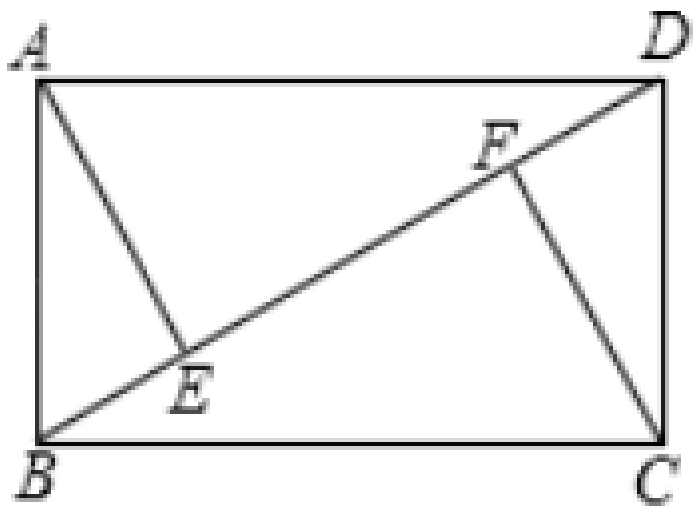


## 10 图形的性质之解答题

参考答案与试题解析

一. 解答题 (共 23 小题)

1. (2019? 舟山) 如图, 在矩形  $ABCD$  中, 点  $E, F$  在对角线  $BD$  . 请添加一个条件, 使得结论 “  $AE = CF$  ” 成立, 并加以证明.



**【答案】**解: 添加的条件是  $BE = DF$  (答案不唯一) .

证明:  $\because$  四边形  $ABCD$  是矩形,

$\therefore AB \parallel CD$  ,  $AB = CD$  ,

$\therefore \angle ABD = \angle BDC$  ,

又  $\because BE = DF$  (添加),

$\therefore \triangle ABE \cong \triangle CDF$  (SAS),

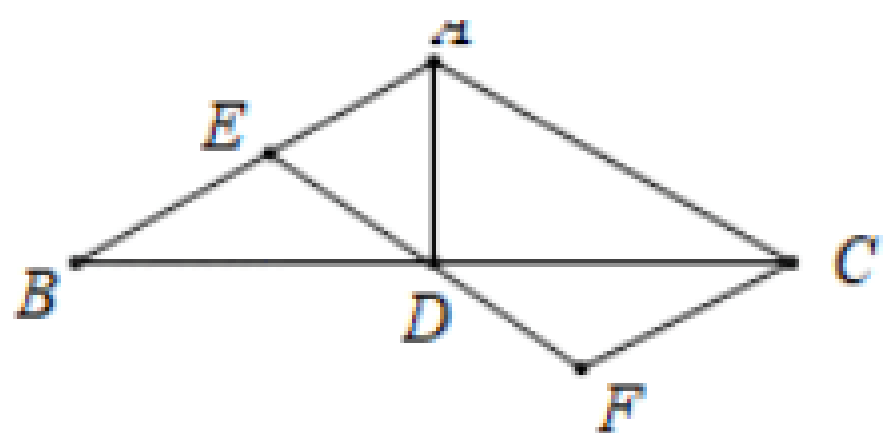
$\therefore AE = CF$  .

**【点睛】** 本题考查矩形的性质、全等三角形的判定和性质等知识, 解题的关键是熟练掌握全等三角形的判定方法, 属于中考常考题型.

2. (2019? 温州) 如图, 在  $\triangle ABC$  中,  $AD$  是  $BC$  边上的中线,  $E$  是  $AB$  边上一点, 过点  $C$  作  $CF \parallel AB$  交  $ED$  的延长线于点  $F$  .

(1) 求证:  $\triangle BDE \cong \triangle CDF$  .

(2) 当  $AD \perp BC$  ,  $AE = 1$  ,  $CF = 2$  时, 求  $AC$  的长.



**【答案】** (1) 证明:  $\because CF \parallel AB$  ,

$\therefore \angle B = \angle FCD$  ,  $\angle BED = \angle F$  ,

$\because AD$  是  $BC$  边上的中线,

$\therefore BD = CD$  ,

$\therefore \triangle BDE \cong \triangle CDF$  (AAS);

(2) 解:  $\because \triangle BDE \cong \triangle CDF$ ,

$\therefore BE = CF = 2$ ,

$\therefore AB = AE + BE = 1 + 2 = 3$ ,

$\because AD \perp BC$ ,  $BD = CD$ ,

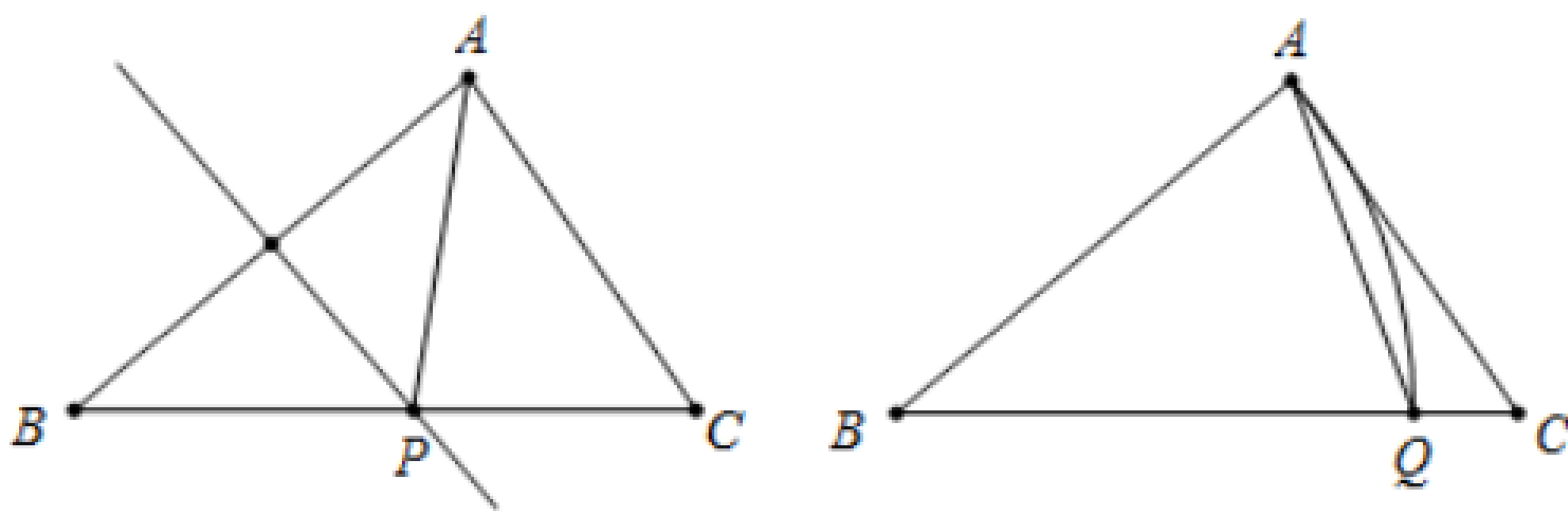
$\therefore AC = AB = 3$ .

**【点睛】** 本题考查了全等三角形的判定和性质, 平行线的性质, 熟练掌握全等三角形的判定和性质是解题的关键.

3. (2019? 杭州) 如图, 在  $\triangle ABC$  中,  $AC < AB < BC$ .

(1) 已知线段  $AB$  的垂直平分线与  $BC$  边交于点  $P$ , 连接  $AP$ , 求证:  $\angle APC = 2\angle B$ .

(2) 以点  $B$  为圆心, 线段  $AB$  的长为半径画弧, 与  $BC$  边交于点  $Q$ , 连接  $AQ$ . 若  $\angle AQC = 3\angle B$ , 求  $\angle B$  的度数.



**【答案】** 解: (1) 证明:  $\because$  线段  $AB$  的垂直平分线与  $BC$  边交于点  $P$ ,

$\therefore PA = PB$ ,

$\therefore \angle B = \angle BAP$ ,

$\because \angle APC = \angle B + \angle BAP$ ,

$\therefore \angle APC = 2\angle B$ ;

(2) 根据题意可知  $BA = BQ$ ,

$\therefore \angle BAQ = \angle BQA$ ,

$\because \angle AQC = 3\angle B$ ,  $\angle AQC = \angle B + \angle BAQ$ ,

$\therefore \angle BQA = 2\angle B$ ,

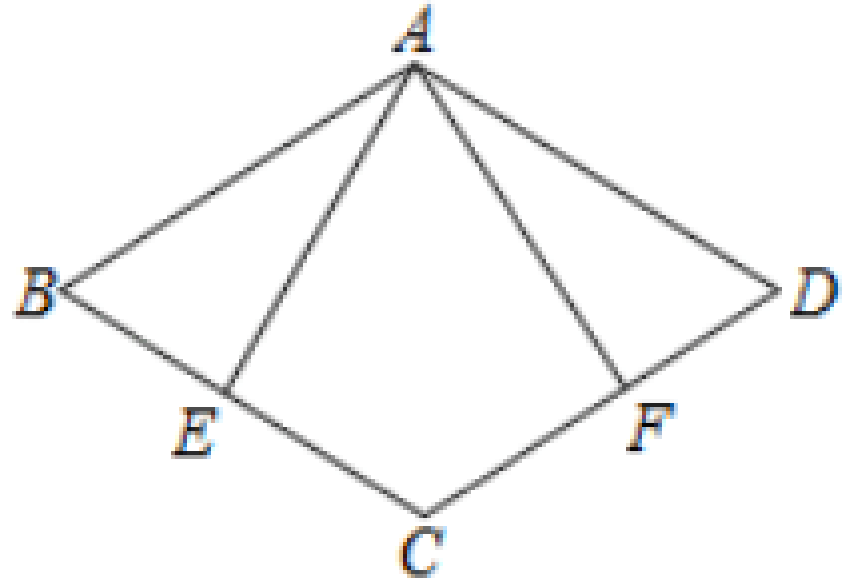
$\because \angle BAQ + \angle BQA + \angle B = 180^\circ$ ,

$\therefore 5\angle B = 180^\circ$ ,

$\therefore \angle B = 36^\circ$ .

4 2019? ABCD E F BC CD BE DF AE AF

AE AF



ABCD

AB AD B D

BE DF

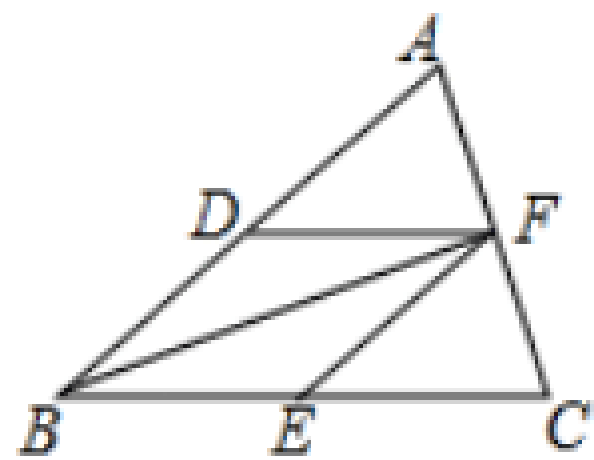
ABE ADF SAS

AE CF

5 2019? ABC D E F AB BC AC DF EF BF

1 BEFD

2 AFB 90 AB 6 BEFD



1 D E F AB BC AC

DF BC EF AB

DF BE EF BD

BEFD

2 AFB 90 D AB AB 6

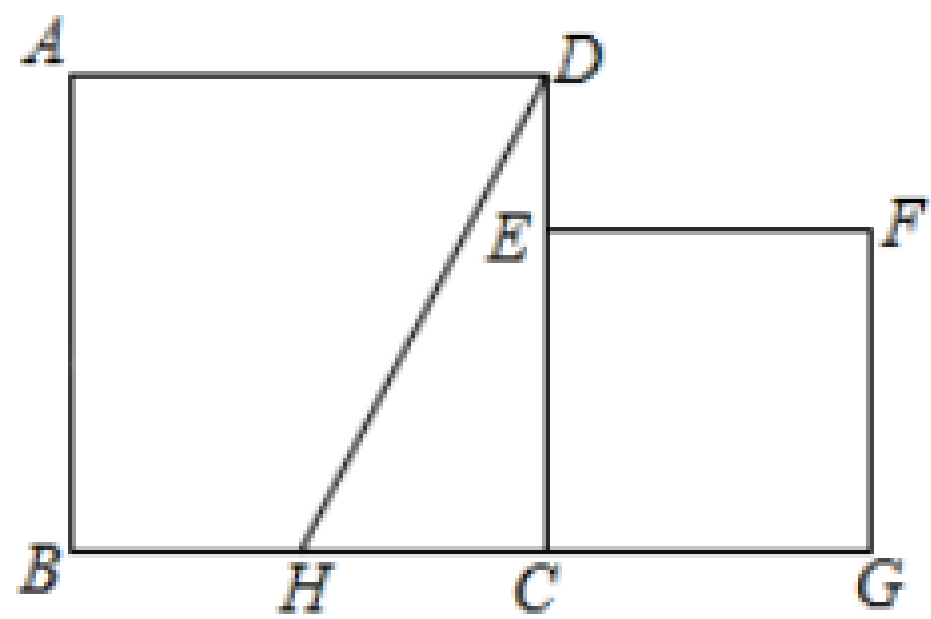
DF DB DA  $= \frac{1}{2} AB$  3

BEFD

BEFD

DB 3

6 2019? ABCD 1 CEFG S<sub>1</sub> E DC G  
 BC AD DE S<sub>2</sub> S<sub>1</sub> S<sub>2</sub>  
 1 CE  
 2 H BC HD HD HG



1 CEFG a  
 ABCD 1

DE 1 a

S<sub>1</sub> S<sub>2</sub>

a<sup>2</sup> 1 1 a

$$a_1 = \frac{\sqrt{5}}{2} - \frac{1}{2}$$

$$a_2 = \frac{\sqrt{5}}{2} - \frac{1}{2}$$

CE  $\frac{\sqrt{5}}{2} - \frac{1}{2}$

2 H BC BC 1

CH 0.5

DH  $= \sqrt{1^2 + 0.5^2} = \frac{\sqrt{5}}{2}$

CH 0.5 CG  $= \frac{\sqrt{5}}{2} - \frac{1}{2}$

HG  $= \frac{\sqrt{5}}{2}$

HD HG

7 2019?

EFGH

E G

ABCD

AD BC

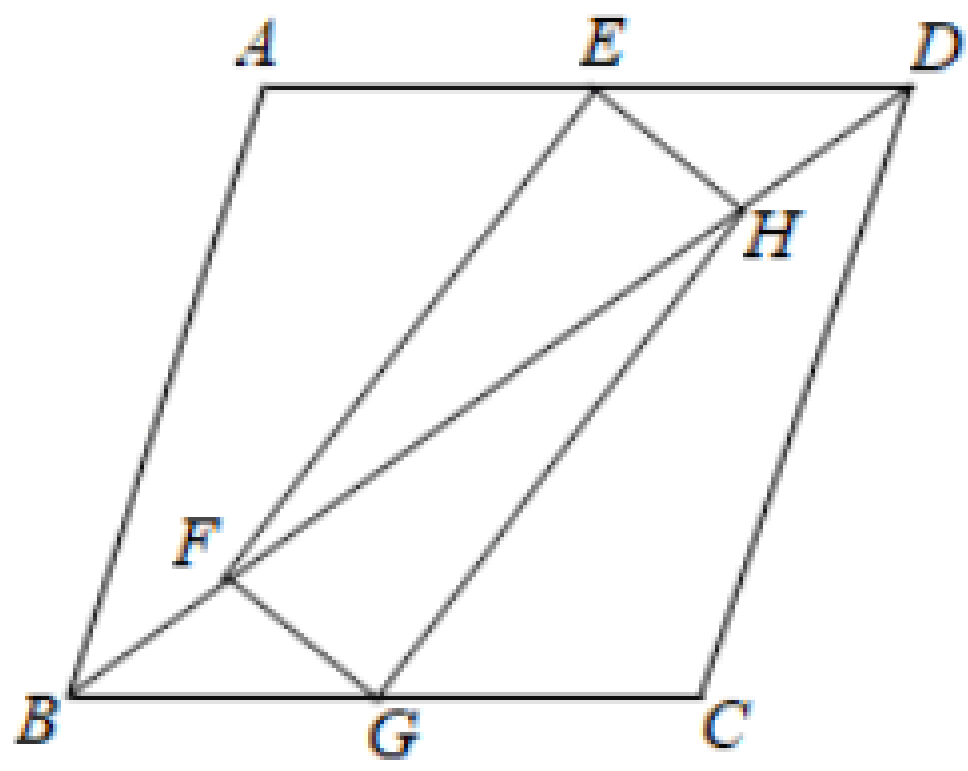
F H

ABCD

BD

1 BG DE

2 E AD FH 2 ABCD



1 EFGH

EH FG EH FG

GFH EHF

BFG 180 GFH DHE 180 EHF

BFG DHE

ABCD

AD BC

GBF EDH

BGF DEH AAS

BG DE

2 EG

ABCD

AD BC AD BC

E AD

AE ED

BG DE

AE BG AE BG

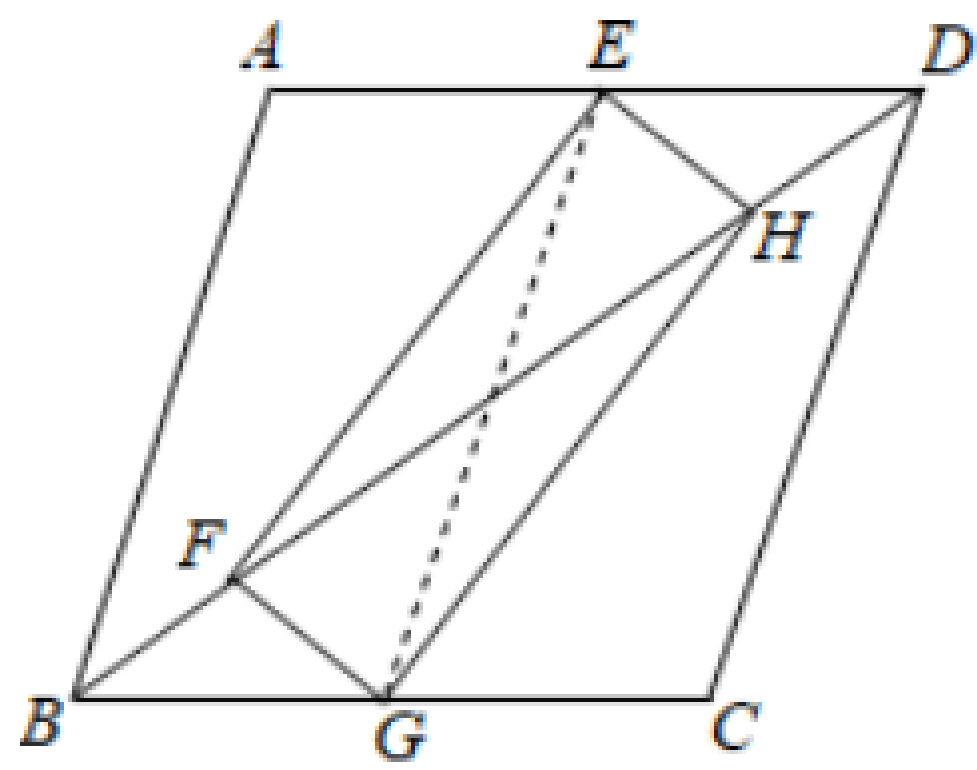
ABGE

AB EG

EG FH 2

AB 2

ABCD 8



8 2019?

6 6

A B C

1 1

D

A B C D

2 2

AB

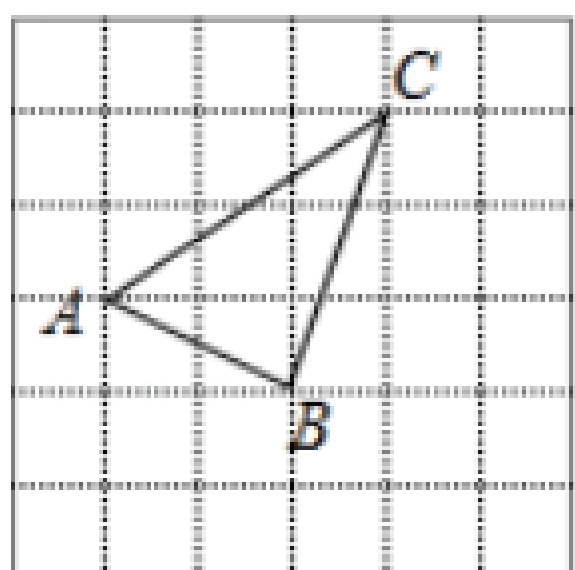


图1

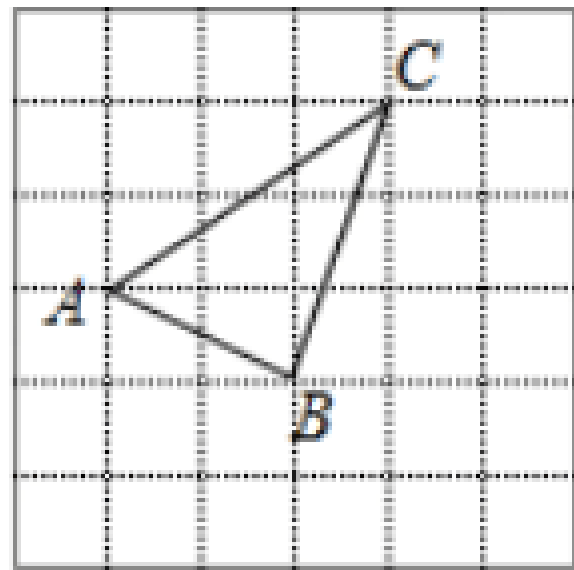


图2

1

CD AB CD' =  $\sqrt{5}$  BD AC BD' =  $\sqrt{13}$

AD' BC AD' =  $\sqrt{10}$

1

2 2

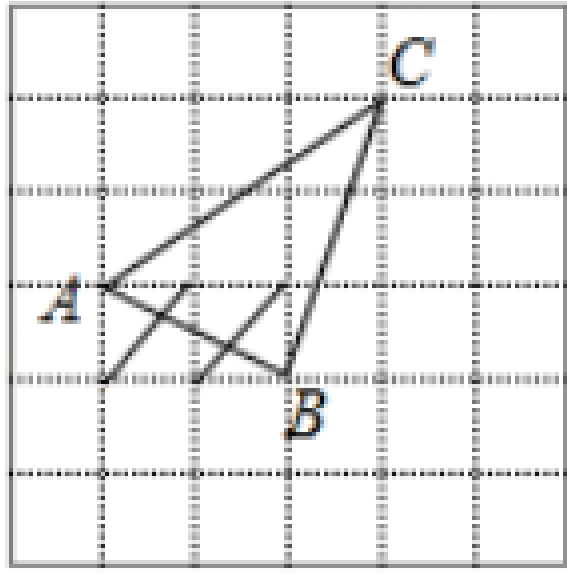


图2

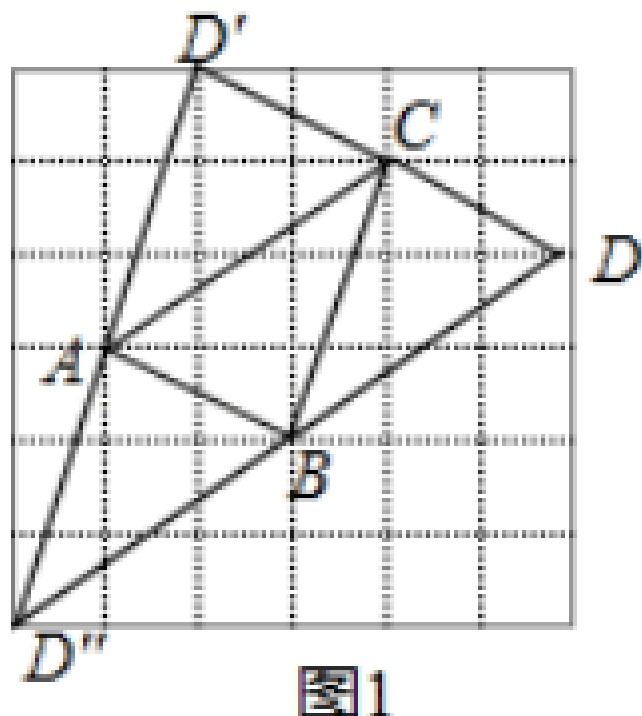


图1

9 2019?

7 5

ABCD

A B C D

1 1

EFG

E F G

AB BC CD

EFG 90

2 2

MNPQ

M N P Q

AB BC CD DA

MP

NQ



图1

1

EFG

1 2



图2

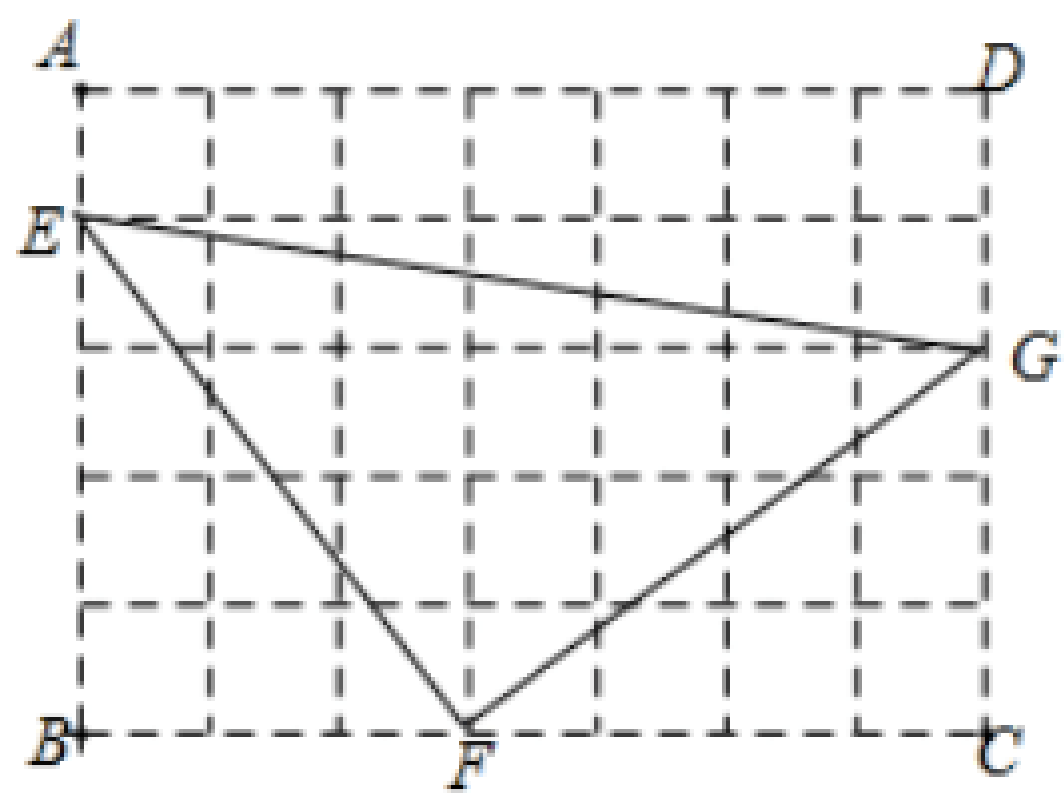


图1

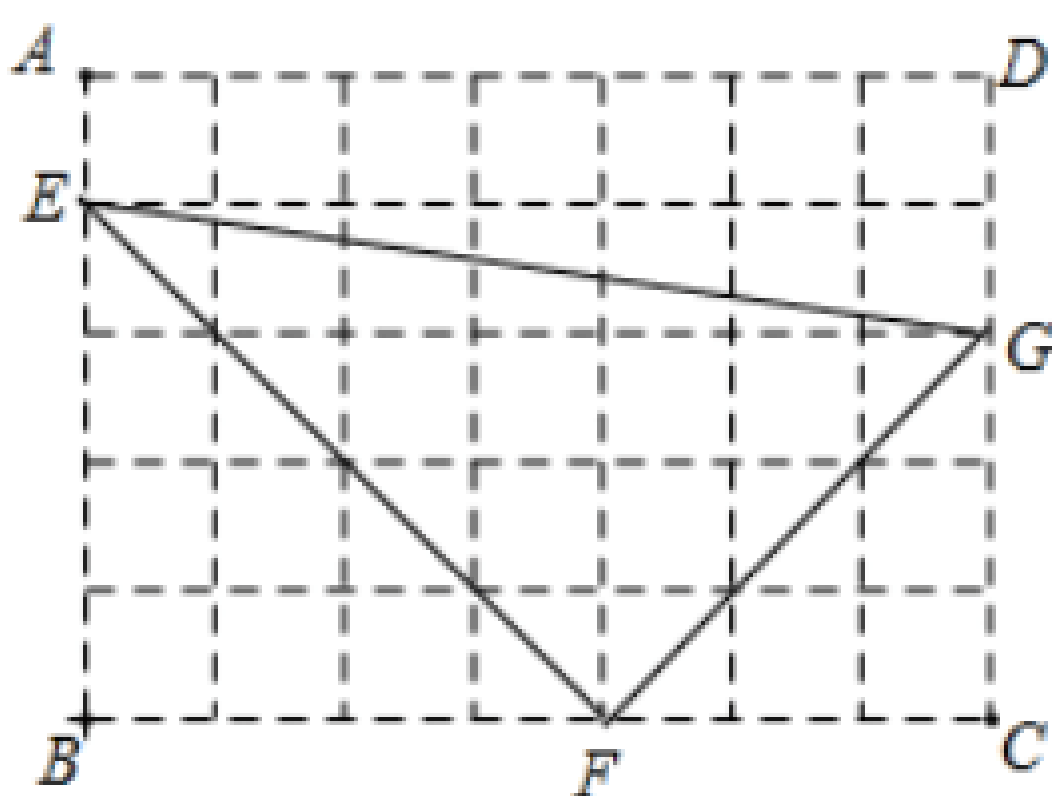


图2

2

MNPQ

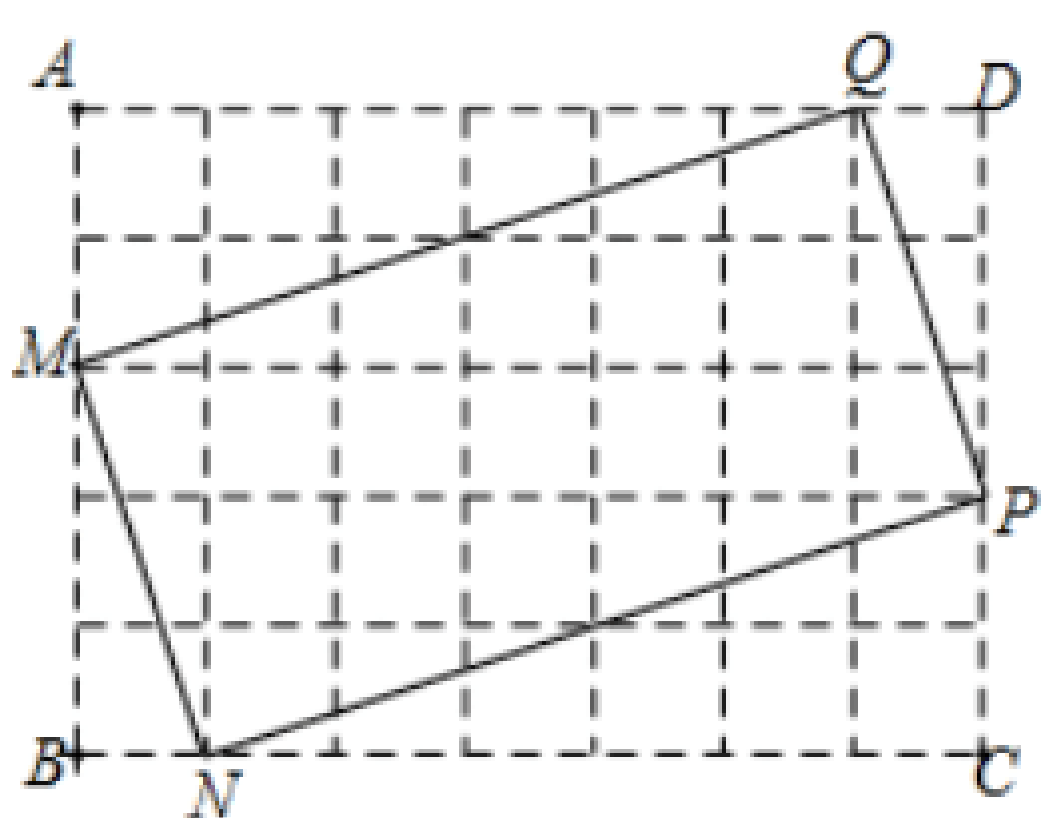


图3

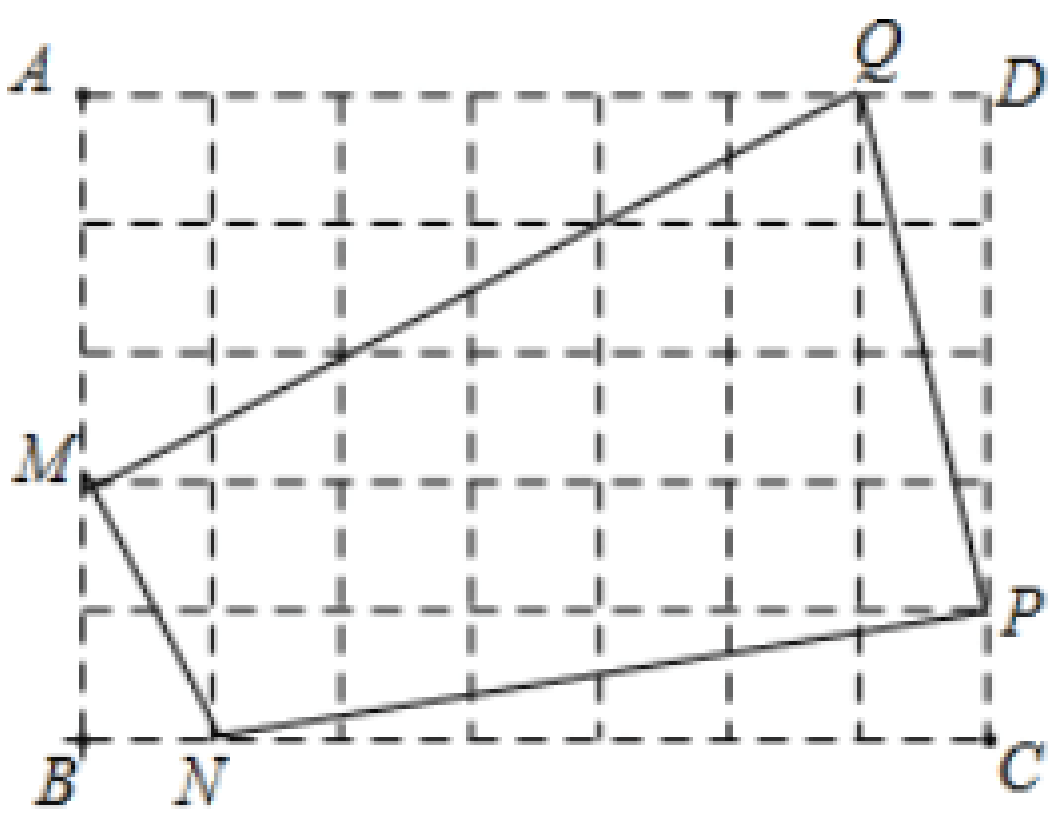


图4

10 2019?

4 4

ABC

1 1

CD CD CB

D

2 2

ABEC E

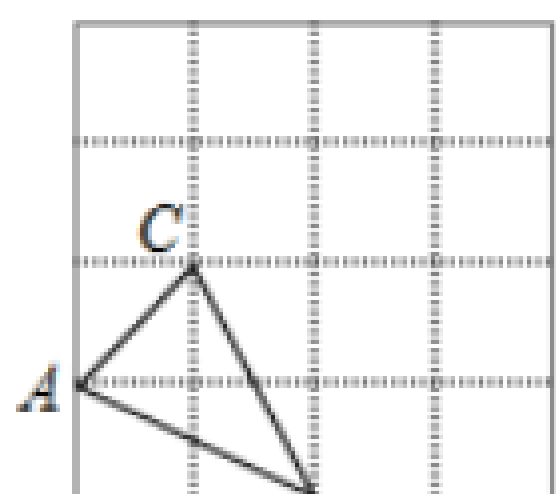


图1

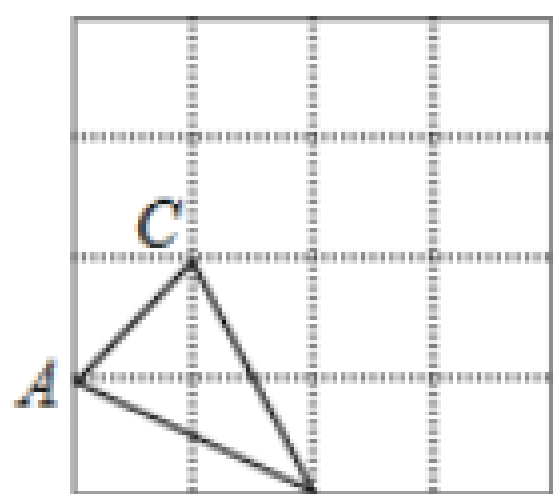


图2

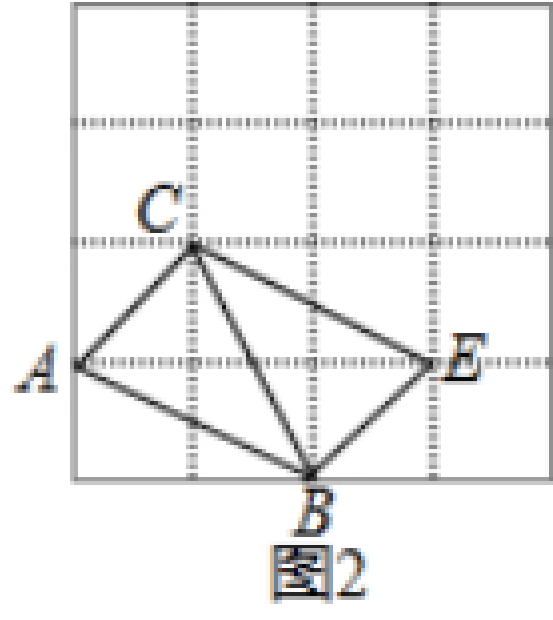
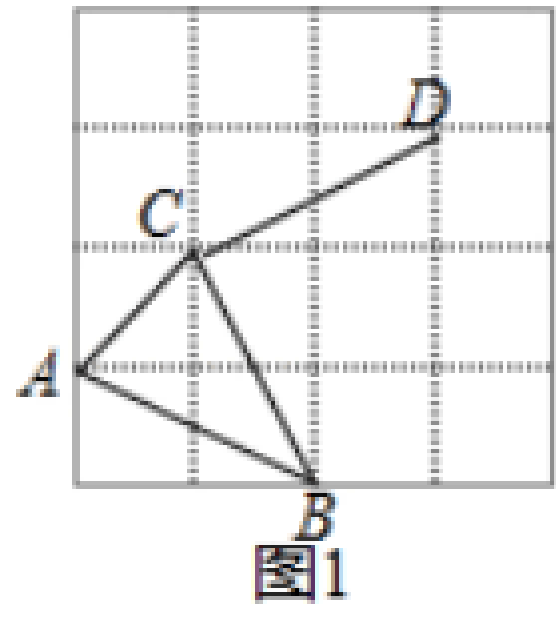
1

CD

2

ABEC





11 2019?

7 6

ABC

EF E F

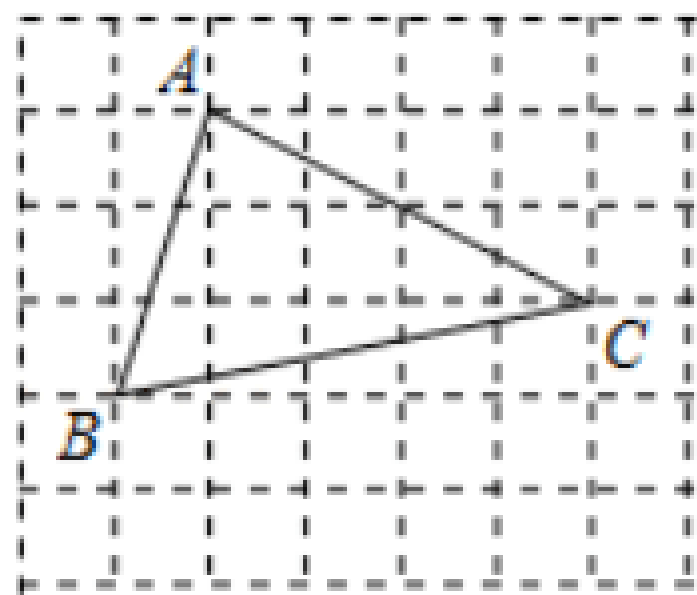


图1: EF平分BC

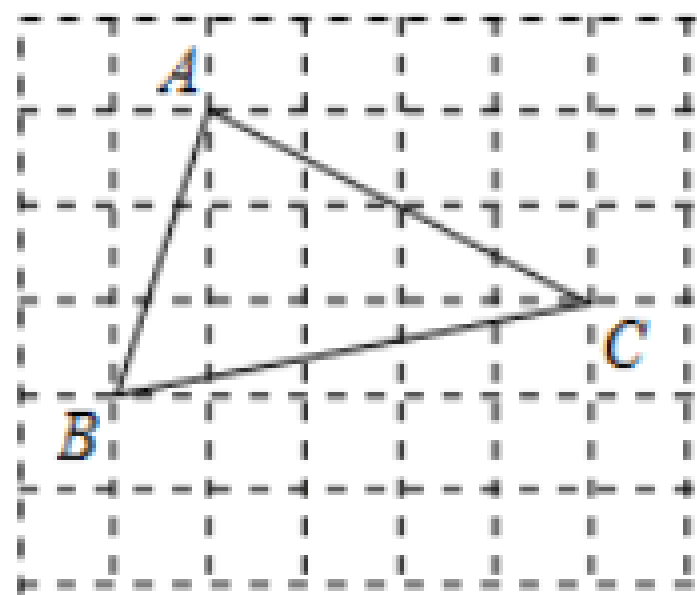


图2: EF⊥AC

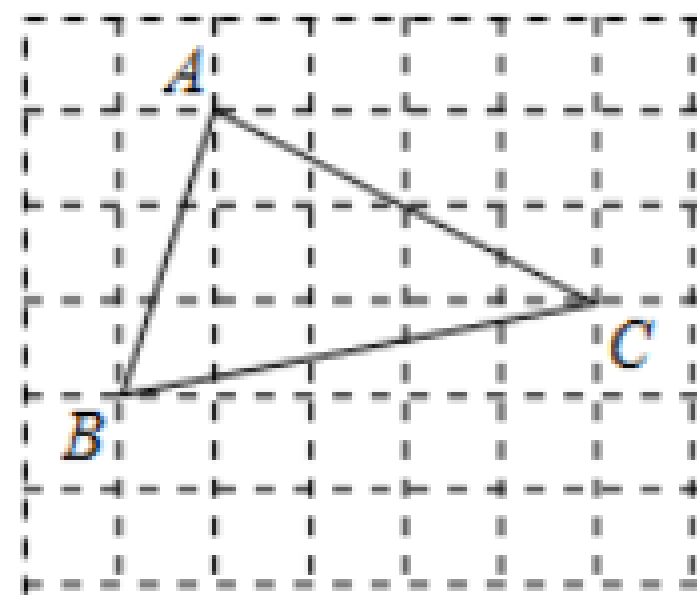


图3: EF垂直平分AB

AC

E

E

AB

F

EG

BC

$EC = \sqrt{5}$   $EF = \sqrt{5}$   $FC = \sqrt{10}$

F

EF AC

AB

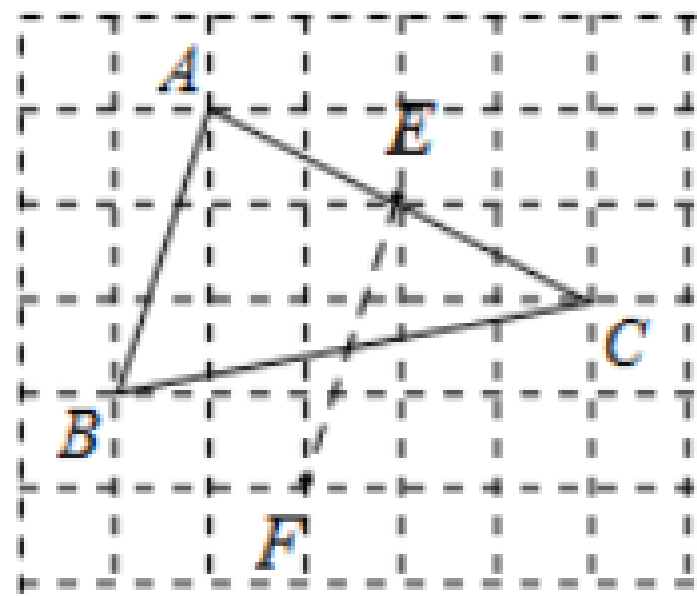


图1: EF平分BC

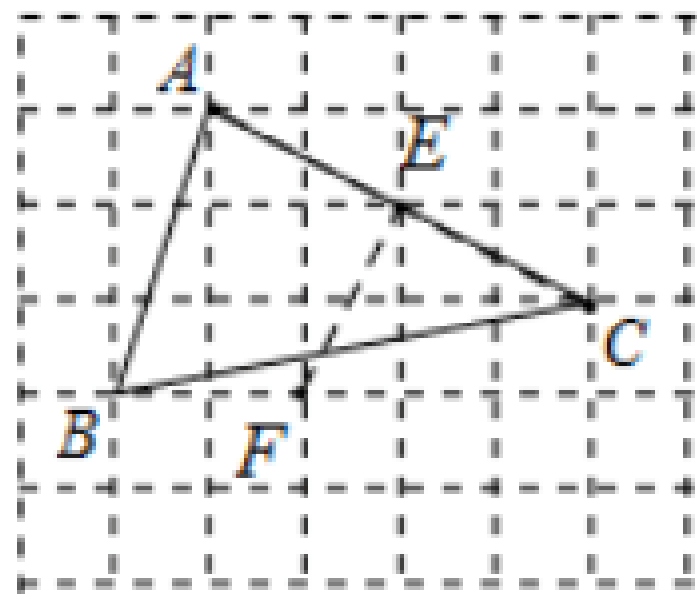


图2: EF⊥AC

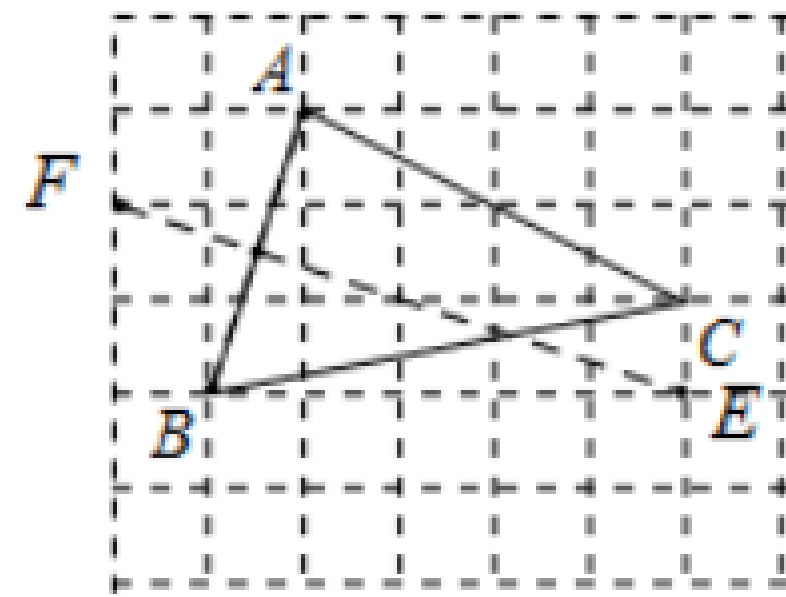


图3: EF垂直平分AB

12 2019?

ABCDE

AB

AE

6

BC

5

A

B 90

C

135

E 90

AE

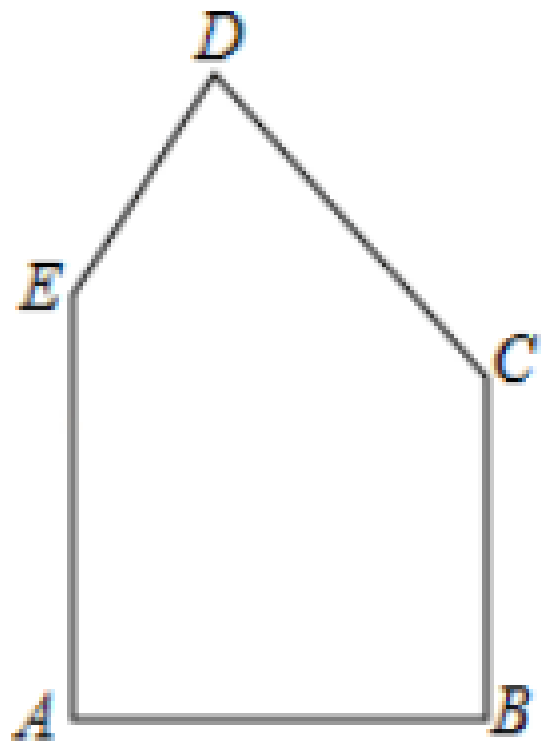
1

BC

AE

2

1



1

BC

1

C CF AE F S<sub>1</sub> AB?BC 6 5 30

AE 2

E EF AB CD F FG AB G C CH FG H

AEFG

BCHG

C 135

FCH 45

CHF

AE FG 6 HG BC 5 BG CH FH

BG CH FH FG HG 6 5 1

AG AB BG 6 1 5

S<sub>2</sub> AE ?AG 6 5 30

2

CD F F FM AB M FN AE N C CG FM G

ANFM

BCGM

C 135

FCG 45

CGF

MG BC 5 BM CG FG DG

AM x BM 6 x

FM GM +FG GM +CG BC +BM 11 x

S AM FM x 11 x x<sup>2</sup>+11x x 5.5<sup>2</sup>+30.25

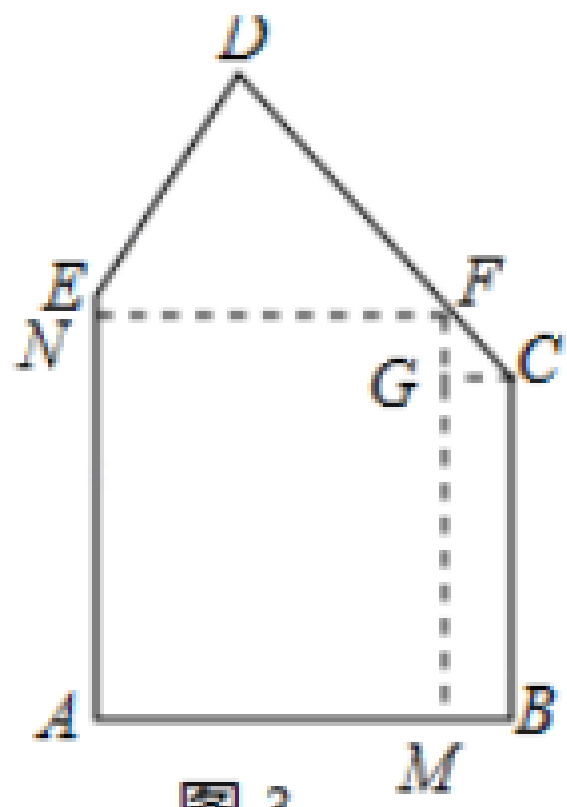


图 3

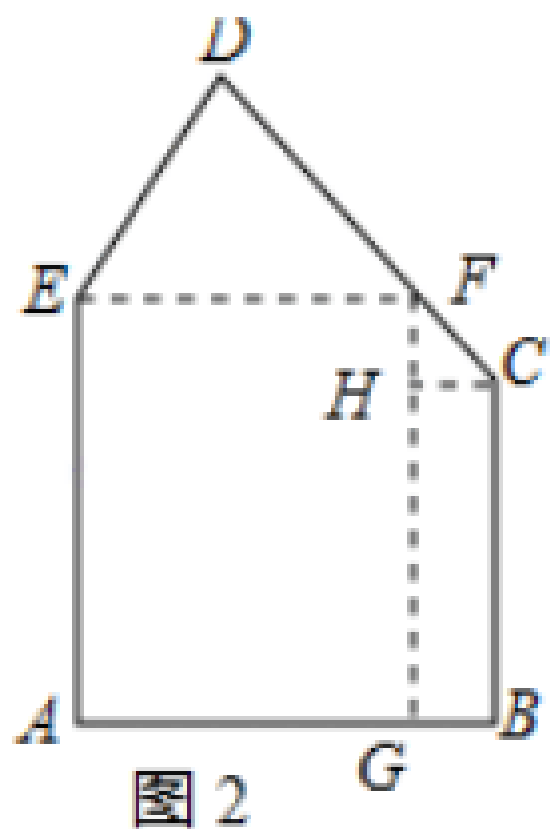


图 2

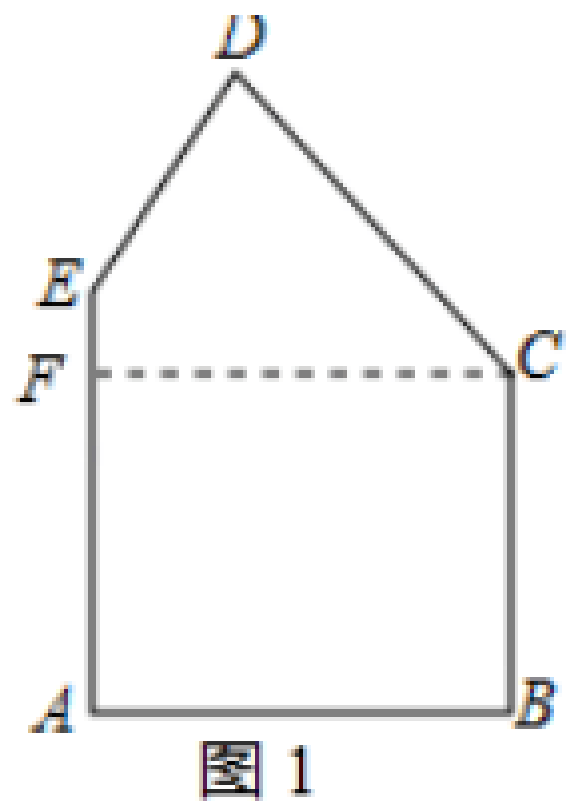


图 1

13 2019?

1 1 ABC AB AC AD ABC E F BD AD

ABEF

2 2 5 4 A B ABEF AB

E F

3 3 1 EF M DM AB Q EF AC N

N AC DE 2BE QB 3 AB

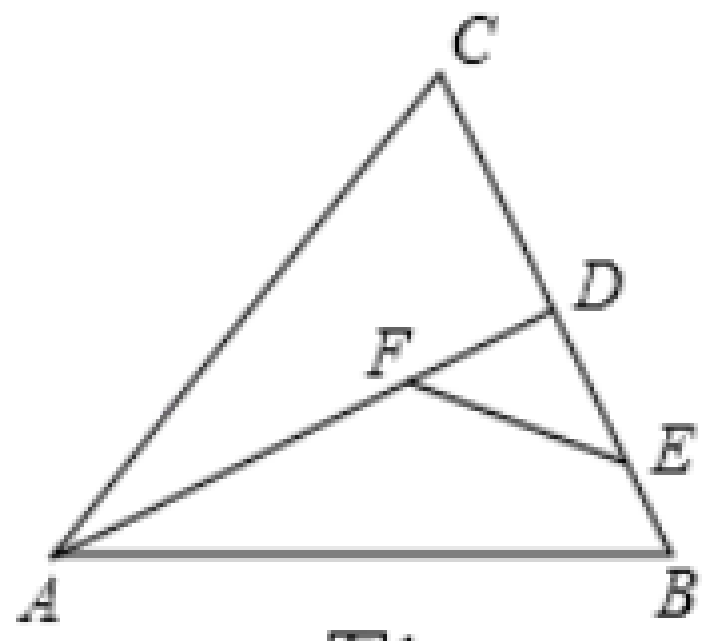


图1

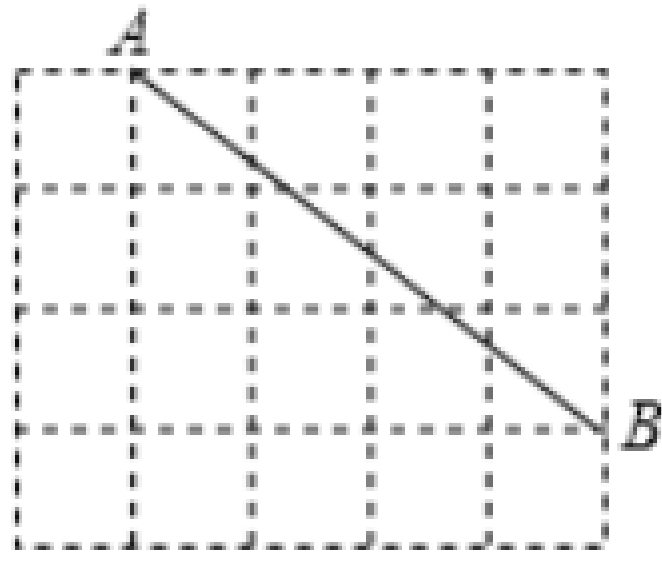


图2

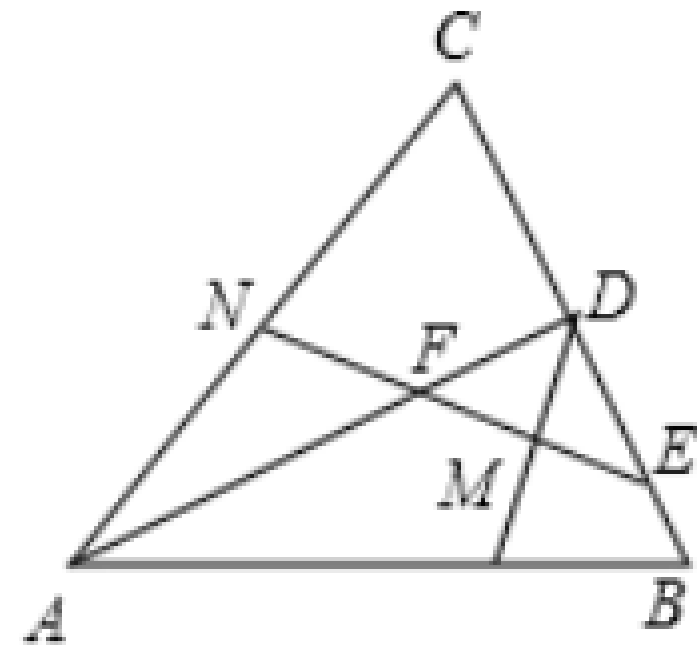


图3

1 AB AC AD ABC

AD BC ADB 90 DAB+ DBA 90

FAB EBA

ABEF

2

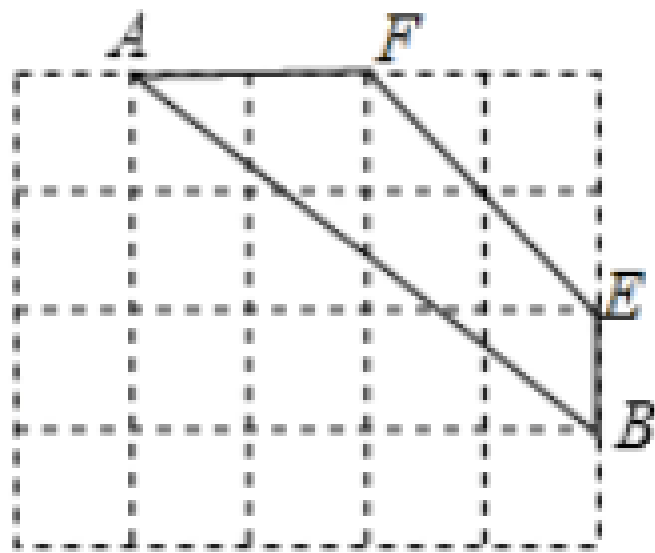


图2

AFEB

3 AB AC AD ABC

BD CD

DE 2BE

BD CD 3BE

CE CD+DE 5BE

EDF 90 M EF

DM ME

MDE MED

AB AC

B C

DBQ ECN

$$\frac{QB}{NC} = \frac{BD}{CE} = \frac{3}{5}$$

QB 3

NC 5

AN CN

AC 2CN 10

AB AC 10

14 2019?

3

1 ABCDE

1 AC AD BE BD CE ABCDE

2 AC BE CE ABCDE

2

3 ABCDEF

AC CE EA ABCDEF

AD BE CF ABCDEF

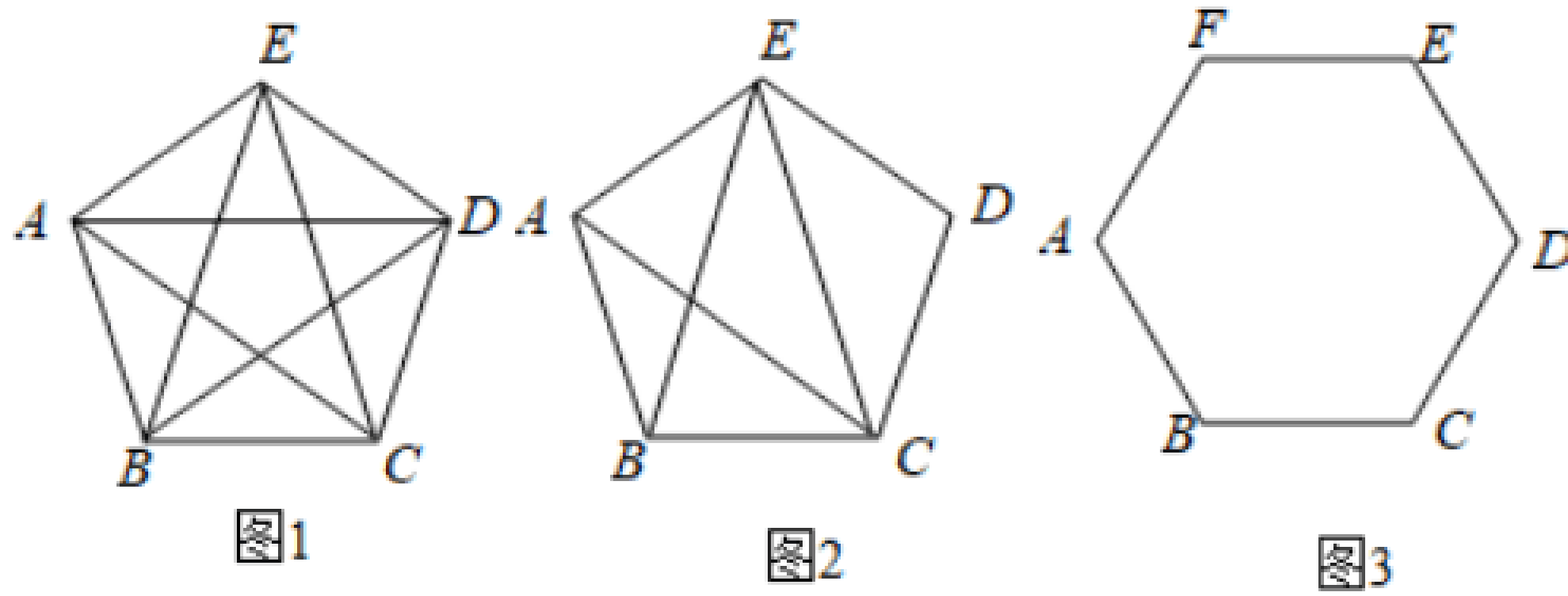


图1

图2

图3

1 ABCDE

AB BC CD DE EA

ABC BCD CDE DEA EAB

ABC BCD CDE DEA EAB SSS

$$\begin{cases} AB = BC = CD = DE = EA \\ BC = CD = DE = EA = AB \\ AC = BD = CE = DA = BE \end{cases}$$

ABC BCD CDE DEA EAB

ABCDE

AC BE CE ABCDE

ABE BCA DEC  $\begin{cases} AE = BA = DC \\ AB = BC = DE \\ BE = AC = CE \end{cases}$

ABE BCA DEC SSS

BAE CBA EDC AEB ABE BAC BCA DCE DEC

ACE BEC  $\begin{cases} AE = BC \\ CE = BE \\ AC = CE \end{cases}$

ACE BEC SSS

ACE CEB CEA CAE EBC ECB

ABCE 360

ABC+ ECB 180

AB CE

ABE BEC BAC ACE

CAE CEA 2 ABE

BAE 3 ABE

CBA D AED BCD 3 ABE BAE

ABCDE

2 AC CE EA 3

ABCDEF

ABCDEF

AB BC CD DE EF FA

AEF CAB ECD  $\begin{cases} EF = AB = CD \\ AF = CB = ED \\ AE = CA = EC \end{cases}$

AEF CAB ECD SSS

AEF CAB ECD F D B 90

ABCDEF

AD BE CF ABCDEF

4 AE AC CE BF

BFE FBC  $\begin{cases} EF = CB \\ BE = FC \\ BF = FB \end{cases}$

BFE FBC SSS

BFE FBC

AB AF

AFB ABF

AFE ABC

FAE BCA  $\begin{cases} AF = CB \\ \angle AFE = \angle CBA \\ EF = AB \end{cases}$

FAE BCA SAS

AE CA

AE CE

AE CA CE

AEF CAB ECD

F D B 90

120

ABCDEF

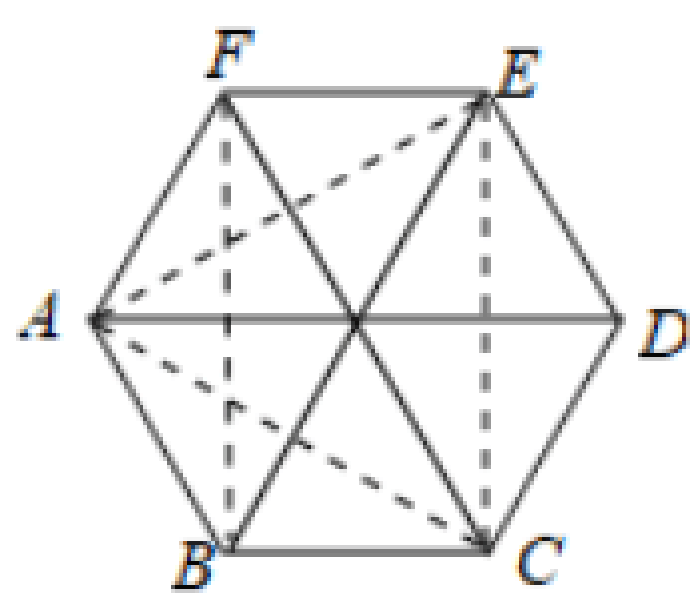


图 4

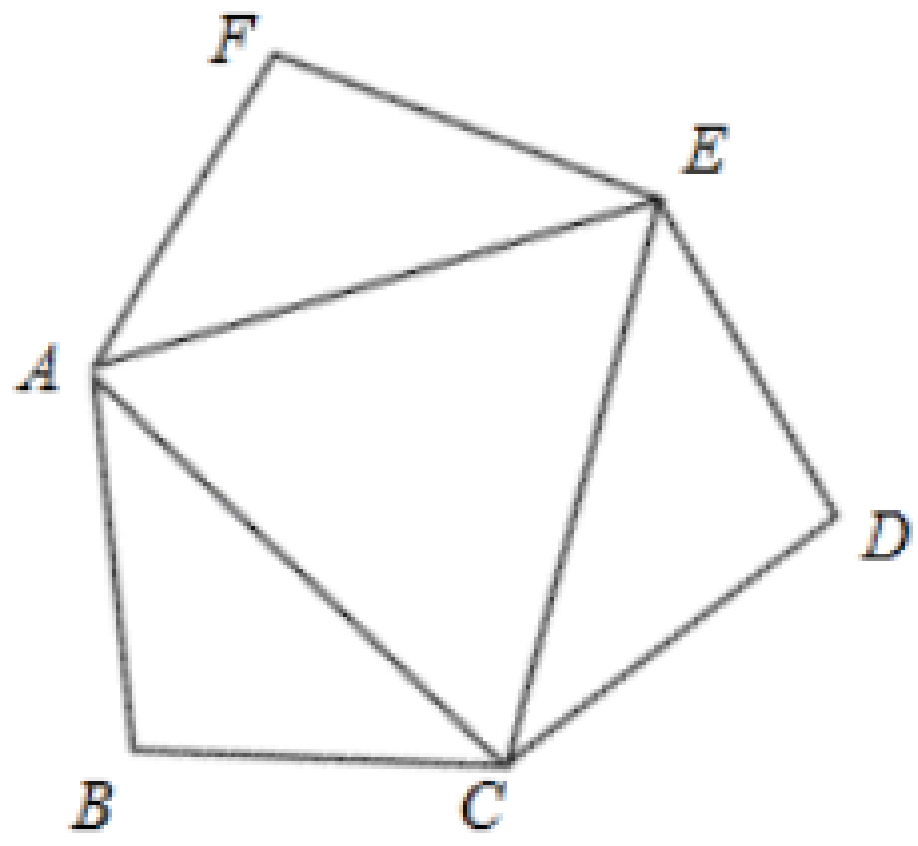


图 3

15 2019?

1 1 ABC AD BC D PQMN QM BC P N  
 AB AC BC 6 AD 4 PQMN

2 2

ABC AB P' P' Q' M' N' Q' M' BC N' ABC BN'  
 AC N NM BC M NP NM AB P PQ BC Q PPQM  
 BN

3 2 PQMN

4 2 BN NE NM EQ EM 3  $\tan \angle NBM = \frac{3}{4}$   
 QEM

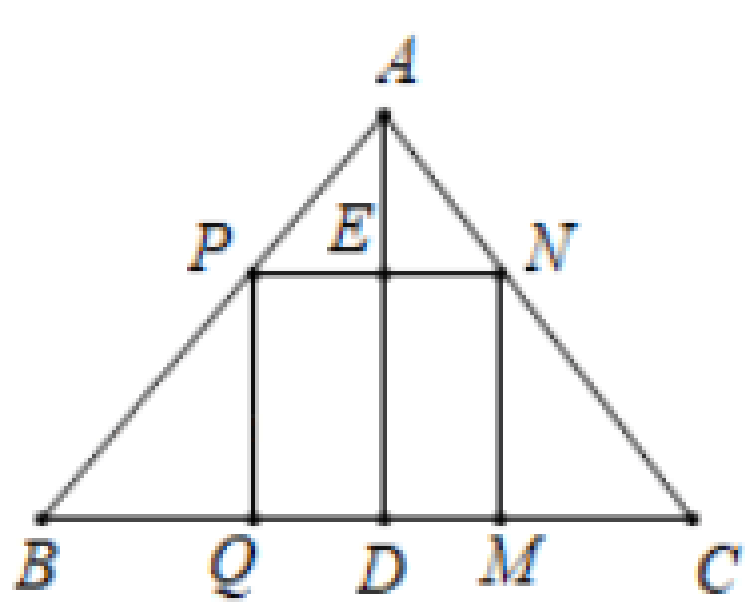


图 1

1

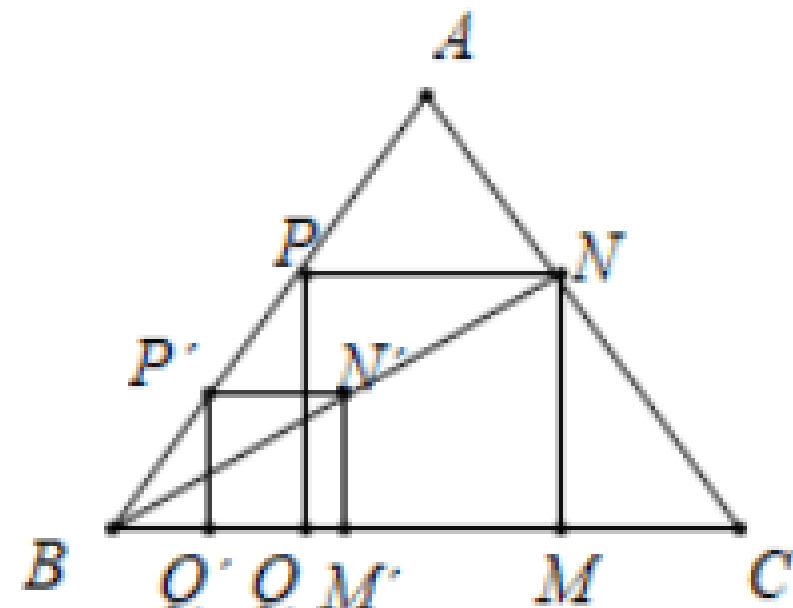


图 2

1

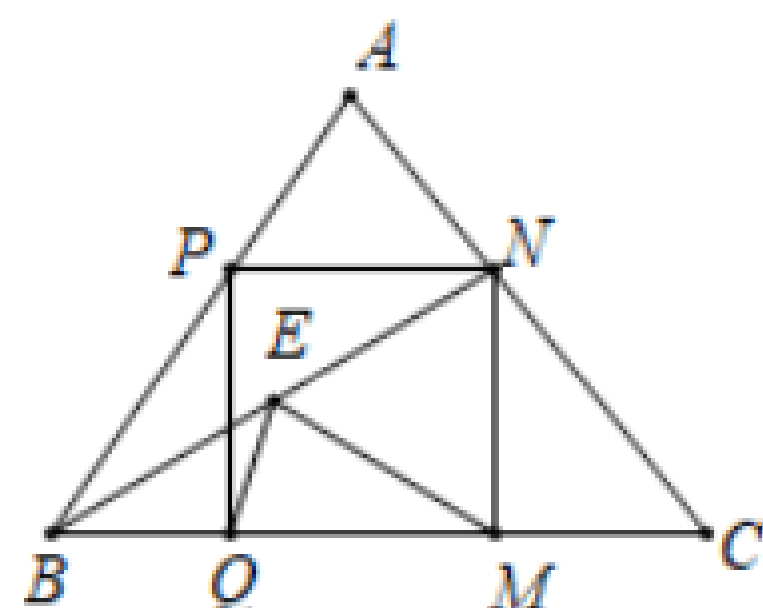


图 3



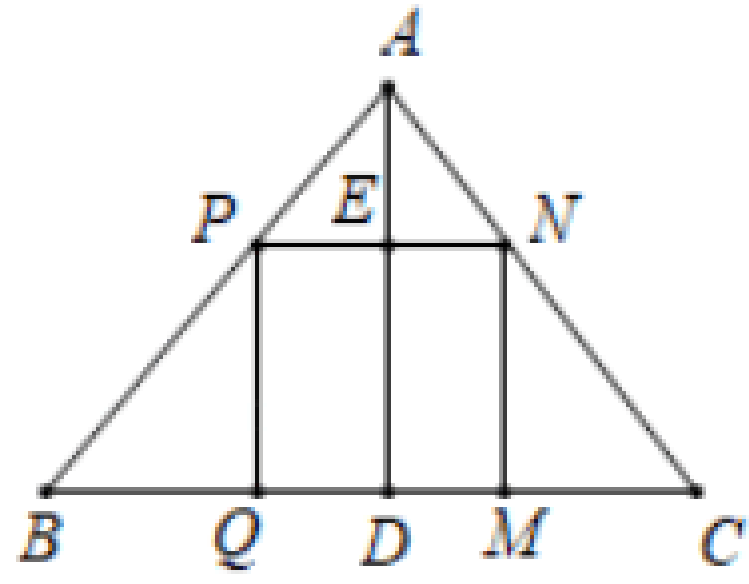


图1

PN // BC

△APN ∽ △ABC

$$\frac{PN}{BC} = \frac{AE}{AD} \quad \frac{PN}{6} = \frac{4 - PN}{4}$$

$$PN = \frac{12}{5}$$

2

2

PNMQ

3

2

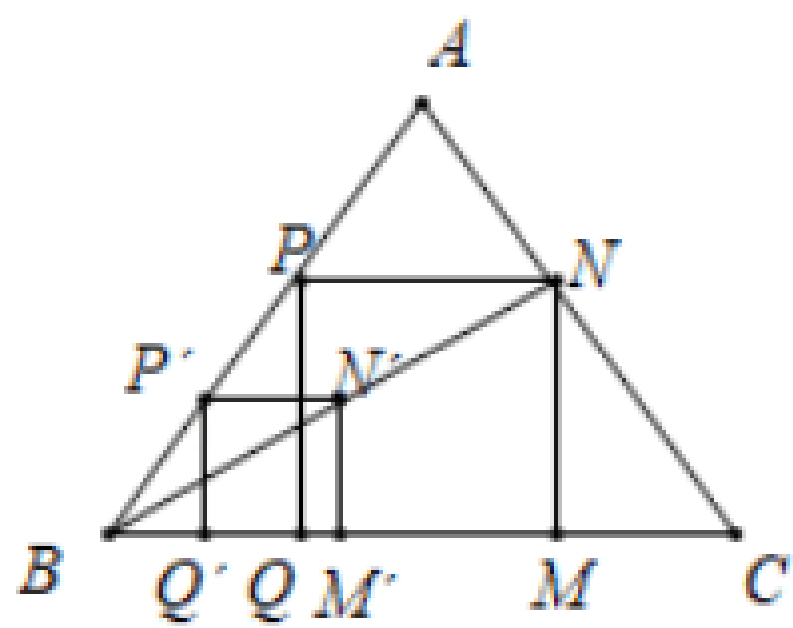


图2

△QMN ∽ △PQM ∽ △NPQ ∽ △BMN

PNMQ ∽ △M'N' ∽ △M'N

BN // M'N' ∽ BNM

$$\frac{M'N'}{MN} = \frac{BN'}{BN}$$

$$\frac{P'N'}{PN} = \frac{BN'}{BN}$$

$$\frac{M'N'}{MN} = \frac{P'N'}{PN}$$

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