

$$\mathbf{OM}' = \mathbf{R} \mathbf{OM} \quad : \quad \mathbf{M}'$$

$$\mathbf{OM}' = \mathbf{R} \mathbf{OM}$$

$$\mathbf{OM}' = -3 \mathbf{OM} :$$

$$\mathbf{OM}' = -\mathbf{OM} :$$

M', M, O

$$R \quad O \quad [AB] \quad (1)$$

$$: \quad A, B \quad A', B' \quad [A'B']$$

$$. A'B' = |R| \cdot AB$$

$$(\Delta') \quad (\Delta) \quad (2)$$

$$O \quad r \quad \omega \quad (3)$$

$$: \quad r' \quad \omega' \quad R$$

$$. r' = |R| \cdot r \quad \omega \quad \omega'$$

$$\left(\overline{A'B'}, \overline{A'C'} \right) \quad \left(\overline{AB}, \overline{AC} \right) \quad (4)$$

$$: \quad A, B, C \quad A', B', C'$$

$$\left(\overline{A'B'}, \overline{A'C'} \right) = \left(\overline{AB}, \overline{AC} \right) + 2k\pi ; \quad k \in \mathbb{Z}$$

$$: \quad -$$

$$R \quad S \quad (1)$$

$$S' = R^2 S : \quad S'$$

$$R \quad A, B \quad A', B' \quad (2)$$

$$. \overline{A'B'} = R \overline{AB} :$$

$$A \quad R \quad O \quad A \quad A' \quad (3)$$

$$\frac{1}{R} \quad O \quad A'$$

$$(A_1, \alpha_1), (A_2, \alpha_2), (A_3, \alpha_3) \quad G \quad (4)$$

$$A_1, A_2, A_3 \quad A'_1, A'_2, A'_3$$

$$G \quad G' \quad (A'_1, \alpha_1), (A'_2, \alpha_2), (A'_3, \alpha_3)$$

تمارين و مشكلات

1

ABC
AC B D (1)
D, C, A G, F, E (2)
E, F, G, D, B (3)
ABDGFE (4)

2

ABCD
O
M [BC] N [CD] (Δ)
O S
S N N' S M M' -1
(Δ) (M' N') -2

3

AB = AC ABC
(BM) H A [AH] M [BC] H
J (AB) (CM) I (AC)
(AH) S
S (BI) (CJ) (1)
S (AC) (2)

. J S I (3)

BJIC (4)

4

O (C) . ABC

. ABC

. A BC M

. MD = MC : [AM] D

. DMC (1)

. B A C r (2)

ADC

MB + MC = MA : BM = AD

5

×

√

-1

O M M' -2

OM' = R.OM : R

B C [BC] A -3

-1 O

r O -4

O R O

$\frac{r'}{r} = |R| : r'$

-5

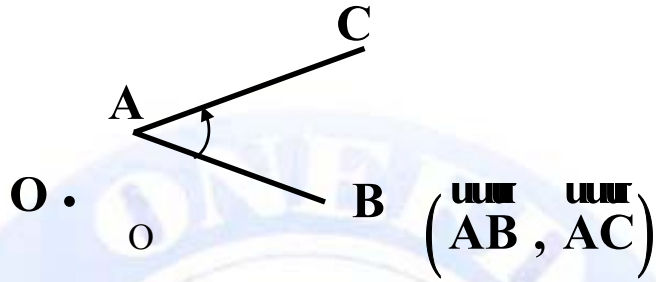
π O -6

-7

-8

6

:

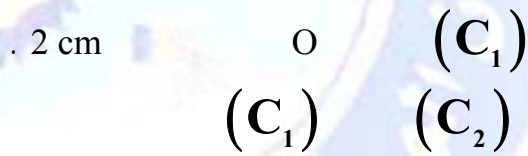


.2



.-2

7



. 2 cm

2

8

C B A

. C A (C₁)

. C B (C₂)

.E (C₂) D (C₁) C (Δ)

(BE) (AD) -

9

J, C, I -1

[CE] K (DC) (AJ) E -2

J, K, B

10

[DC] J [AB] I . ABCD

(DB) (AC) F . (BC) (AD) E

E, J, F, I

11 (*)

O . ABCD

[BO] J [AO] I

J J' I' A A' A I I' B B' B
 $A'O' = OB'$: O'

OAB OIJ (1)

OA'B' OIJ (2)

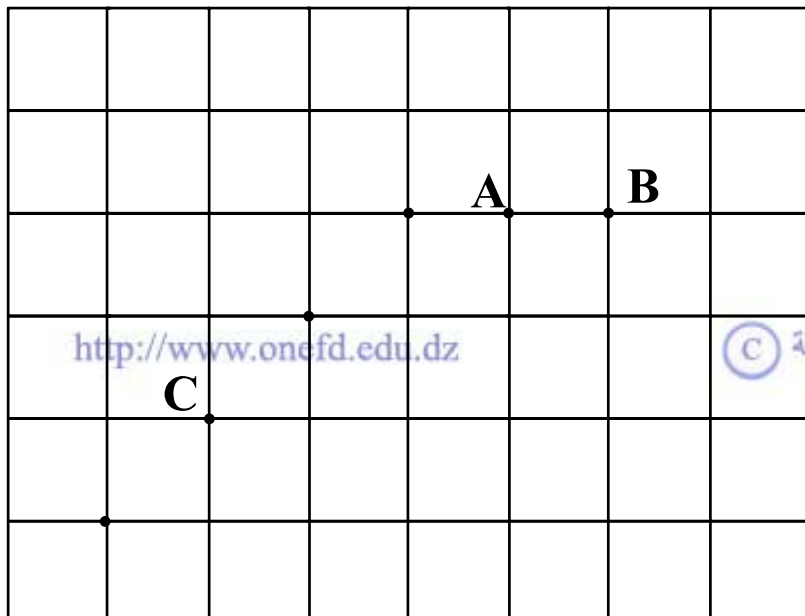
OAB OI'J' (3)

OBA ODC (4)

OA'B' ODC (5)

O'A'B' ODC (6)

12 (*)



. D C B A -1

B A $\frac{3}{4}$ -2

. D C -3

. 13

M' M h B A

$$AM' = 2 BM :$$

. h

. 14 (*)

. (C) A . O (C)

. (C) M

. M A N

. (C) M N

. 15 (*)

B A . α O (C)

. (C) M

. ABM G

. (C) M G (E) -

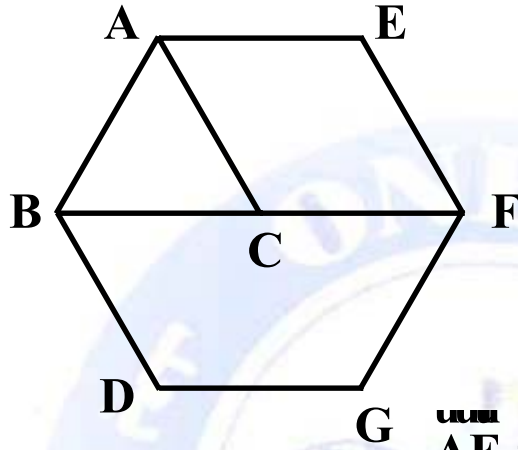
. 16 (*)

G (D₃) (D₂) (D₁)

. G (D₁) A

. (D₃) (D₂) (D₁) ABC

الحلول



1

: D -1

: G, F, E -2

E, F, G, D, B -3

: C

ABC CA = CB :

$\overline{CF} = \overline{BC}$: CF = CB :

$\overline{AE} = \overline{BC}$ ABCE

CB = CE AB = BC AB = CE :

$\overline{DG} = \overline{BC}$: BCGD

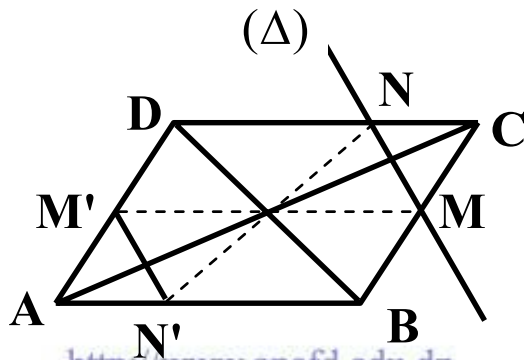
AC = CG : BD = AC BD = CG :

CD = CA : BD = CD BD = CG :

AB = CD : ABDC

CA = CB = CF = CE = CD = CG : **CD = CA** :

ABCGFE -4



2

: N', M' (1)

O B D

O C A

[AD]

[BC]

M' o M' [BC] M
[AD]

M' o [AB] [CD]
(AD) (OM)

[AB] N' o N' [DC] N
(AB) (ON) N'
:-2

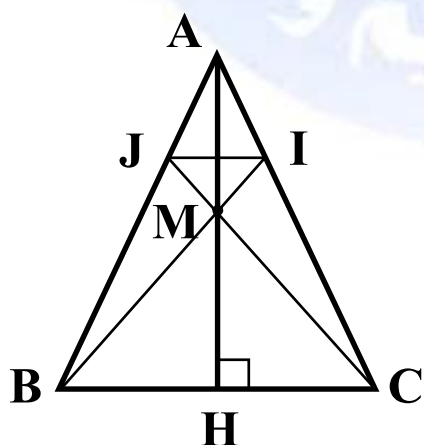
N N' M M'
(MN) ($M'N'$)

: ($M'N'$) // (MN)
($M'N'$) // (Δ)

3

: S (CI) (CJ) (1)

(BC) (AH) ABC



S B C
S M M

(CI) (CM)
(BI) (BM)
S

(AC) S A S C B (2)

(BI) (AC) (CJ) (BI) (AB) (AC) (3
 . J I J (CJ) (AB) I
 . BJIC (4
 . S I J S C B
 [CI] [BJ]
 CI = BJ :

4

$\hat{ABC} = 60^\circ$: ABC

$\hat{DMC} = 60^\circ$:

DMC

AC

$(\overline{BA}, \overline{BC})$ $(\overline{MD}, \overline{MC})$

MDC

$\hat{MDC} = \hat{MCD} = 60^\circ$

: r

ADC

- (2

M

D

C

C

. B A

$\hat{DCM} = 60^\circ$:

BMC

ADC

:

: BM = AD

-

BMC

ADC

CD = MC AC = BC :

[MC] [CD] (BC) [AC]

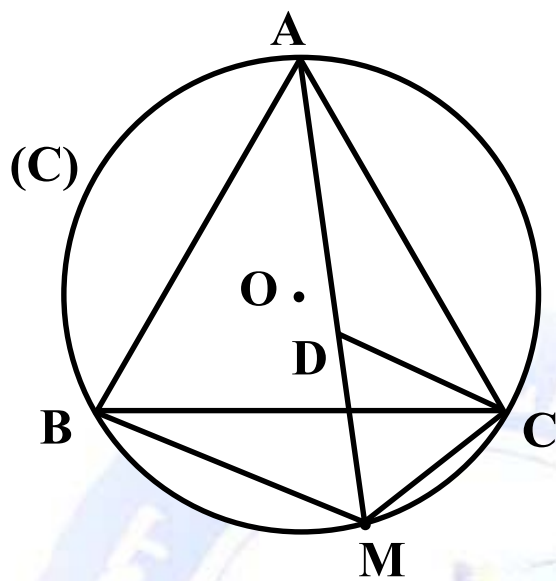
BM = AD : [BM] [AD]

MB + MC = MA :

-

MA = AD + MD MC = MD BM = AD :

. MB + MC = MA : MA = BM + MC :



5

√ (3)

× (2)

× (1)

√ (6)

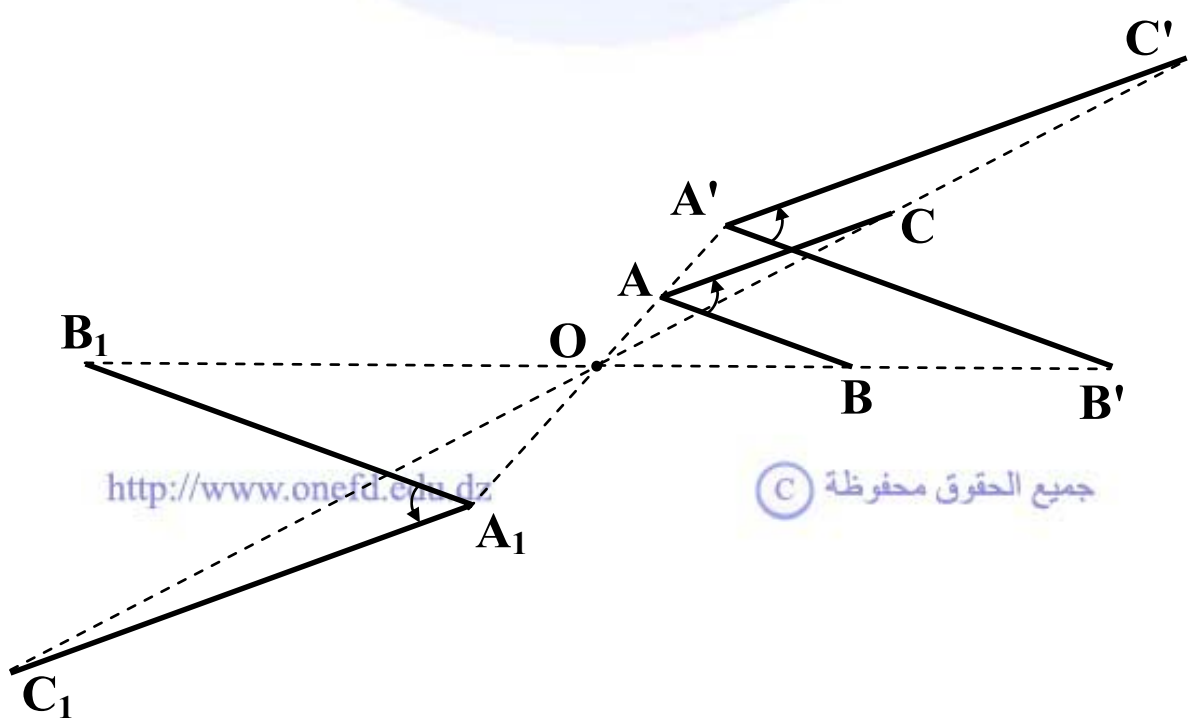
× (5)

√ (4)

√ (8)

√ (7)

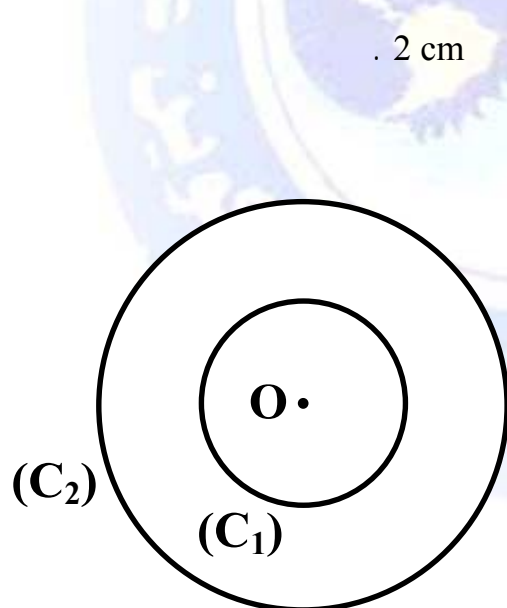
6



$$\begin{aligned} \vec{A'B'} &= \vec{AB} \\ \vec{A'C'} &= \vec{AC} \end{aligned}$$

$$\left(\begin{smallmatrix} \text{uuuu} & \text{uuuu} \\ \text{A}_1\text{B}_1 & \text{A}_1\text{C}_1 \end{smallmatrix} \right) = \left(\begin{smallmatrix} \text{uu} & \text{uu} \\ \text{AB} & \text{AC} \end{smallmatrix} \right) + 2\kappa\pi \quad , \quad \kappa \in \mathbb{Z}$$

7



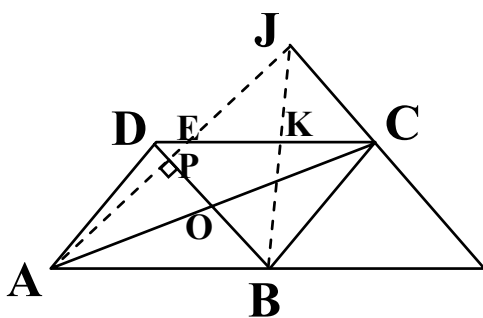
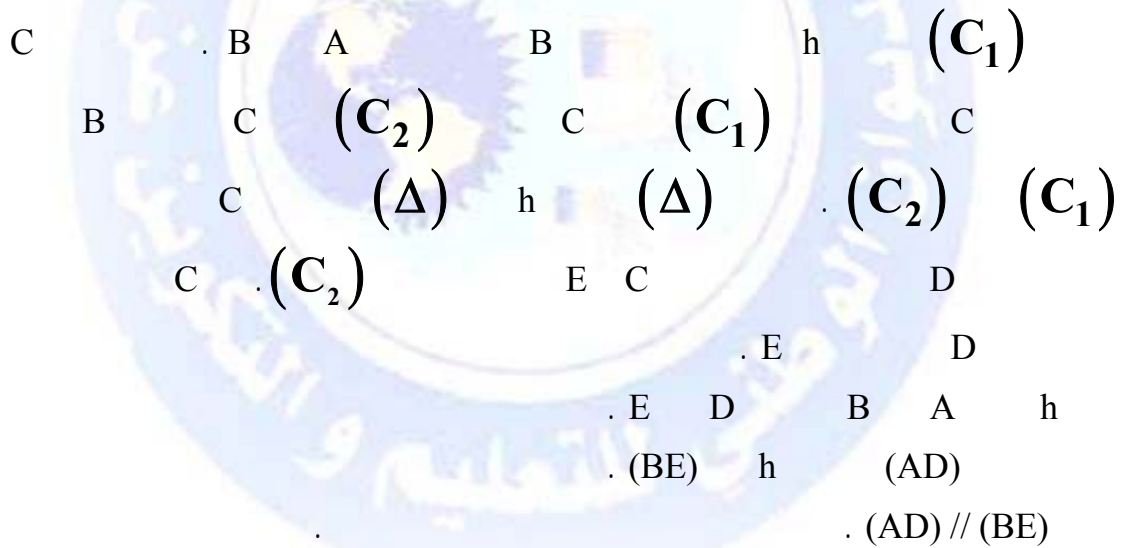
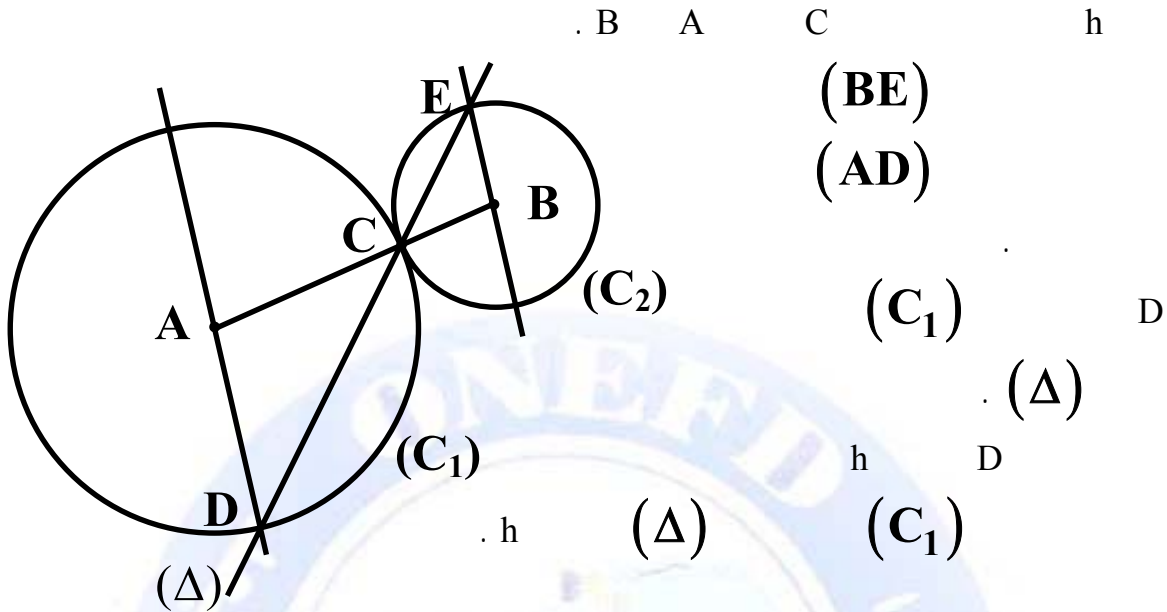
(C_2)

$$: (\mathbf{C}_1)$$

$$: (\mathbf{C}_2)$$

$$R_2 = 2R_1 = 4 \text{ cm} :$$

$$S_2 = (2)^2 \times S_1 :$$



: h_1 P, B, O J, I, C :
: **P, B, O**

(BD)

J, K, B : (2)

. A E J h_2

. (AB) (EC) A h_2 (EC)

. (AB) C J h C

. h_2 I C :

[AI] B [EC] K

. (AI) [EC]

. h_2 K B

B, K, J

10

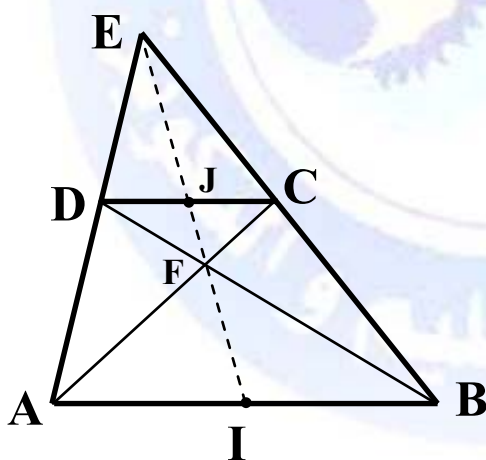
E, J, I : (1)

E h_1

. D A
(AB)

. (DC) h_1

h B



h_1

B

C

E, C, B

(DC)

. [DC] [AB]

[DC] J [AB] I

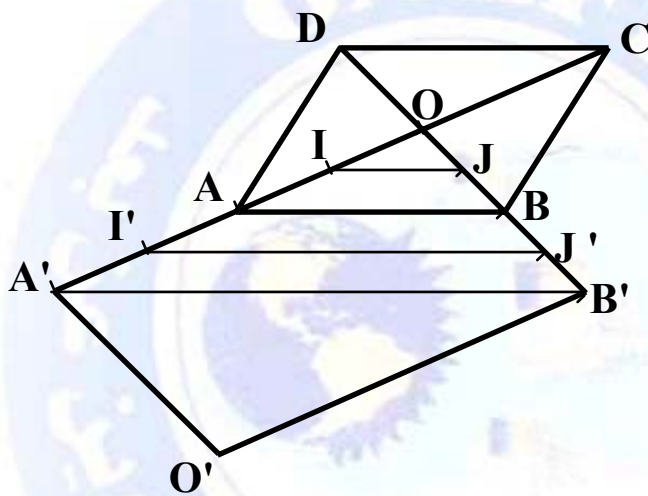
(1) . . . E, J, I :

<http://www.onefd.edu.dz>

. C A F h_2 جميع الحقوق محفوظة © (2)

h_2 (DC) h_2 (AB)
 D, F, B
 $[DC] h_2 [AB]$
 $[CD] h_2 [AB]$ I
 J, F, I
 $E, J, F, I : (2) (1)$

11 (*)



$$\overrightarrow{OB} = 2\overrightarrow{OJ} \quad \overrightarrow{OA} = 2\overrightarrow{OI} : \quad (1)$$

$$\overrightarrow{OB'} = 4\overrightarrow{OJ} \quad \overrightarrow{OA'} = 4\overrightarrow{OI} : \quad (2)$$

$$\overrightarrow{OB} = \frac{2}{3}\overrightarrow{OJ'} \quad \overrightarrow{OA} = \frac{2}{3}\overrightarrow{OI'} : \quad (3)$$

$$\frac{2}{3} \quad O \quad OAB \quad OI'J'$$

$$\overrightarrow{OB} = -\overrightarrow{OD} \quad \overrightarrow{OA} = -\overrightarrow{OC} : \quad (4)$$

$$\overrightarrow{OB'} = -2\overrightarrow{OD} \quad \overrightarrow{OA'} = -2\overrightarrow{OC} : \quad (5)$$

$$\vec{OA'B'} \quad \text{ODC}$$

$$(A'D') // (CD) : \quad \vec{A'D'} = -2\vec{CD} : (5) \quad (6)$$

$$(B'C) \quad (A'D) \quad S$$

$$\frac{SD}{SA'} = \frac{SC}{SB'} = \frac{CD}{A'B'} = \frac{1}{2} :$$

$$SB' = 2SC \quad \text{و} \quad SA' = 2SD :$$

$$(OC) // (O'B') : \quad \vec{SO'B'}$$

$$\vec{SO'} = 2\vec{SO} : \quad \frac{SO}{SO'} = \frac{SC}{SB'} = \frac{1}{2} :$$

$$O, C; D \quad O', B', A'$$

$$\vec{A'O'B'} \quad \text{SDC} \quad 2 \quad S \quad \boxed{12} (*)$$

$$(1) \dots \vec{OB} = R \cdot \vec{OA} : \quad A \quad B$$

$$(2) \dots \vec{OD} = R \cdot \vec{OC} : \quad C \quad D$$

$$B, A, O : (1)$$

$$D, C, O : (2)$$

$$(AB) \quad O \quad (CD) \quad (AB) \quad O \quad I \quad (CD)$$

$$4\vec{IB} - 3\vec{IA} = \vec{O} : \quad \vec{IB} = \frac{3}{4} \vec{IA} :$$

$$: (B, 4), (A, -3) \quad I$$

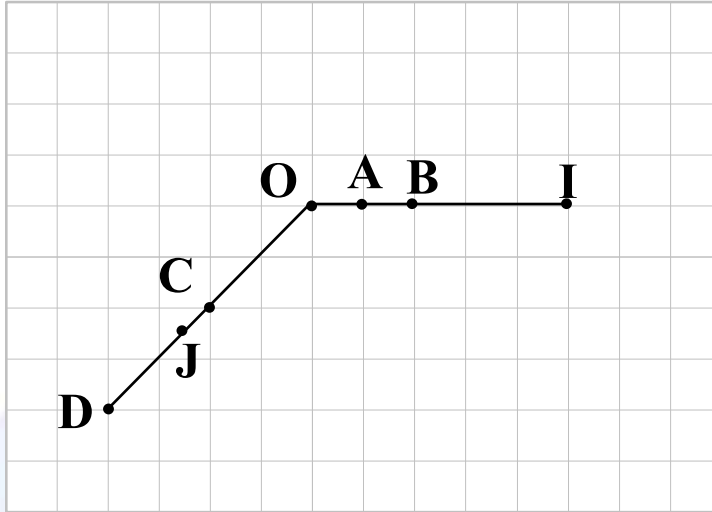
$$4(\vec{IA} + \vec{AB}) - 3\vec{IA} = \vec{O}$$

$$\vec{AI} = 4\vec{AB} : \quad \vec{IA} = -4\vec{AB} :$$

$$\vec{JD} = -3\vec{JC} : \quad J \quad (3)$$

$$J : \quad \vec{JD} + 3\vec{JC} = \vec{O} :$$

$$\begin{aligned}
 \vec{4JC} + \vec{CD} &= \vec{0} : & \vec{JC} + \vec{CD} + 3\vec{JC} &= \vec{0} : \\
 \vec{CJ} &= \frac{1}{4} \vec{CD} : & \vec{JC} &= -\frac{1}{4} \vec{CD} :
 \end{aligned}$$



13

(1)

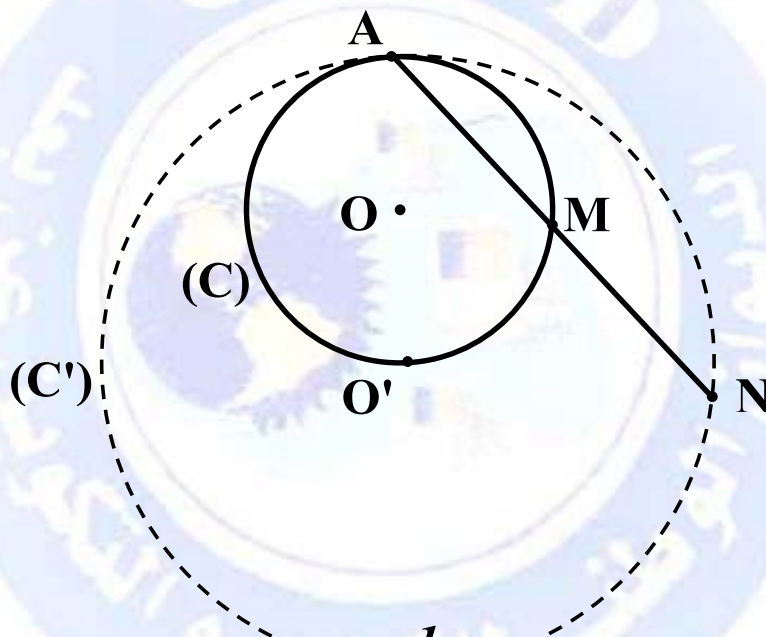
$$\begin{aligned}
 \vec{AO} &= 2\vec{BO} : \\
 \vec{AO} - 2(\vec{AO} - \vec{AB}) &= \vec{0} & \vec{AO} - 2\vec{BO} &= \vec{0} : \\
 \vec{AO} &= 2\vec{AB} : & -\vec{AO} + 2\vec{AB} &= \vec{0} :
 \end{aligned}$$

$$\begin{aligned}
 \vec{AO} + \vec{OM}' &= 2(\vec{BO} + \vec{OM}) : & \vec{AM}' &= 2\vec{BM} : \\
 \vec{OM}' &= 2\vec{OM} : & \vec{AO} - 2\vec{BO} + \vec{OM}' &= 2\vec{OM} : \\
 & & \vec{AO} - 2\vec{BO} &= \vec{0} : \\
 \vec{AO} &= 2\vec{AB} : & &
 \end{aligned}$$

14 (*)

$$\overline{AN} = 2\overline{AM} :$$

$$\begin{array}{ccccccc} & & A & & M & & N \\ & & O' & & (C) & & M \\ R' & & & & O & & O' \\ & & (C) & & R & & R' = 2R \\ & & (C') & & N & & \end{array}$$



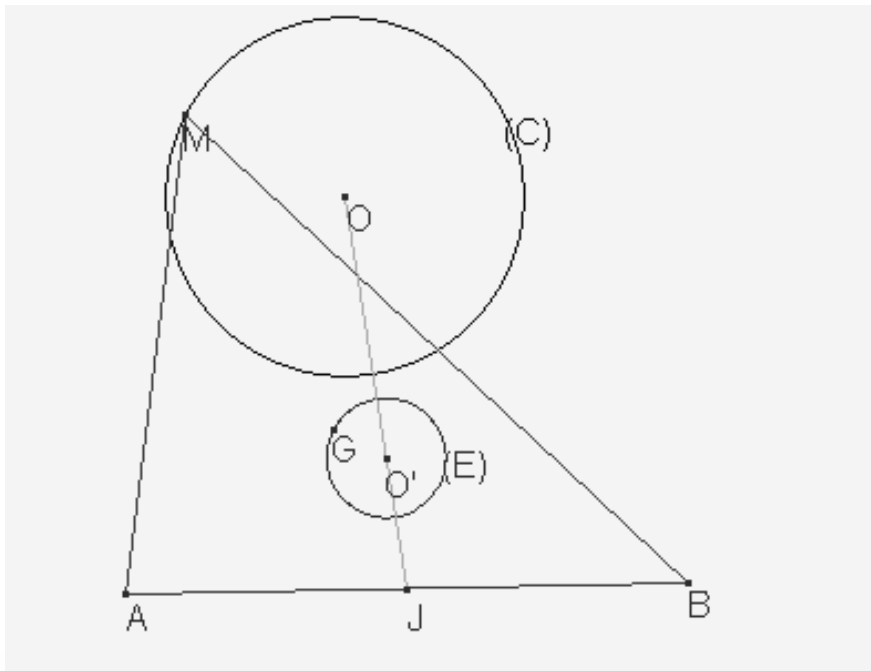
15 (*)

$$\overrightarrow{JG} \equiv \frac{1}{3} \overrightarrow{JM} :$$

$$\begin{array}{ccccccc} \frac{1}{3} & & J & & M & & G \\ & & (C) & & (E) & & \end{array}$$

$$\begin{array}{ccc} O' & \frac{\alpha}{3} & (E) \end{array}$$

$$\overrightarrow{JO'} = \frac{1}{3} \overrightarrow{JO} : \quad O$$



16 (*)

: (1)

L N M ABC

: $[BC]$ $[AC]$ $[AB]$

\rightarrow \rightarrow \rightarrow
 $AB=2AM$ $AC=2AN$

2 A M B
N C

(D_3) B (D_3) M

(D_5)

C (D_2) N

(D_4) (D_2)

: (2)

2 A (D_3) (D_5)

(D_2) (D_4)
 (D_5) (D_2)

$(D_4) \quad (D_3) \quad C$

