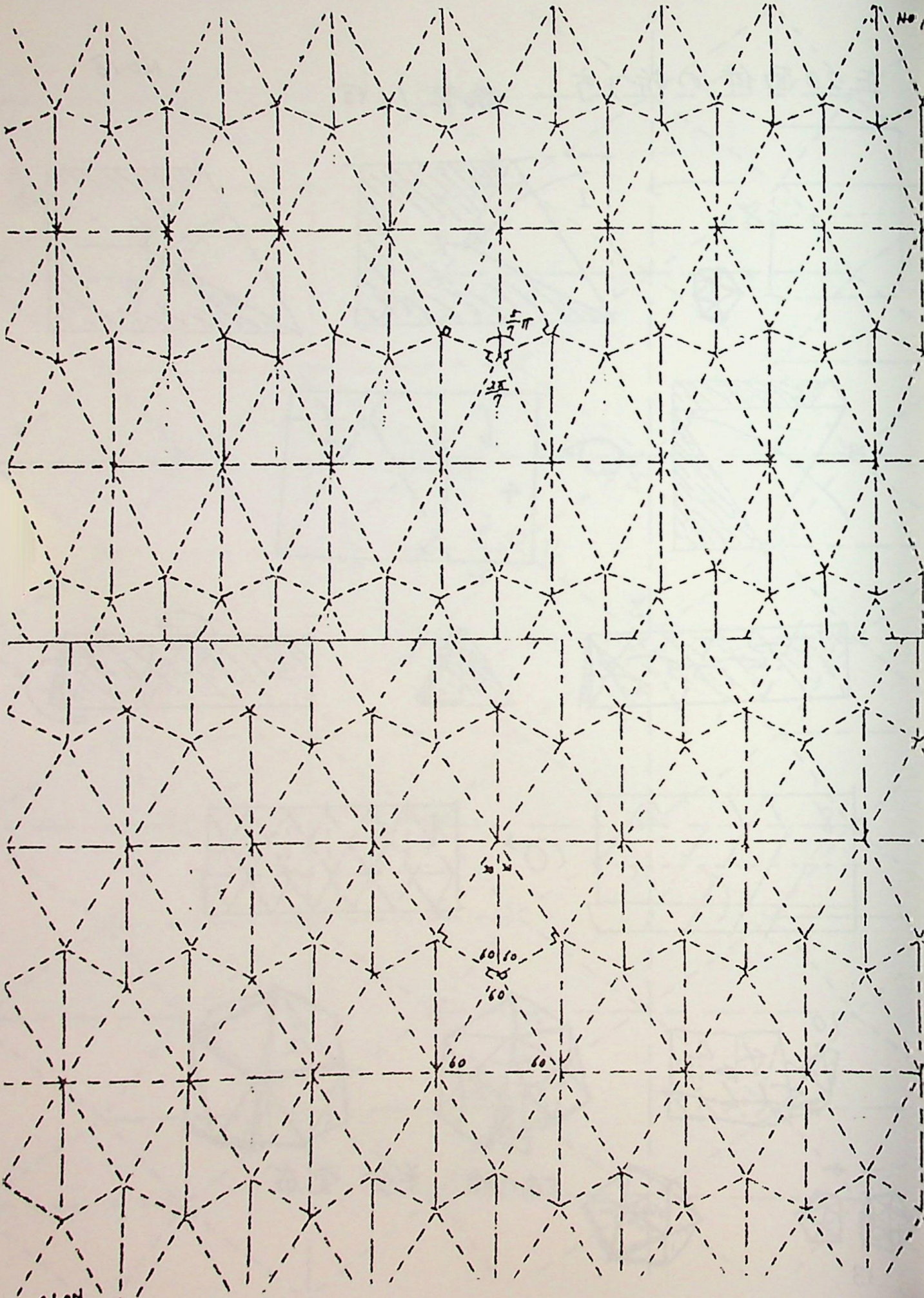
紙型 1:√2

NO 18



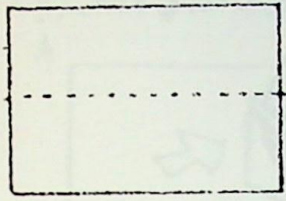
13

5面の輪 半分完成

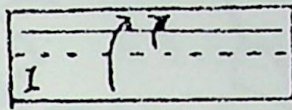


正12面体の折り方

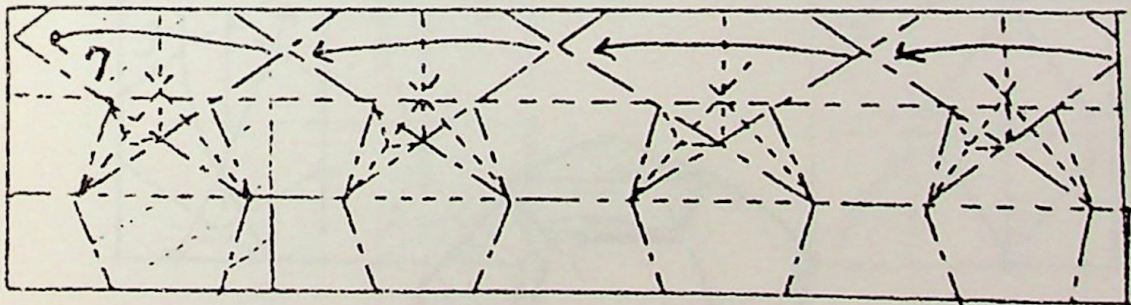
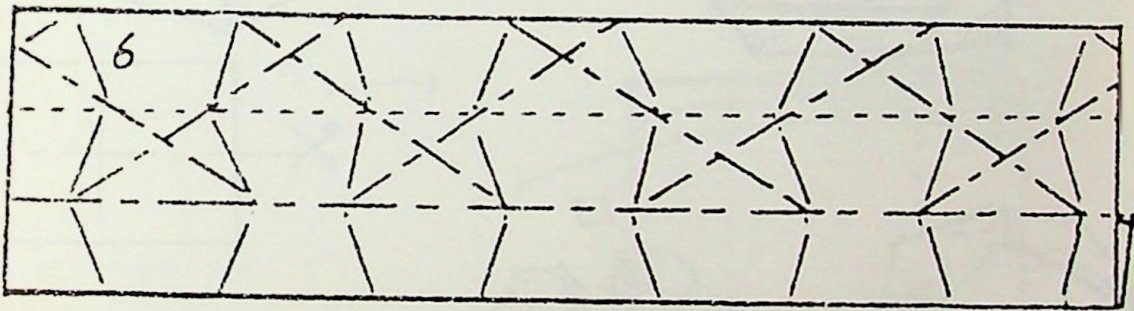
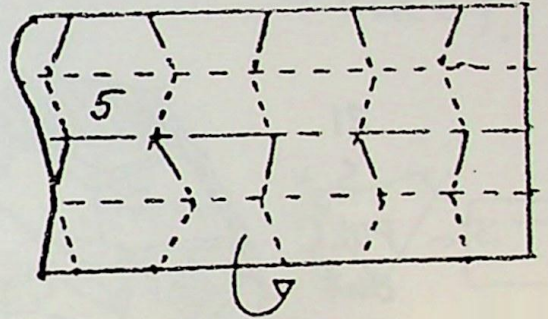
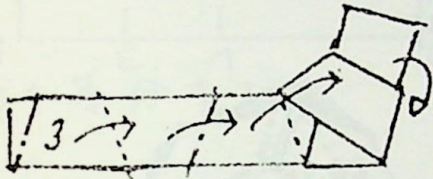
紙型 1:√2を横長に2分して
使用



8



4つに折って結ぶ。



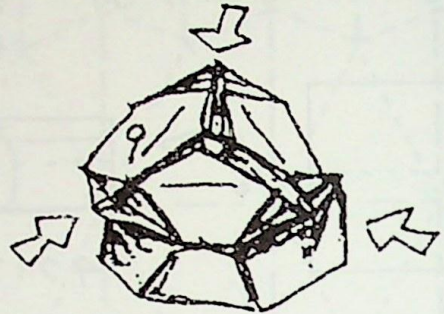
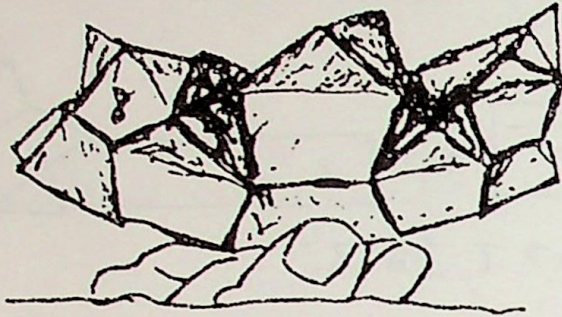
重なった部分(F)

輪にする。

(6角の輪)

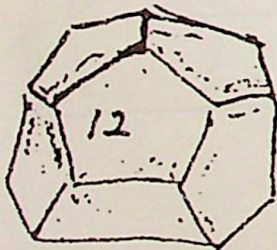
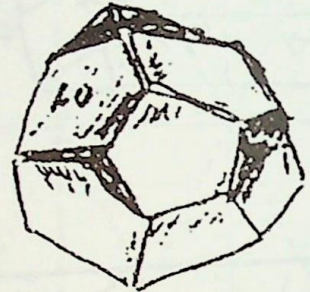
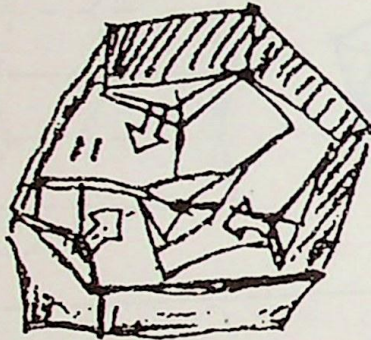
重ねた部分

(上)

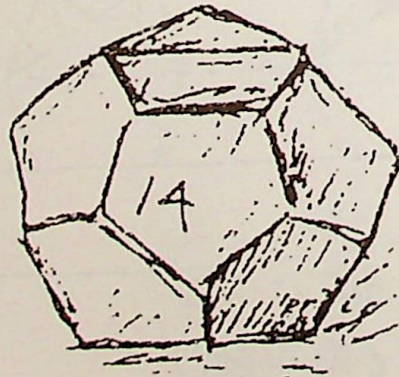
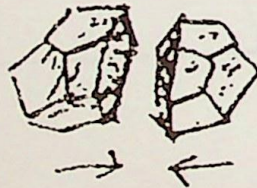


押し
PUSH

引
<
PULL
out

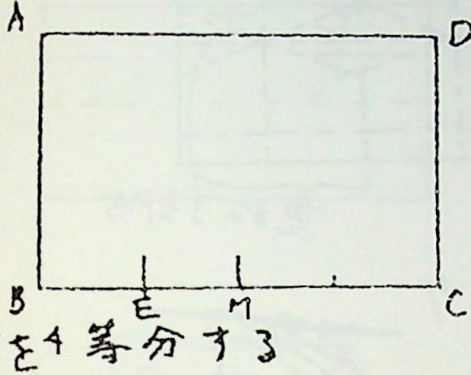


13

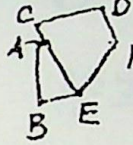


菱形12面体 紙型. 正確に $1:\sqrt{2}$ を使用.

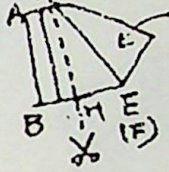
使用する紙型の調整



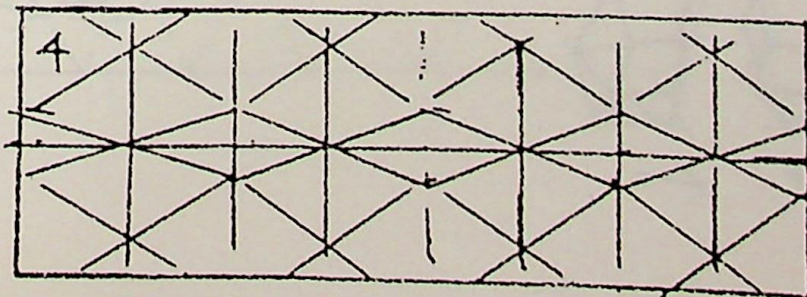
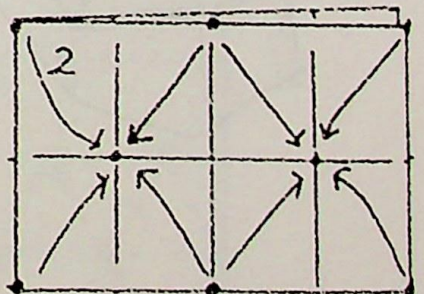
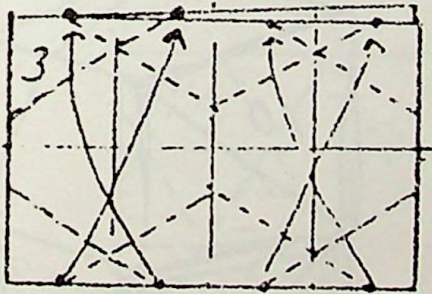
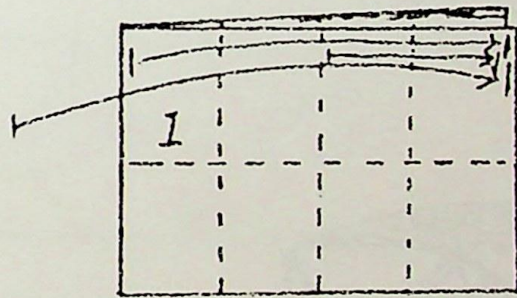
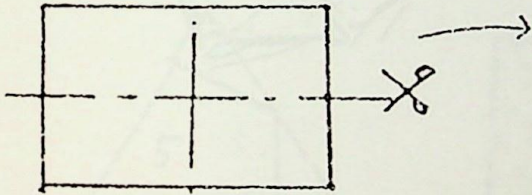
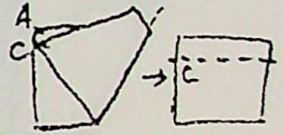
- Eを起点にしてCをAB線上に合わせ.
- AとCが一致すれば正確.
- Aの延長上にCがくれば

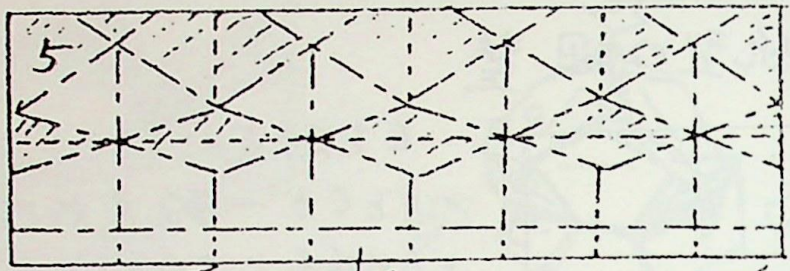


EとFを合わせてGHで切り落とす.



- Aより下にCがくれば
Cの線でも横に切り落とす.

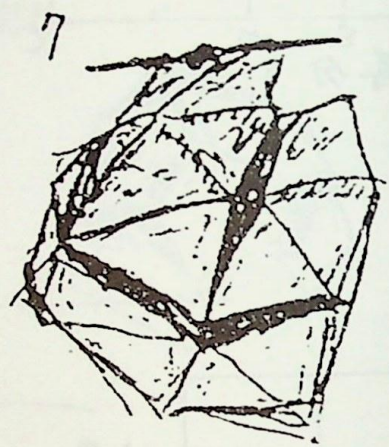
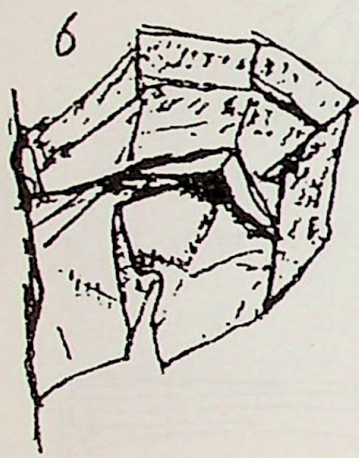




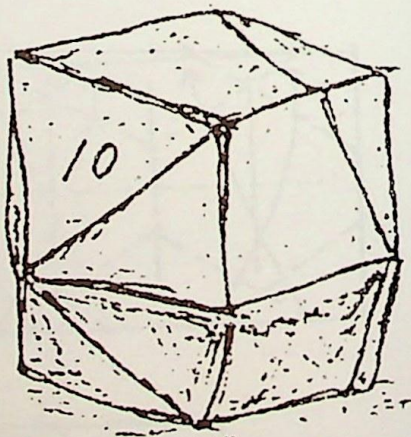
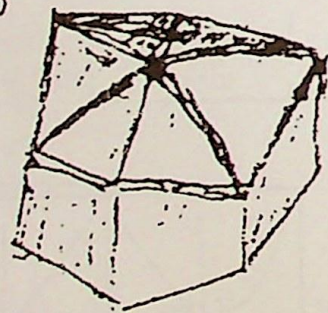
重做了

重做了部分

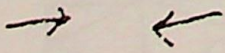
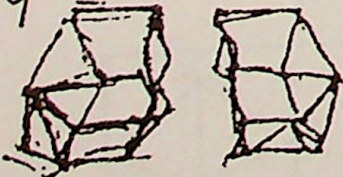
6用柱筒



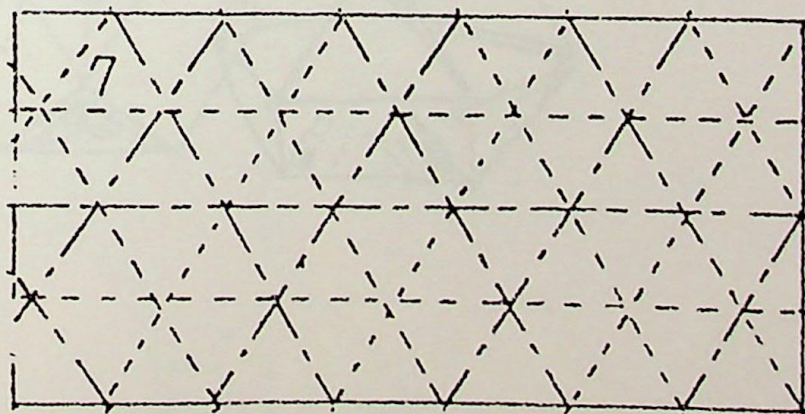
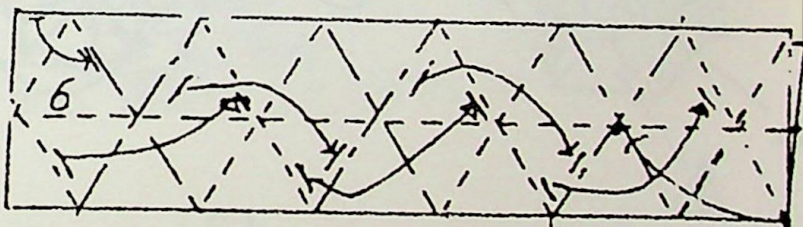
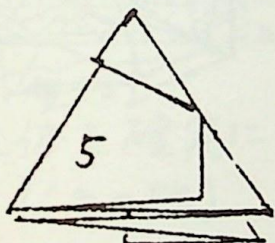
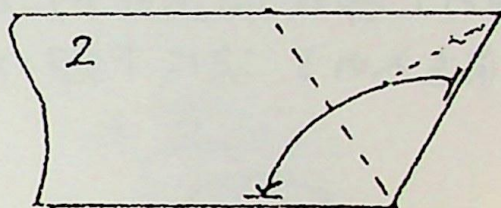
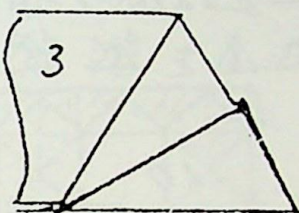
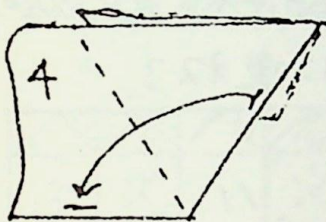
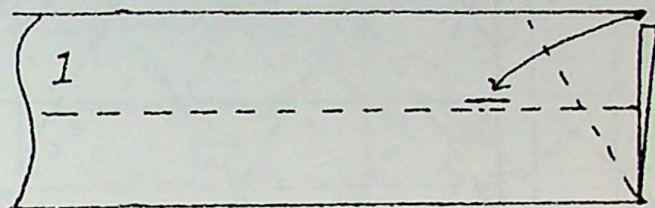
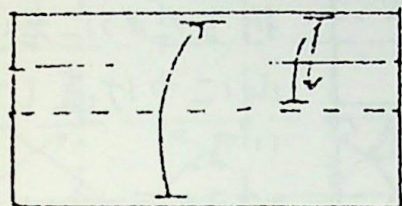
8



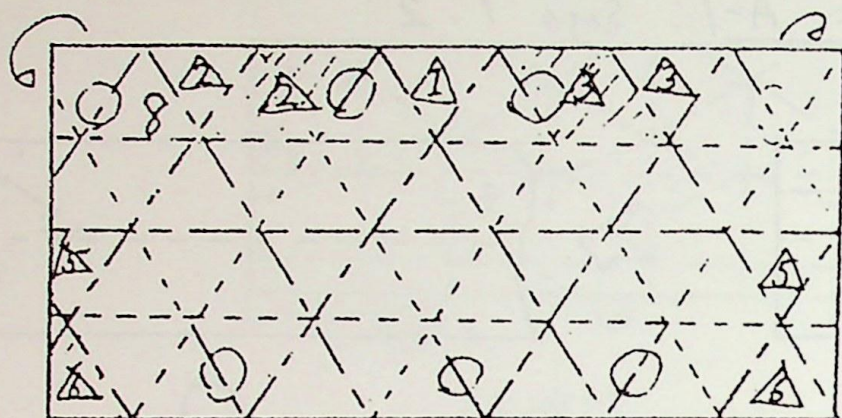
9



等稜14面体 A-1 Size 1:2

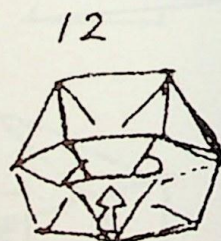
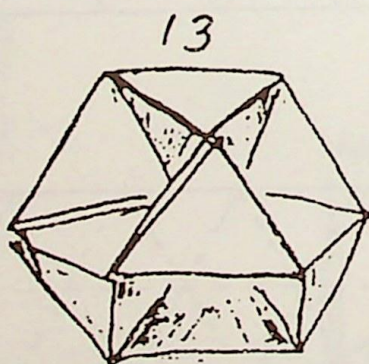
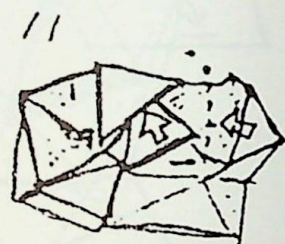
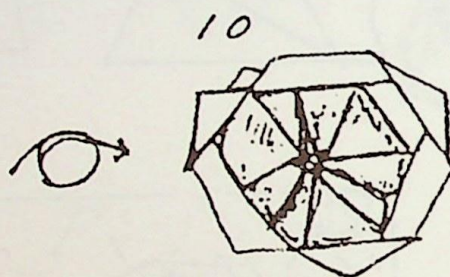
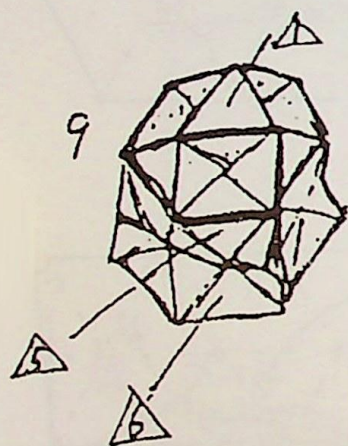


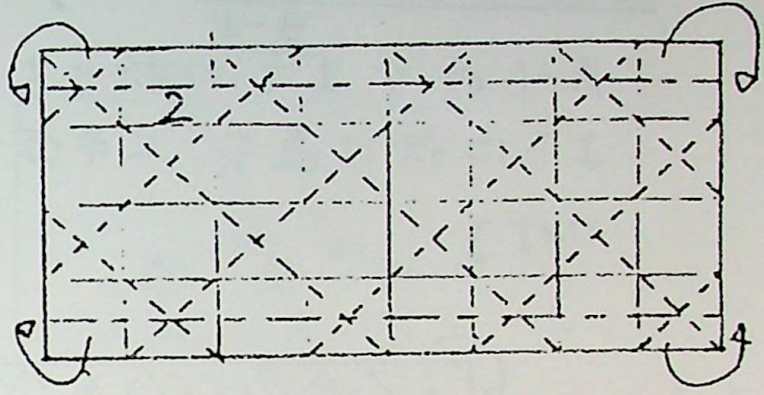
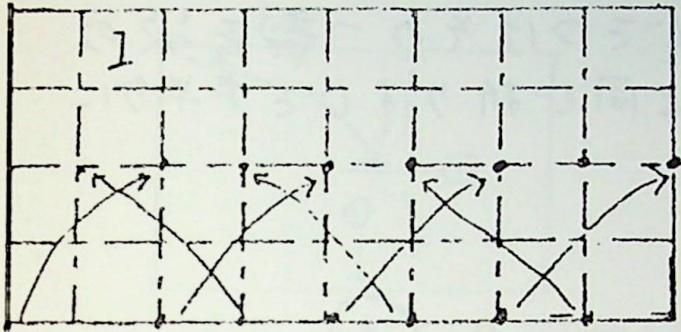
←谷折りに直して
...3



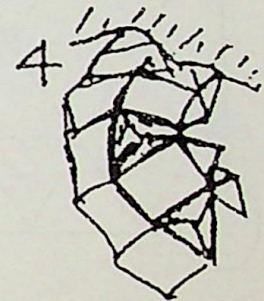
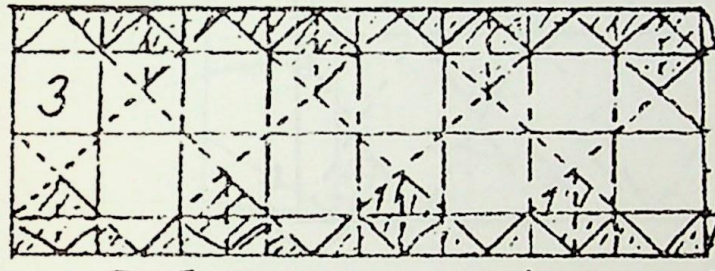
○印のと=3は
折るために谷を
山につけ直して
いる。
上部の両端はう
に折る。

初め上部の三角△の下に△を重ね△の三角を入れ次に△を重ね△の
三角を入れた。次に下部の△△を△△の上に重ねる。

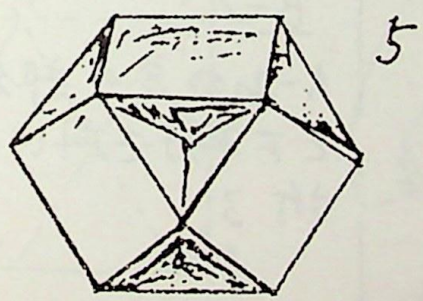




横8等分 たて4等分



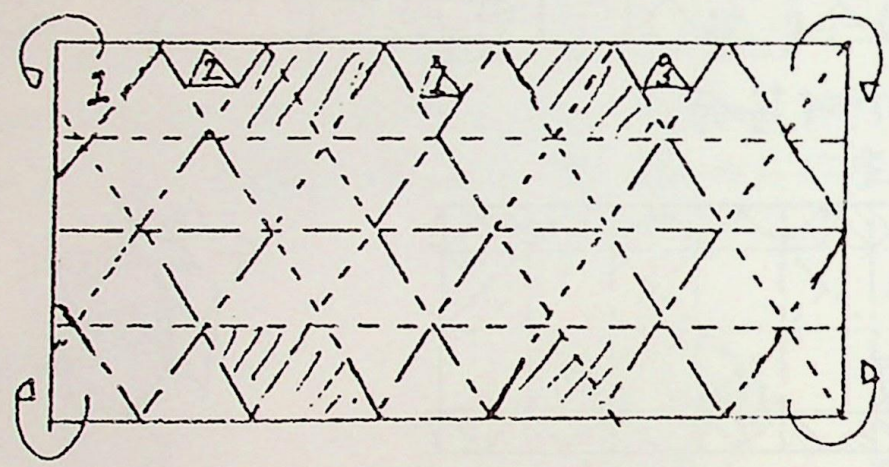
重ねる
全体を確実に折つてから重ねる部分
車輪にして仕上げる
(6角の輪)



等稜14面体 B-1 Size 1:2

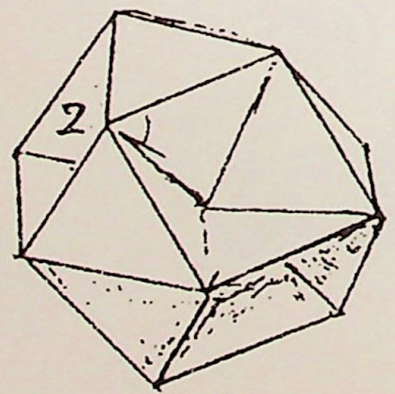
B-2

A-1の7までの折りすじをつけその一部を次のように付け直す。上半分と同じ折りすじを下半分につける。



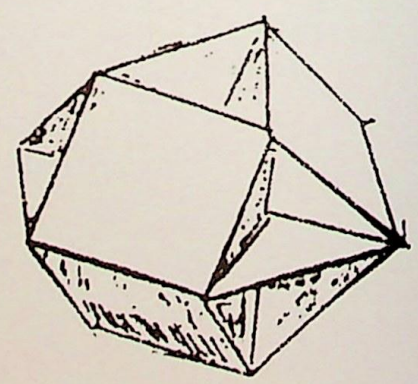
上半分を折ってから下半分を同じように折る。A-1の折り方を参考にする

B-1.



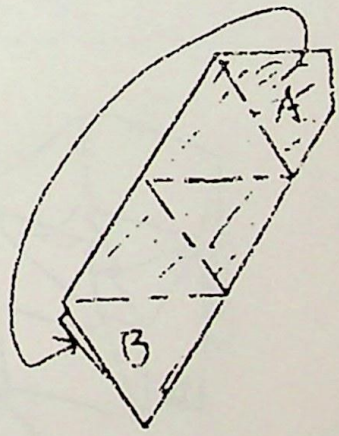
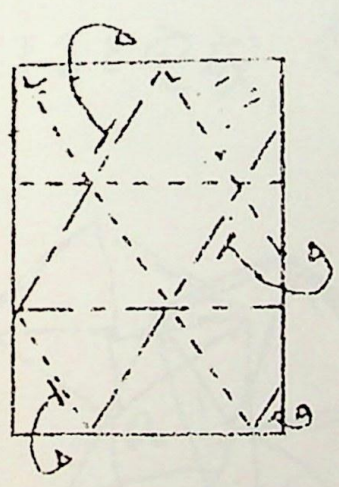
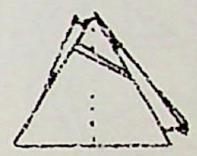
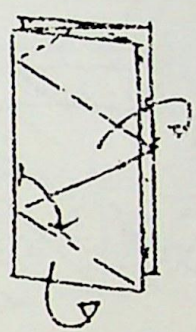
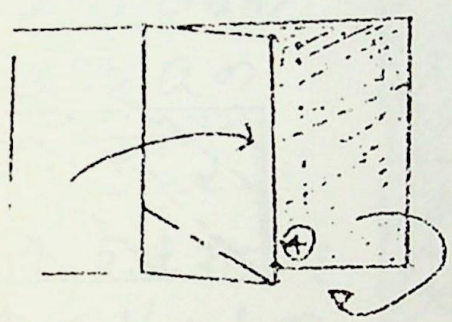
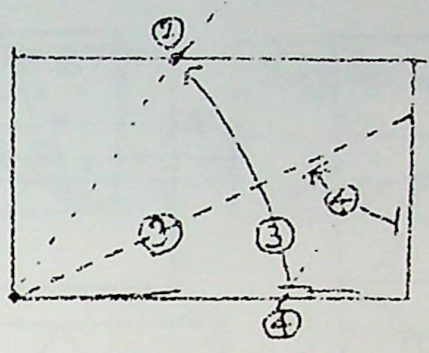
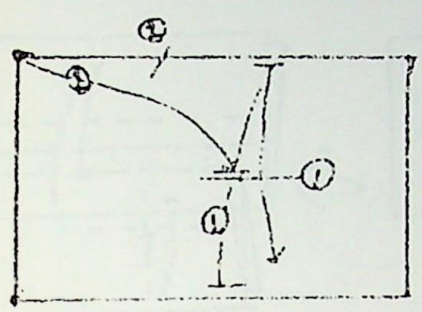
B-2

A-2の3の部分で上半分と下半分を同じ図にして折る。

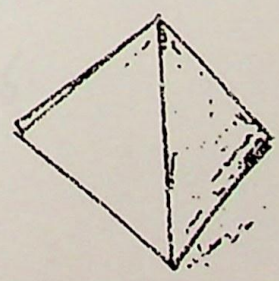


B-2

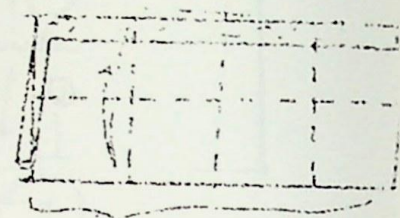
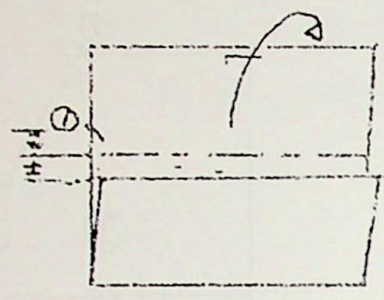
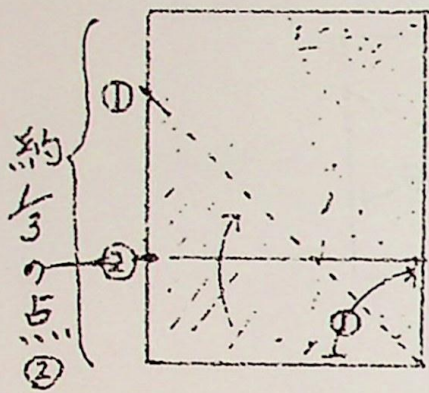
正四面体 Size $1:\sqrt{2}$



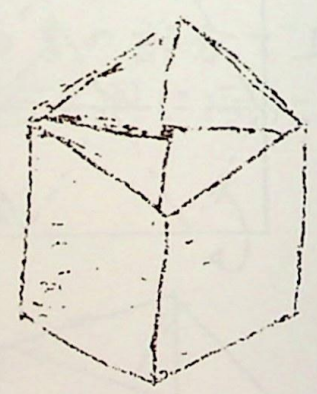
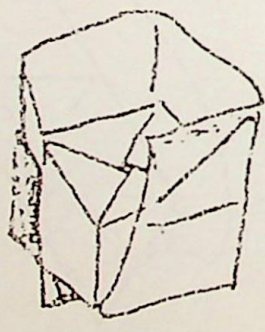
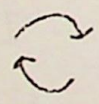
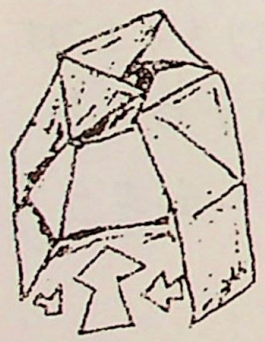
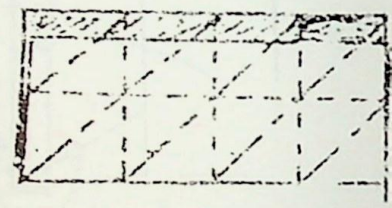
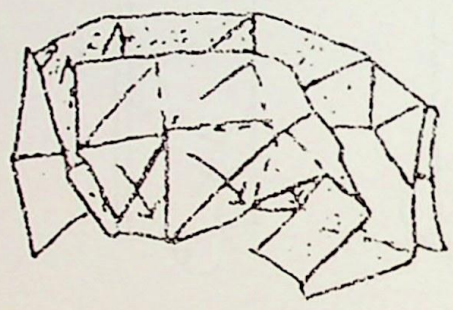
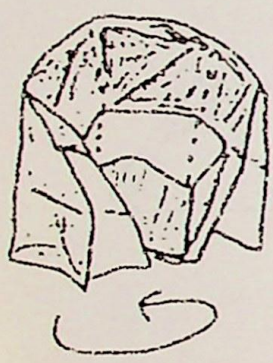
全体をこのように折りまじをつけてAをBに入れると出来上り



正6面体 Size 1:√2

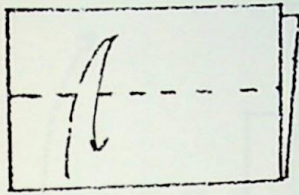


4等分

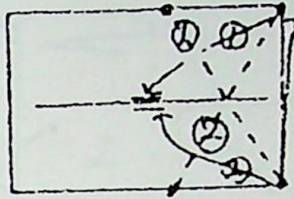


正八面体

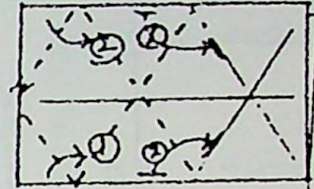
Side $1 : \sqrt{2}$



1



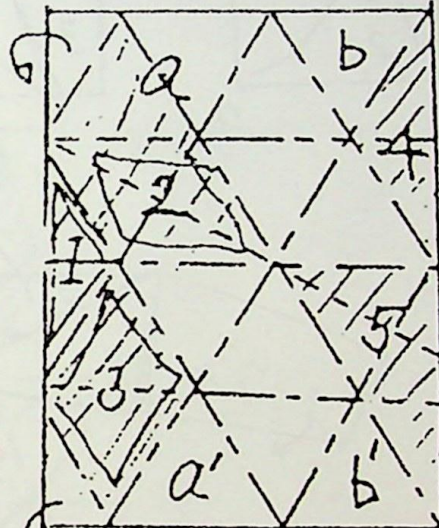
2



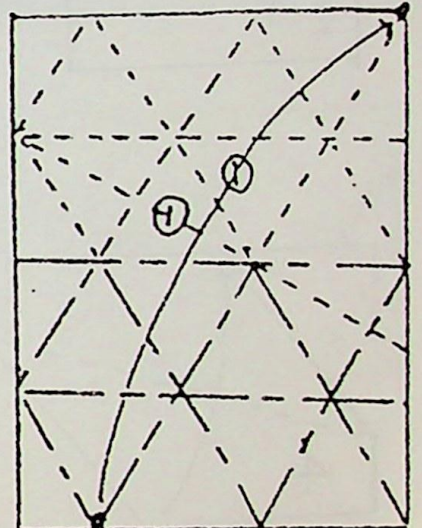
3

初め1を合わせ
次に2, 3, と合わせ
せて a' を a の
中へ入れる。

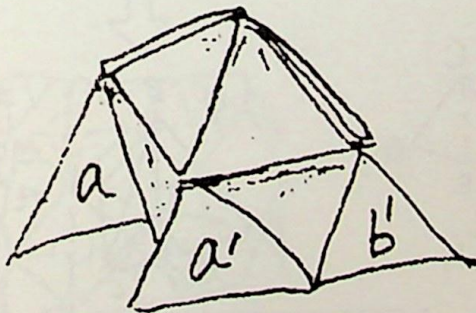
次に4, 5, と折つて
最後に b' を b の
中へ入れると完成。



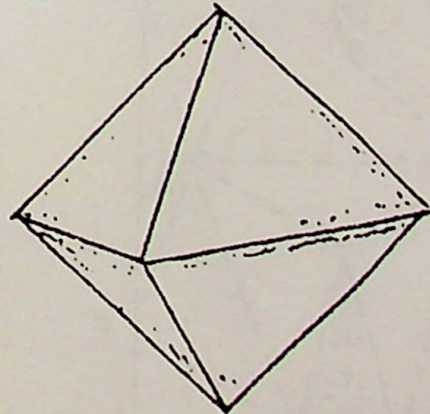
5



4



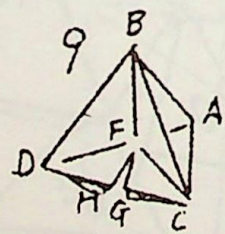
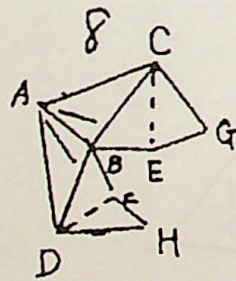
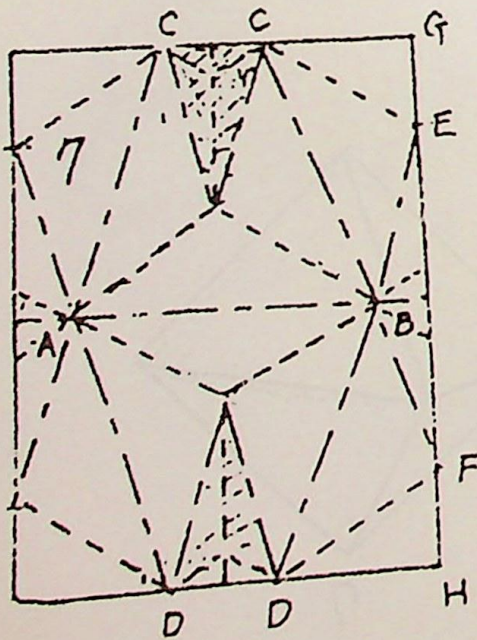
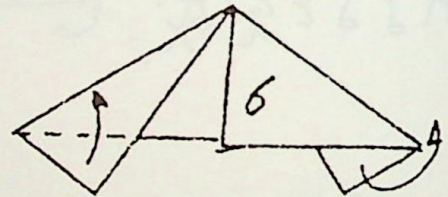
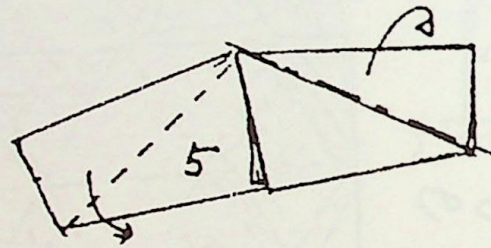
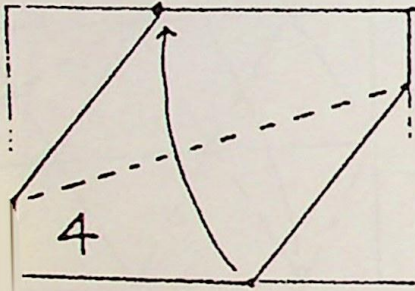
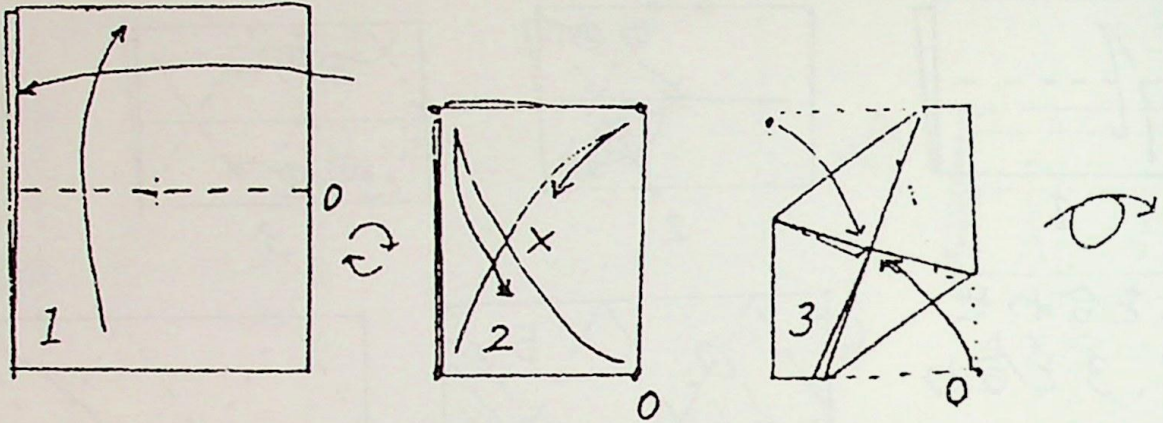
6



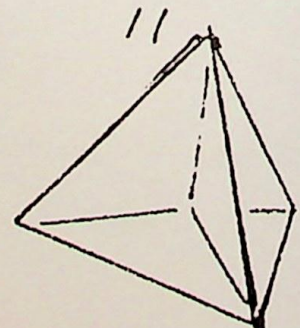
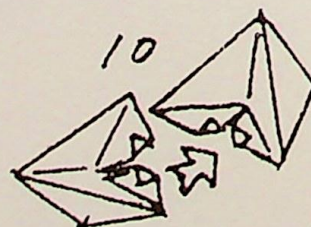
7

正四面体スケルトン

Size 1:√2 正確なもの



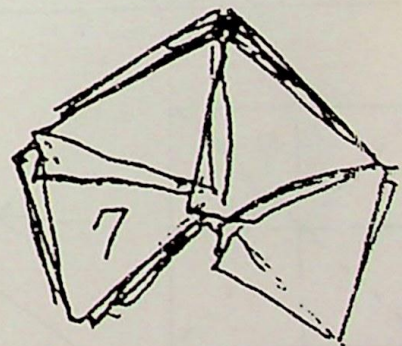
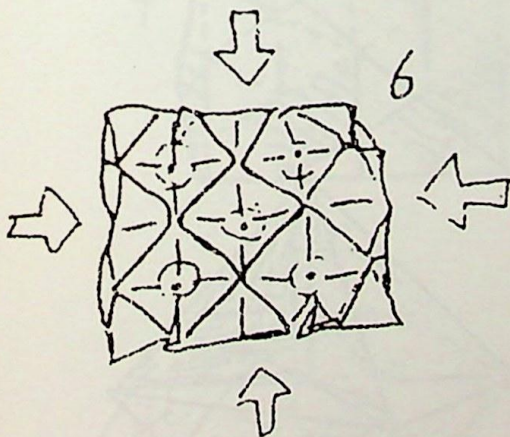
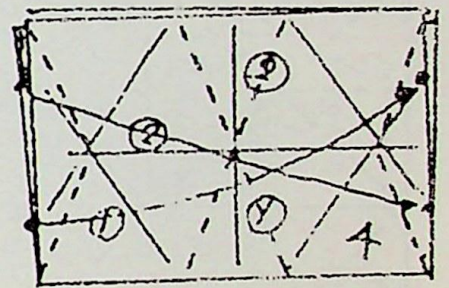
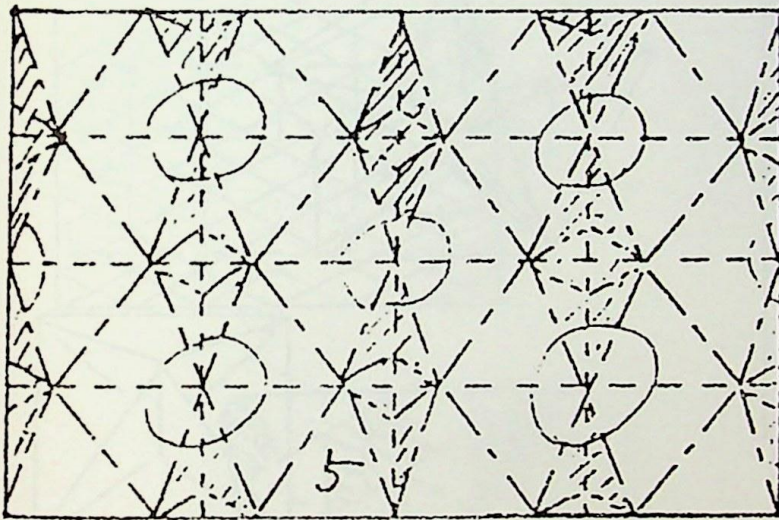
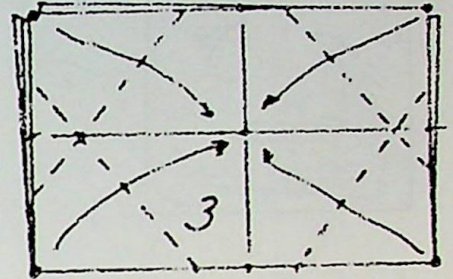
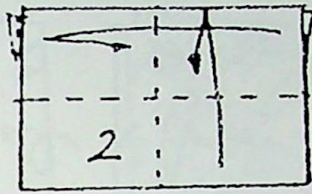
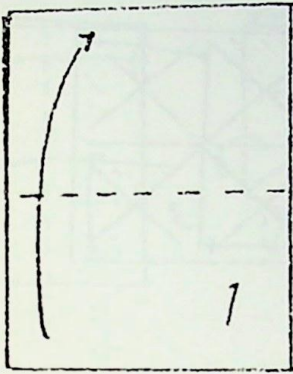
ここには
ゼロハンターで
どけろ?



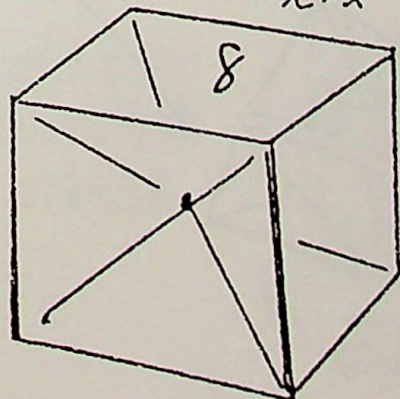
2つ合わせ?

正6面体スケルトン

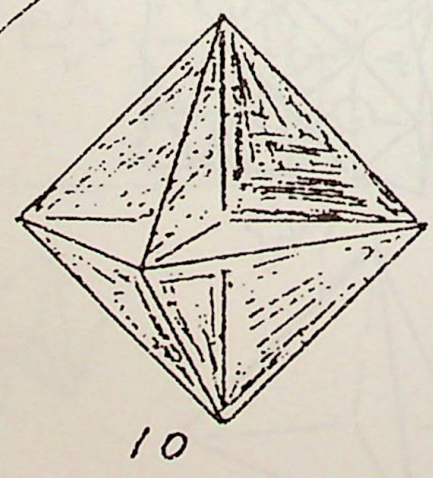
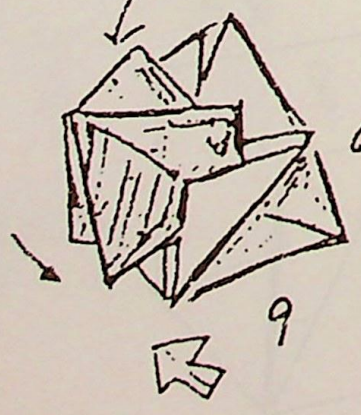
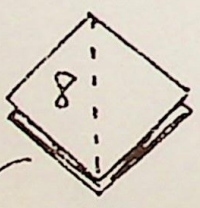
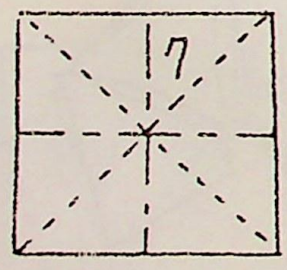
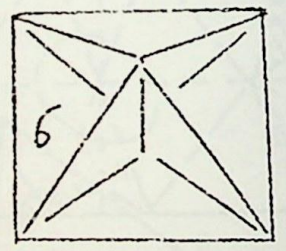
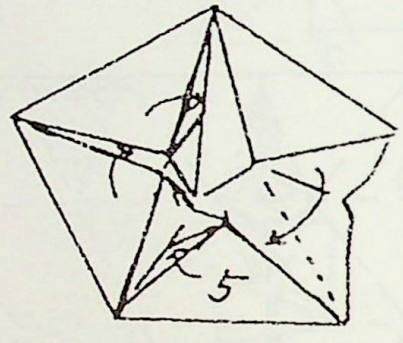
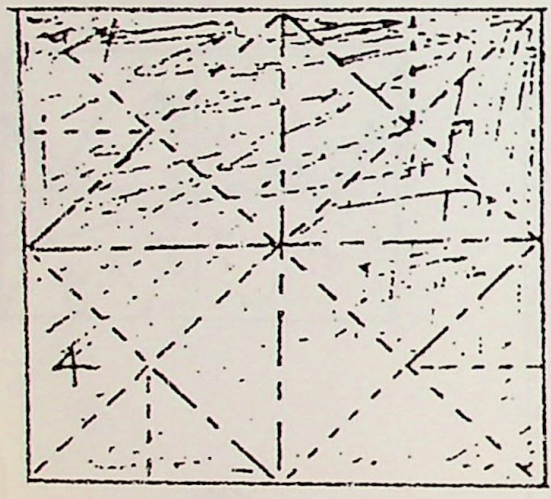
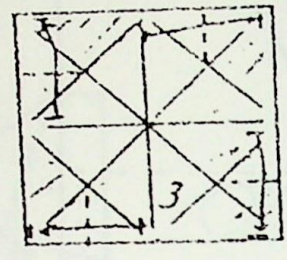
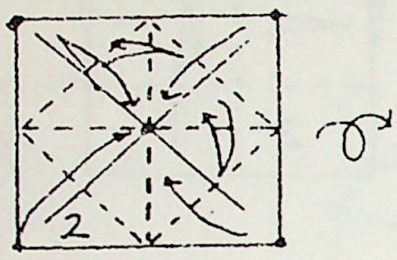
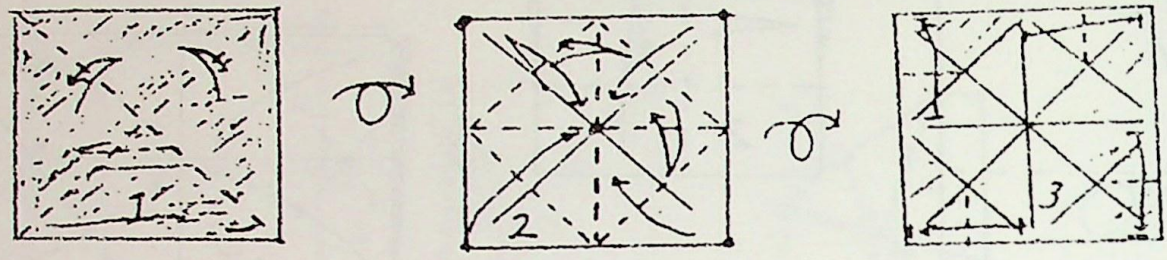
Size 1: $\sqrt{2}$ 正確



セロハンテープでとめて
完成

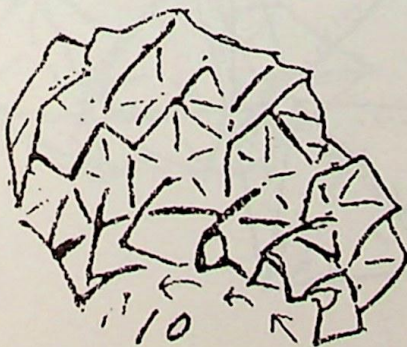
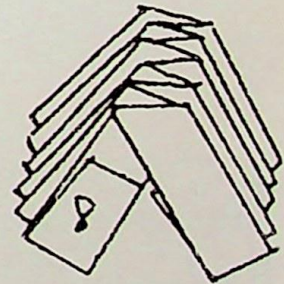
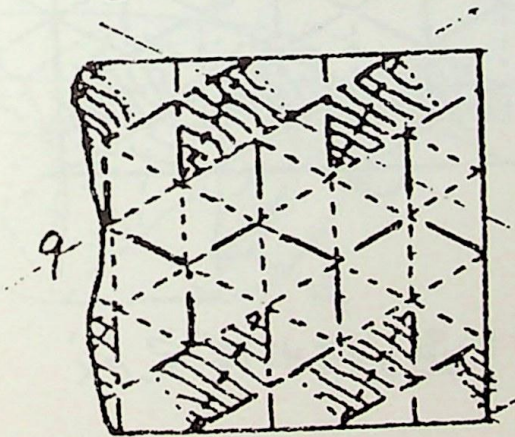
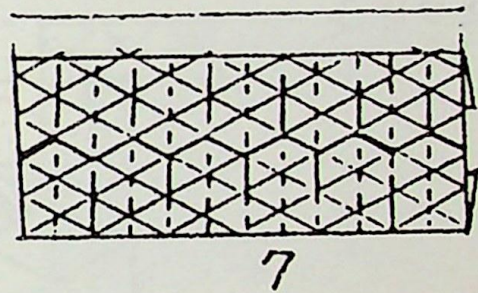
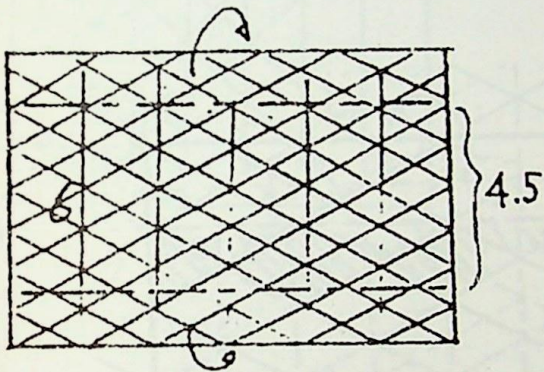
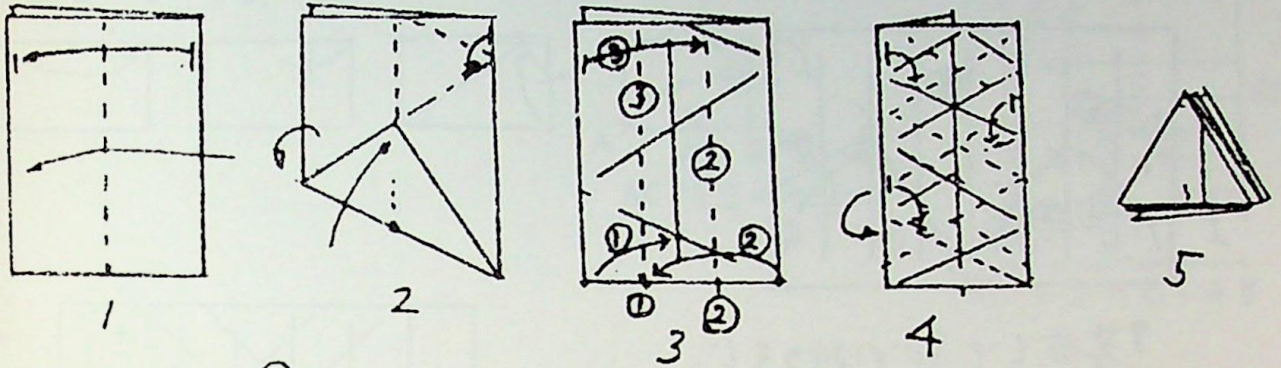


正8面体スケルトン Size 1:1

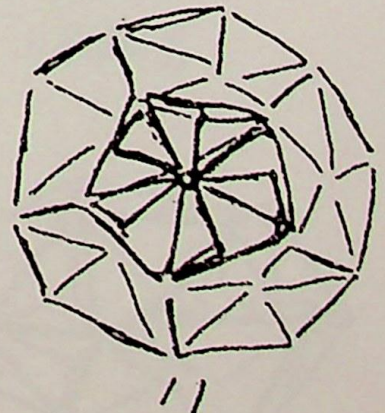


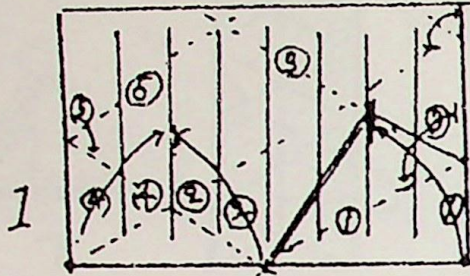
凹形正12面体

Size 1:√2

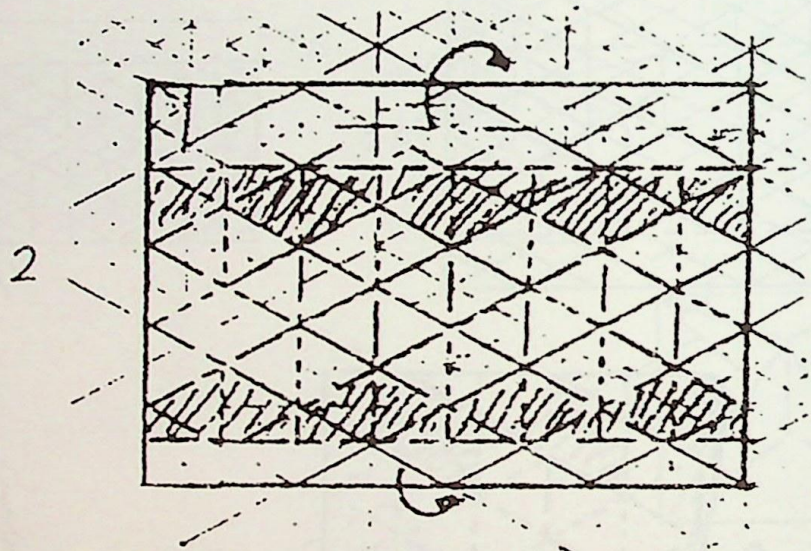


よく折つてから
輪にして完成
五角の輪

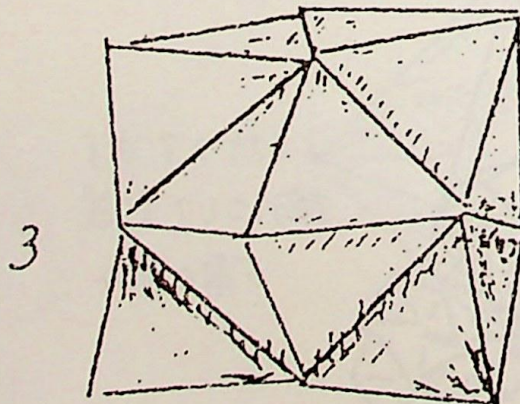


24面体Size 1: $\sqrt{2}$ 

8等分して 30° の折りすじ.
をつける.



輪にして図の折りすじ通り折れば完成
六角柱管

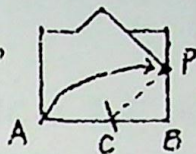
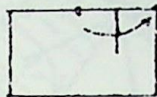
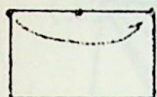


凹形正20面体

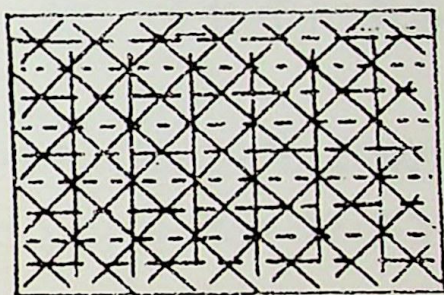
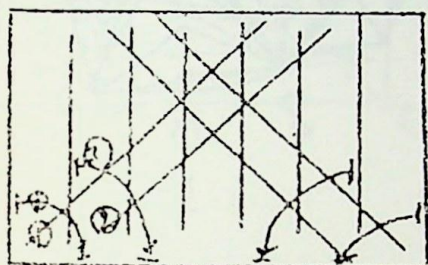
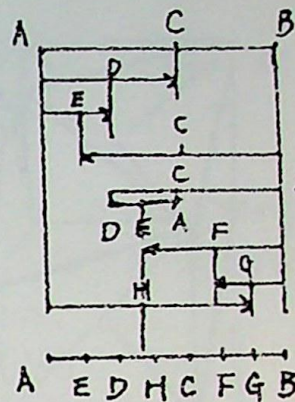
Size $1:\sqrt{2}$ B4<

35

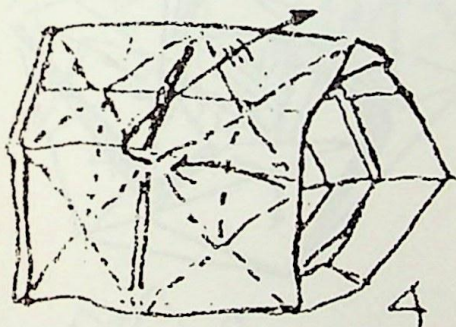
紙面を7等分す。



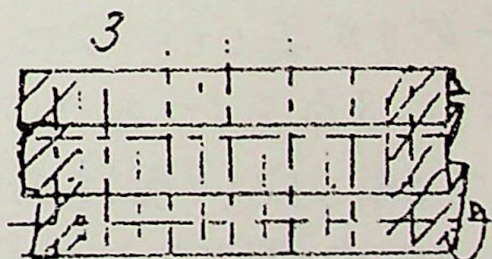
$AC:CB=4:3$



2



4



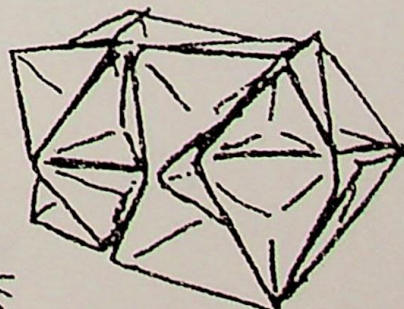
3

輪にす。

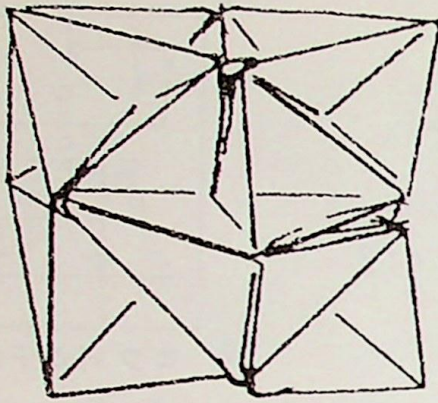
三角柱筒



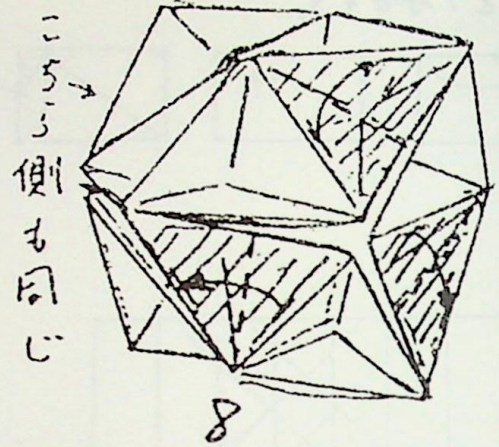
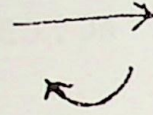
5



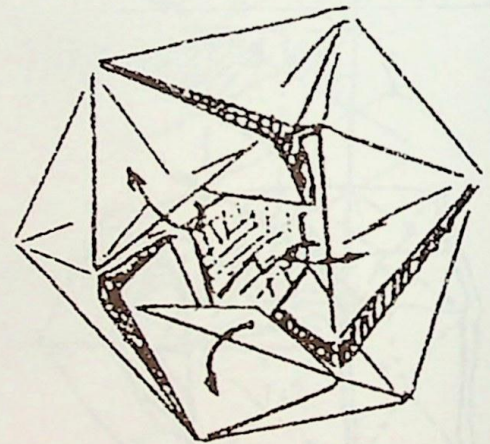
6



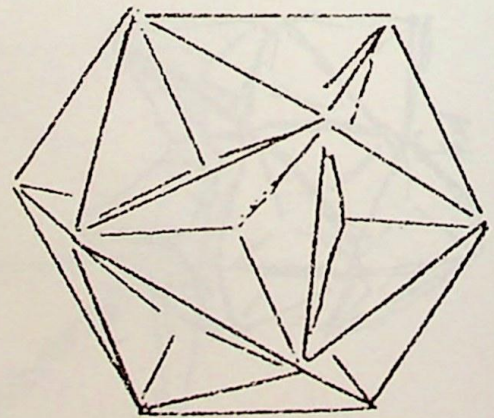
7
(凹等稜24面体)



24面体はピラミッドのスケルトンが正6面体の各面に6コ付いた形で、このとき、ピラミッドの折りすじを正確につけると仕上がりが美しい。次に8のように3角を1つおきにつぶして3角の穴(9個)をあけ次にそれを内側よりふさぐようにすると完成する。



9

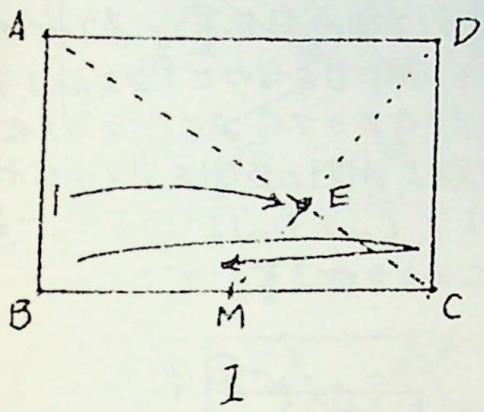


10

特別な四面体

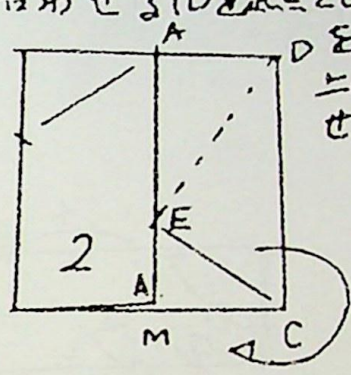
○ 2等辺3角形の常に垂直な面を持つ四面体
(辺の比は $2 : \sqrt{3} : \sqrt{3}$)

Size $1/\sqrt{2}$

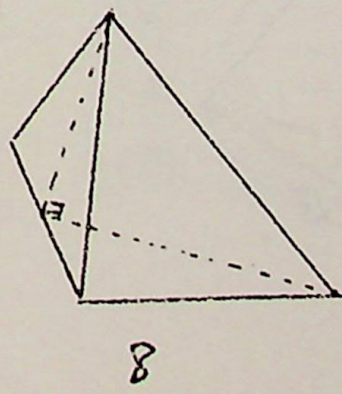
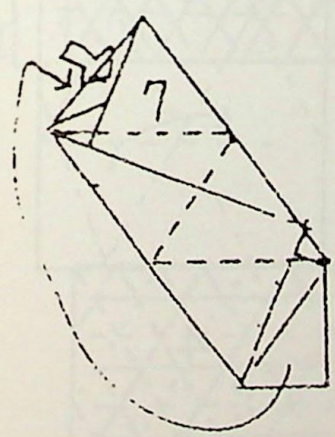
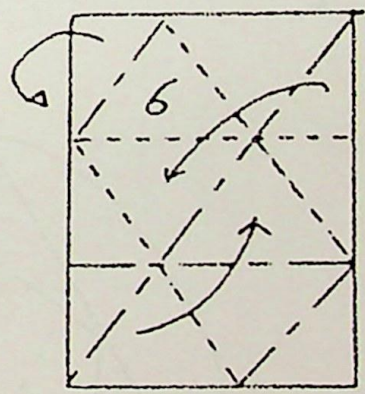
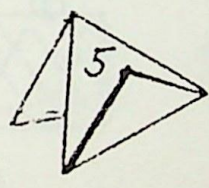
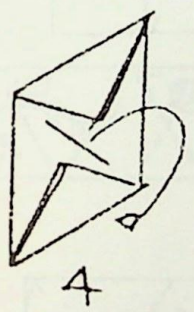


BCの中点Mを取り
DMの交点EにAB
を合わせる(Dを起点としてC

ACのすじの通りに
全体を折る



とEAC線
に合わせる)

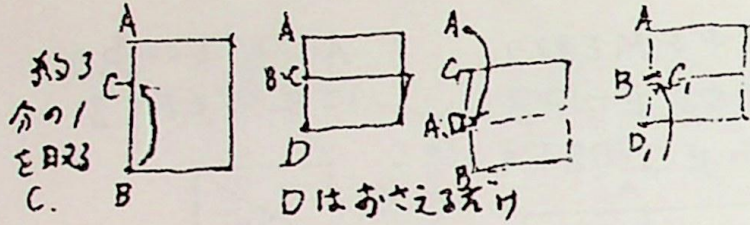


面角 90°
と
 60°

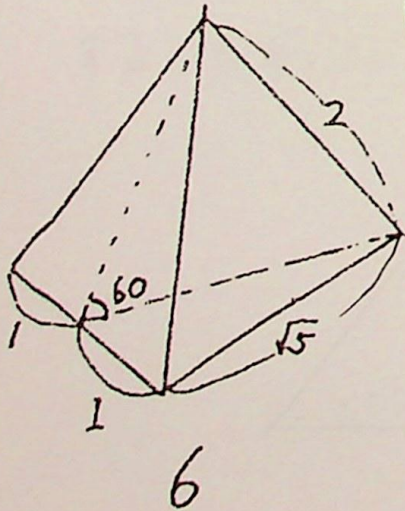
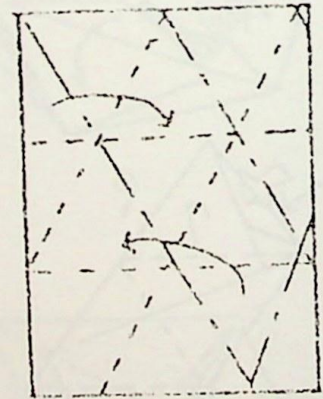
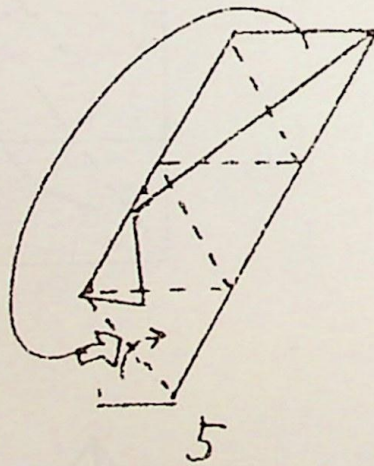
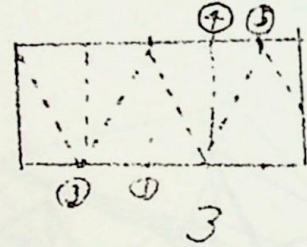
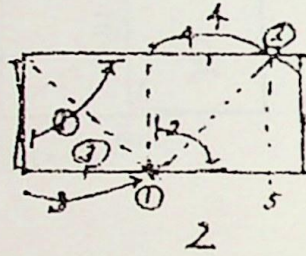
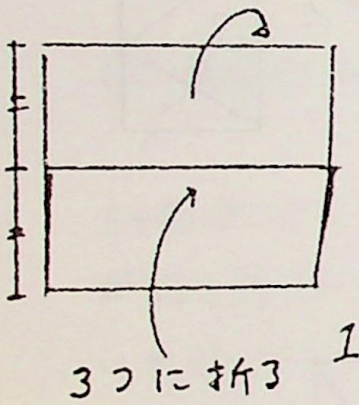
60°の面を持つ四面体
(2等辺三角形は2:√5:√5)

Size 1:√2

。漸近等分法で紙面を3等分する。

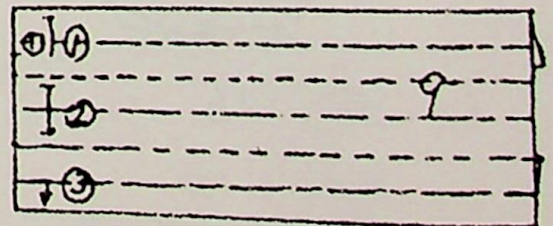
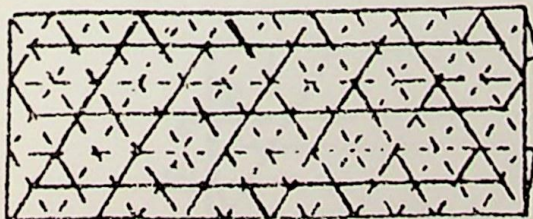
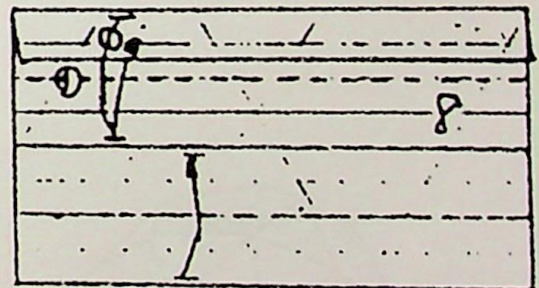
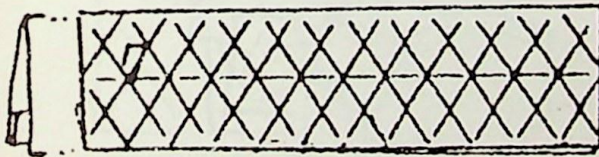
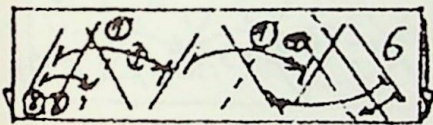
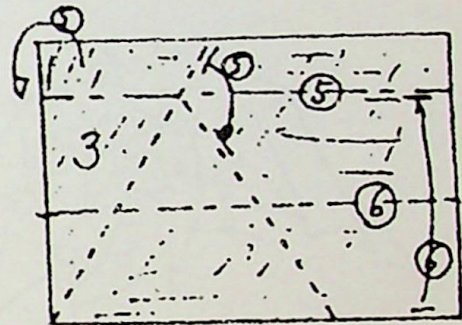
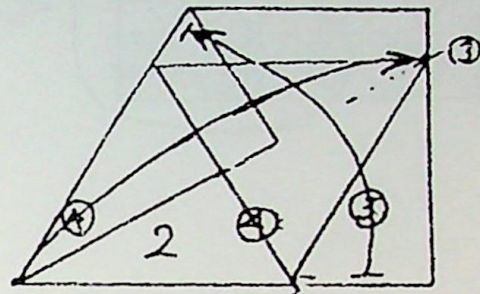
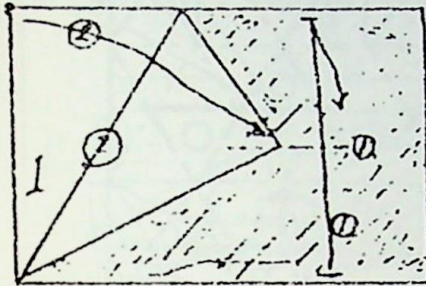


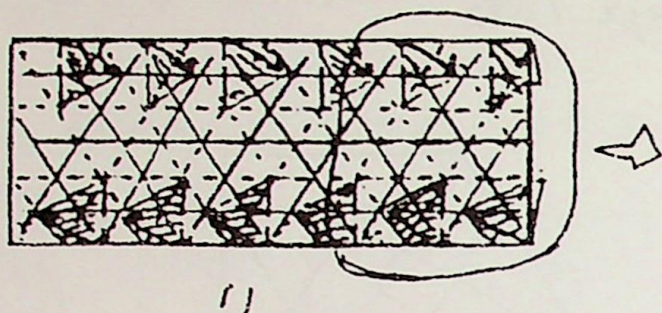
このように初め目分量で約1/3の点Cを取り、次にBを合わせてDを取る、次にD=Aを合わせてC、次にC=Bを合わせてD、を取る、A側とB側を次々と合わせることで、 C_n と D_n はいつか同じ点になる。このときが3等分できている。



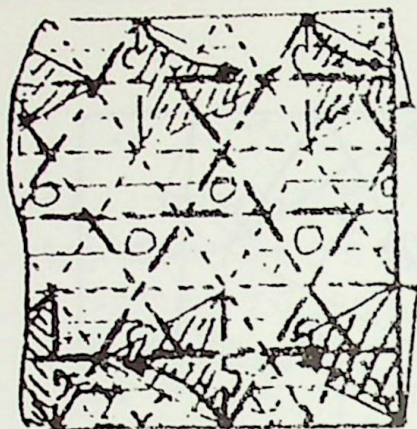
32面体 (3角と5角)

Size 1:√2

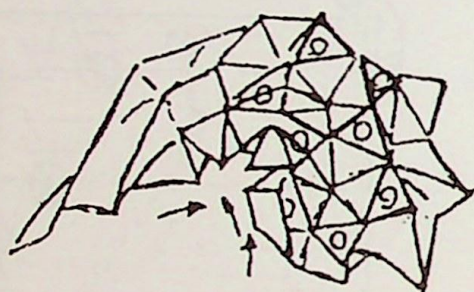




11

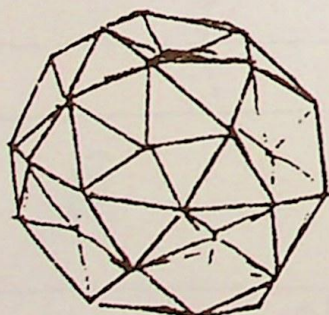


12

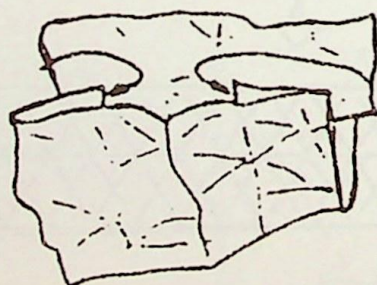


13

12の部分を重ね合わせ
 ○は3角. □は2つの部分で○.
 13のように折りすじ通りに折
 って開きにしてから一応伸ば
 して14のように5角の筒にしてか
 ら折る.

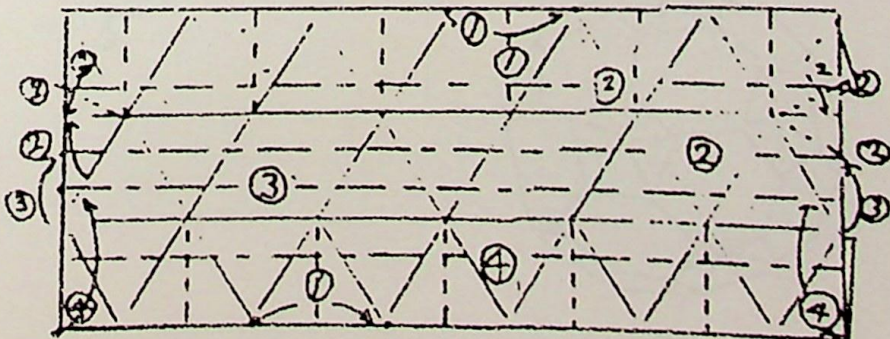
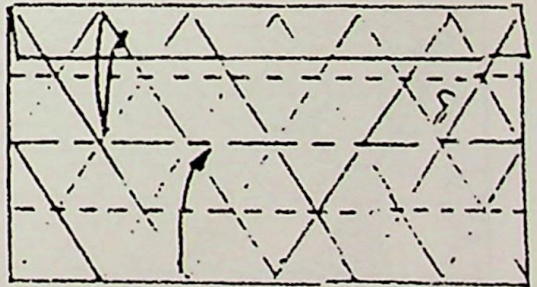
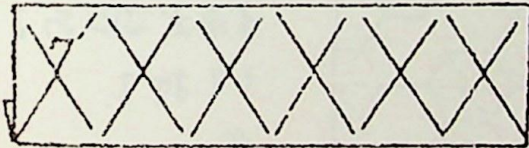
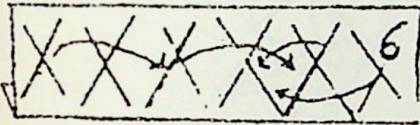
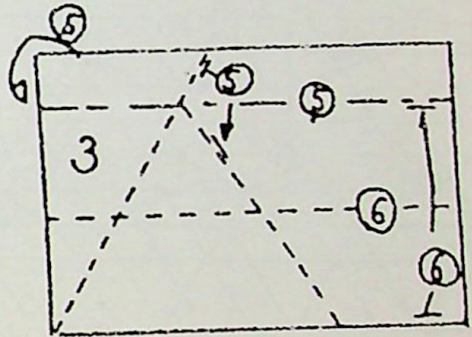
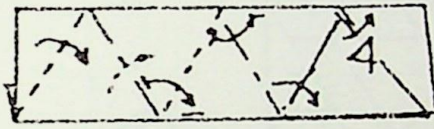
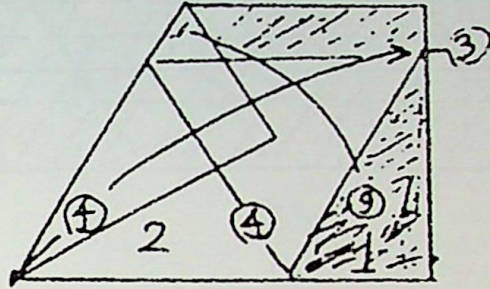
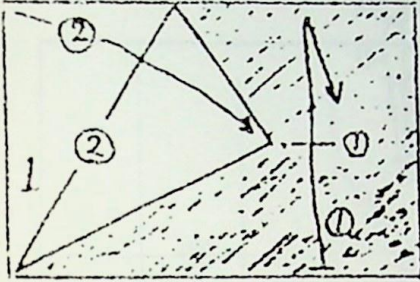


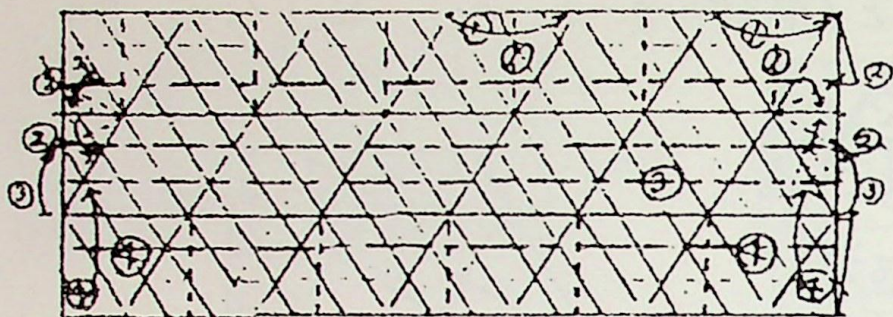
15



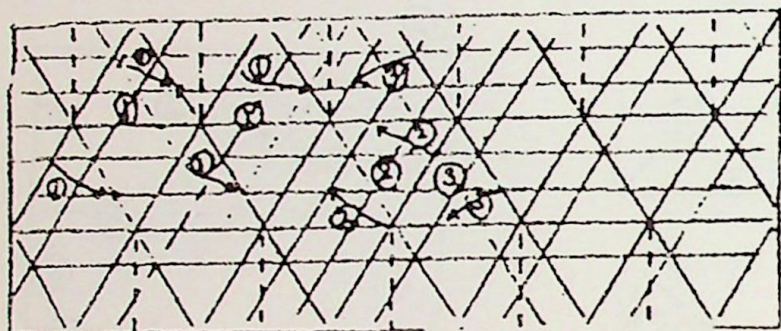
14

32面体 (5角と6角)(サッカーボール) Size 1:√2 41 B4

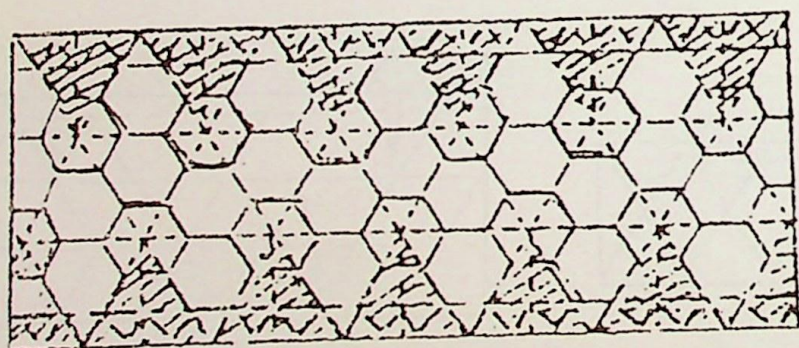




10

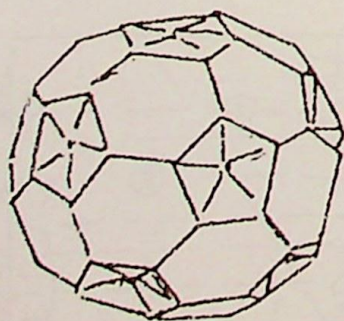


11



12

この折りやすい通りに
一度充分折ってから
5角が5つある筒に
して折る。

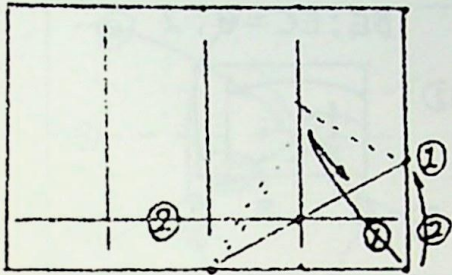


13

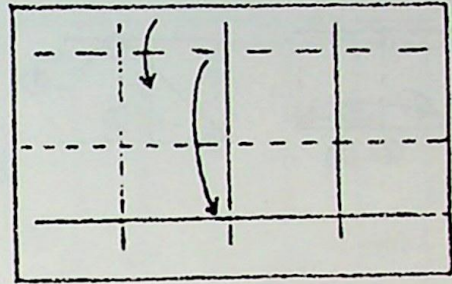
3角の箱

Size 1: $\sqrt{2}$

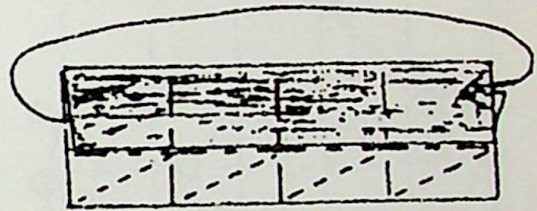
B5



4等分 1

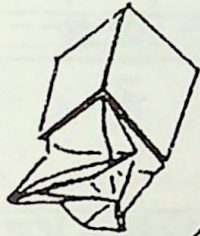


2



3

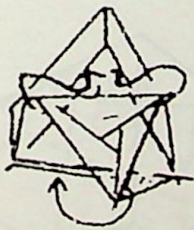
3角の筒にする。



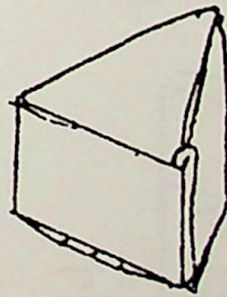
4



ねじる



5



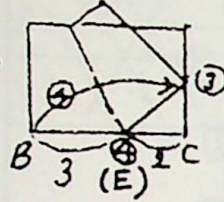
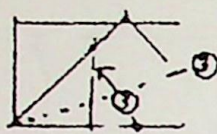
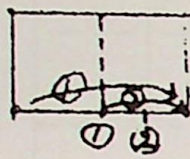
6

4角の箱

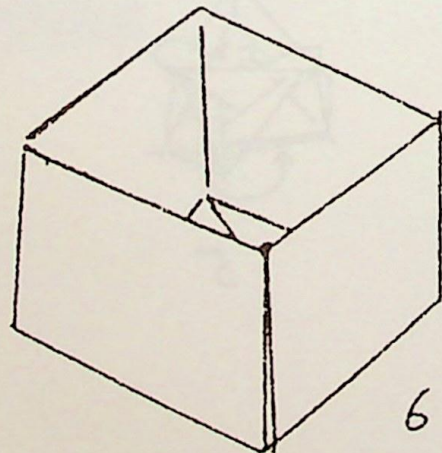
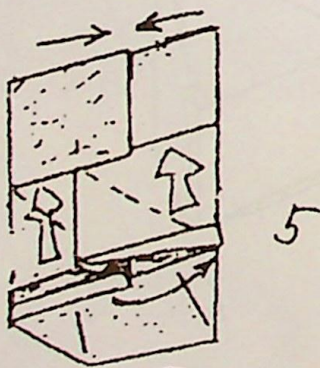
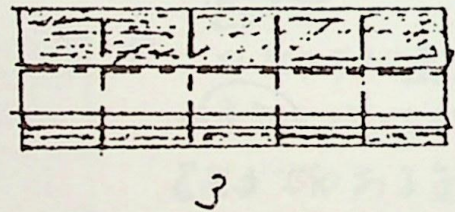
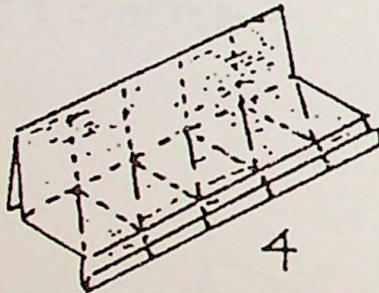
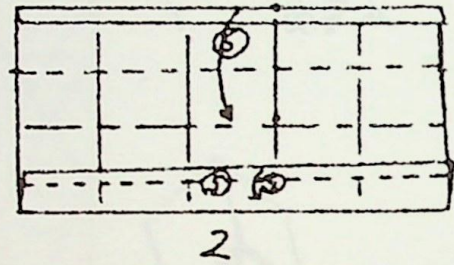
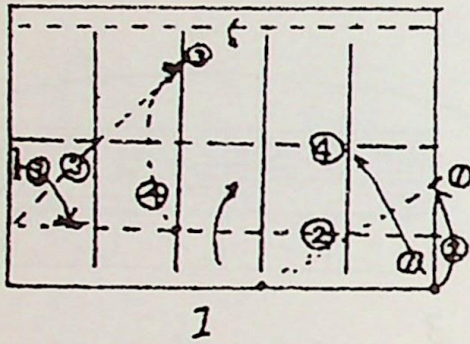
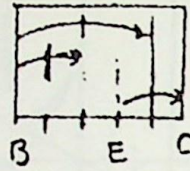
Size $1:\sqrt{2}$

B5

紙面の5等分...ルート分割法より

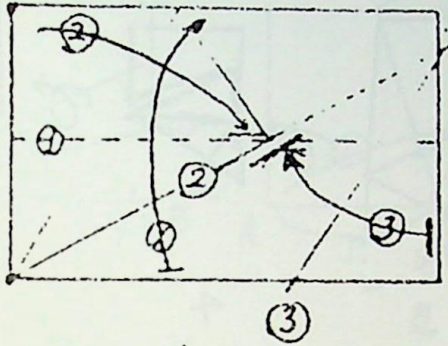


$BE:EC=3:2$

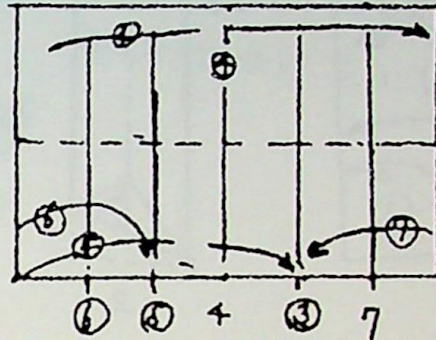


4角の筒にして
ねじって便利に
入れる。

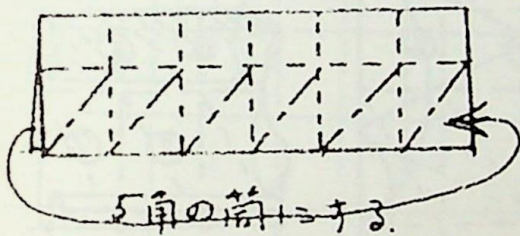
紙面を6等分する。



1



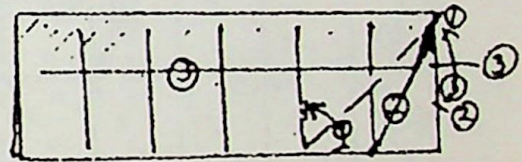
2



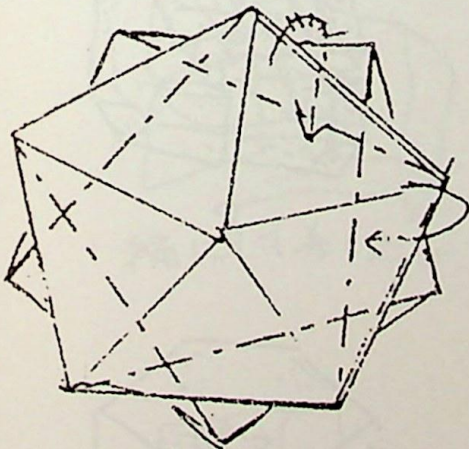
5角の筒にする。

4

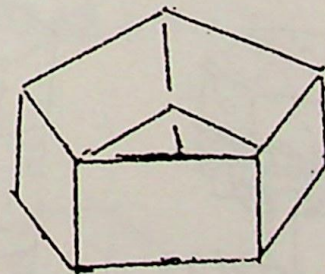
おじの通りねじる。



3



5

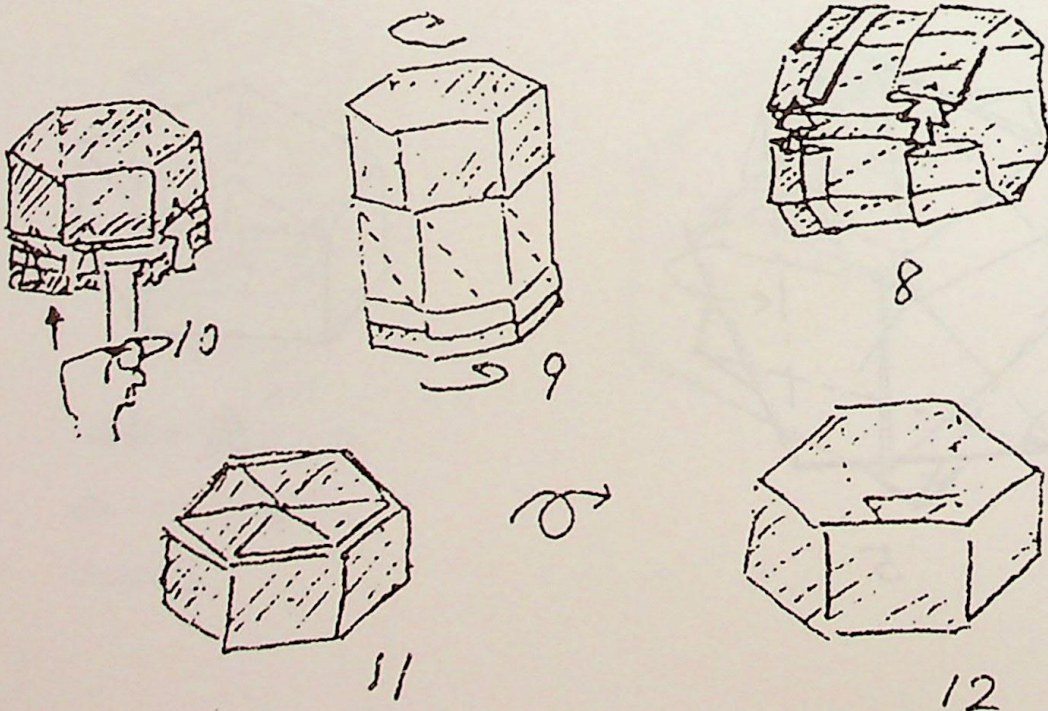
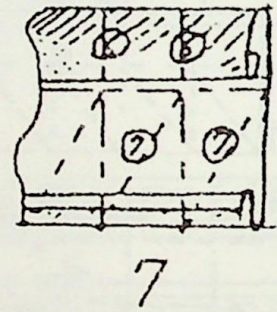
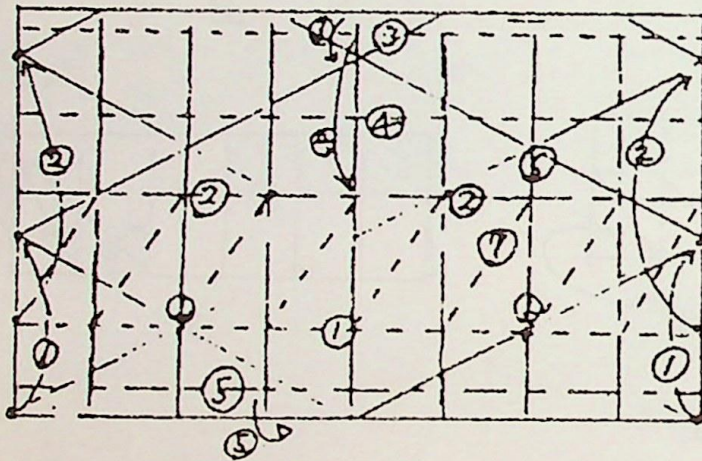
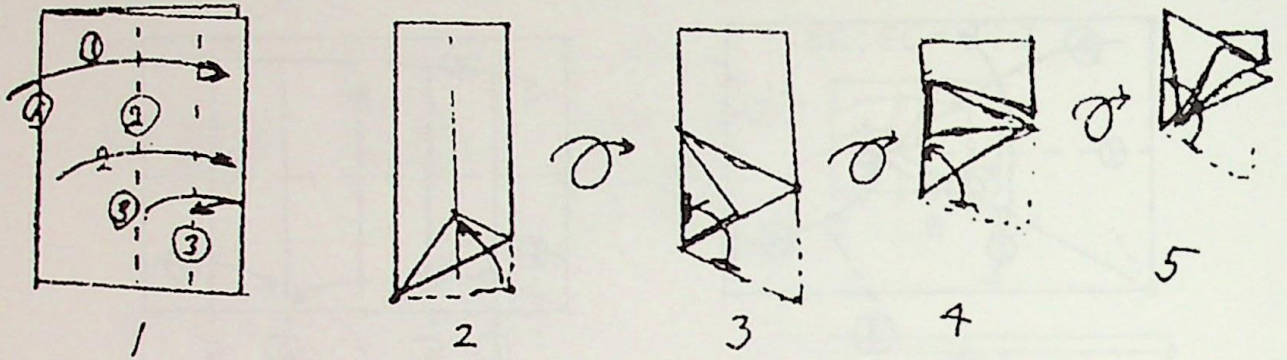


6

六角の箱

B4

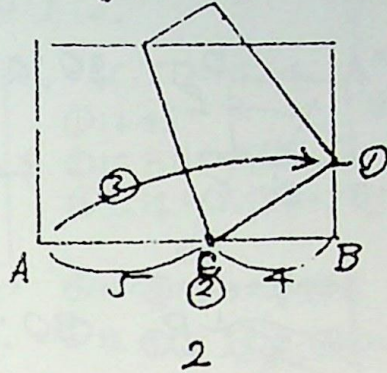
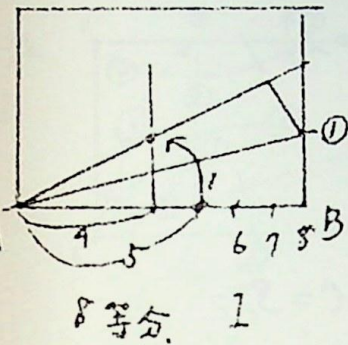
紙面を8等分する



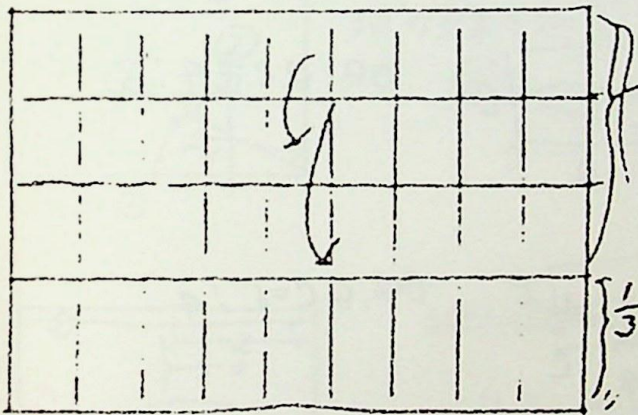
簡単な7角の箱の作り方

B4 (底の内折り)

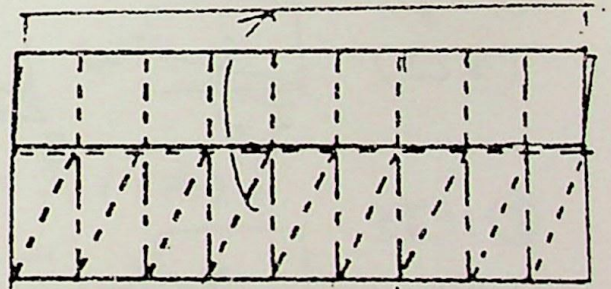
ルート分割法で横を9等分する



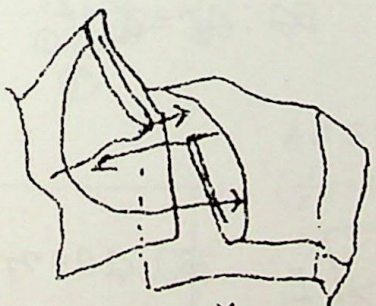
BCを4等分して折りすいと全体につける。



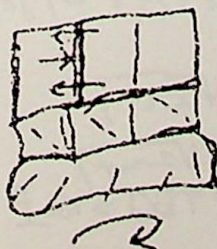
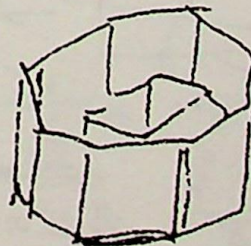
上の2/3の部分を3等分して2回折って箱の側にする。



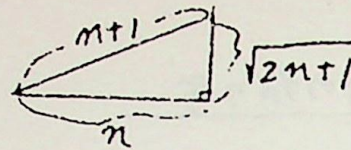
このように折ってすじをつけて後開く。後斜線をつける



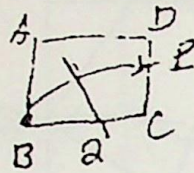
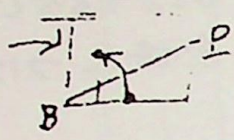
輪にして差込む



ルート分割法

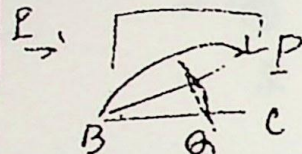
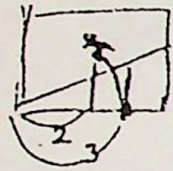


① 3等分



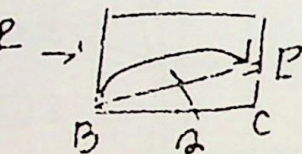
$BQ:QC=2:1$

② 5等分
(2と3)



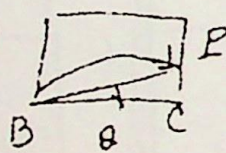
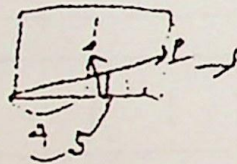
$BQ:QC=3:2$

③ 7等分
(3と4)



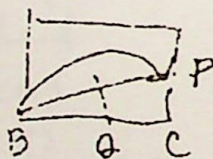
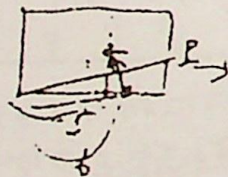
$BQ:QC=4:3$

④ 9等分
(4と5)



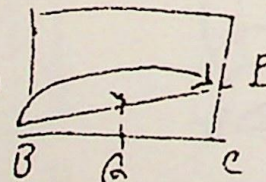
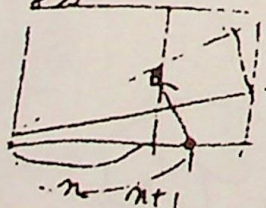
$BQ:QC=5:4$

⑤ 11等分
(5と6)



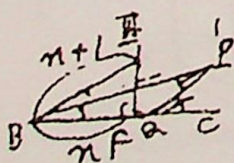
$BQ:QC=6:5$

⑥ $2n+1$ 等分
(n と $n+1$)



$BQ:QC=n:n+1$

証明

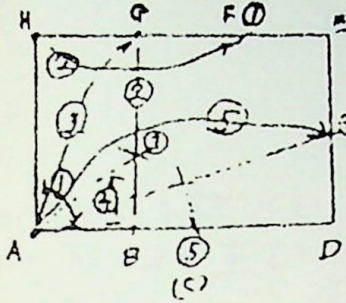


$\triangle BEF$ と $\triangle PQC$ は相似である。
 各辺の割合は
 $BE:BF:EF = n+1:n:\sqrt{2n+1}$
 $PQ:QC:CP = n+1:n:\sqrt{2n+1}$
 $\triangle BQ$ は等辺三角形の $TBQ = \angle P$

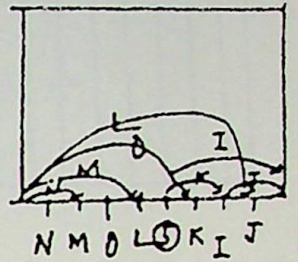
7角の相 B4

紙面を9等分する。

別法. I.
" 2. (30°法)
N+合割法,
理介近等分法.

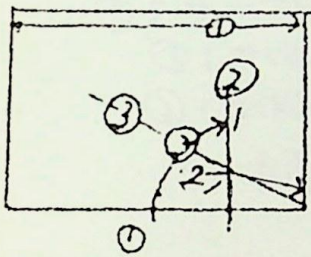


- AC:CD=5:4
- ①は45°
- ②はFHの中点
- ③点は④③:③B=5:3
- ④H④ABの2等分点
- ⑤は④③, ⑤D; ④D=5:4:3

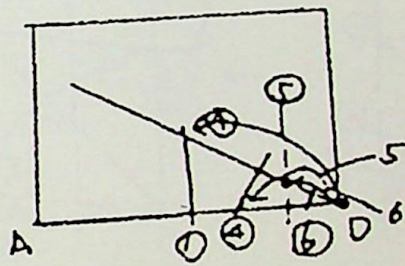


1

2.

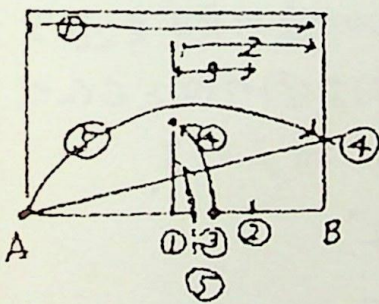


30°の角線を作す。
③



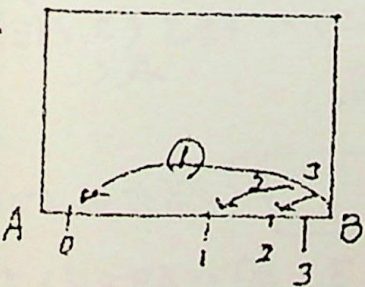
⑥Dが1/9AD
である。

3.

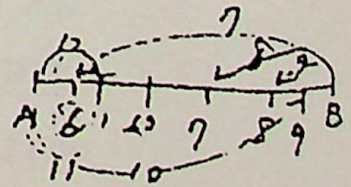
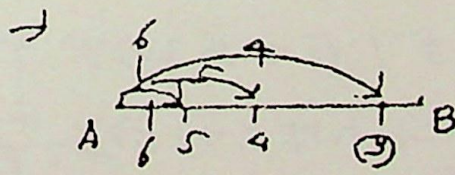


A⑤:⑤B=5:4,
(AB:④B=3:17ある)

4.



AOEが1/9ABを3等分して取す。
(1/8でも、かまわない)

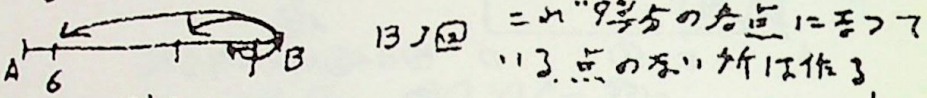
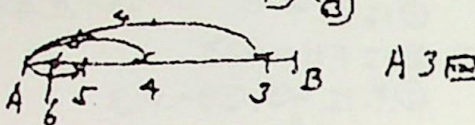
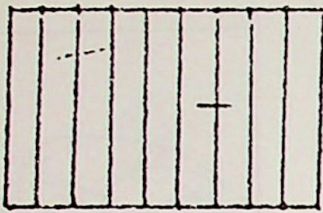


(6, 11, 10, 7, 8, 9の各点は
9等分の各点である)

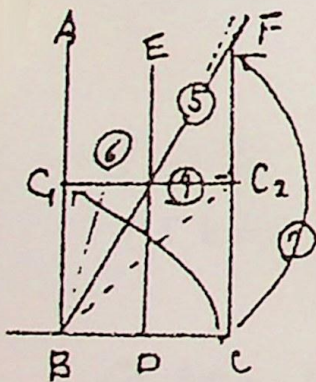
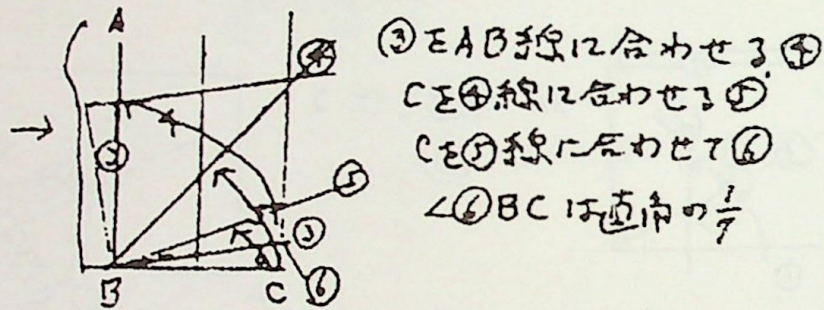
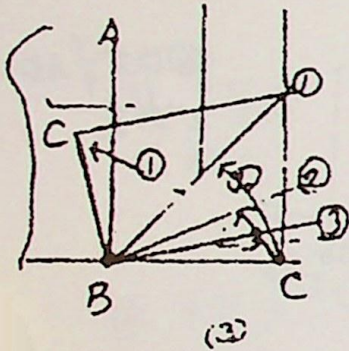
7角の箱

B4

紙面を9等分する。(漸近等分法) 操作は3.



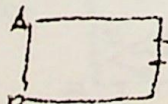
底になる部分の長さEとす。漸近法(直角Eを9等分する)



ABにBCを合わせ(5)の線とEDの線の交点Eを通る
横線C₁C₂E引く。この引き方は(5)の線とCC₂の
線の交点FにCE合わせれば得られる。
CC₂の長さはDCを1とすれば、

$$\tan \frac{5}{7} \times 90 = 2.07652 \text{ である。}$$

したがってCC₂はBCの長さより心持ち(2.1倍)
長くなるように取れば簡単である。

紙型が1:√2であるので、 3等分の1の
を長さにとれば、簡単である。図のABを1とす
れば、1/3 = 0.33... であるが正確には $\frac{\sqrt{2}}{9} \times \tan \frac{5}{7} \times 90$
= 0.32629... である。

2007年1月 300部 增刷
2008年6月 150部 增刷
2009年7月 150部 增刷