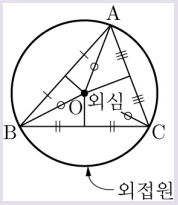
◇「콘텐츠산업 진흥법 시행령」제33조에 의한 표시
1) 제작연월일 : 2016-10-25
2) 제작자 : 교육지대㈜
3) 이 콘텐츠는 「콘텐츠산업 진흥법」에 따라 최초 제작일부터 5년간 보호됩니다.

◇「콘텐츠산업 진흥법」외에도「저작권법」에 의하여 보호되는 콘텐츠의 경우, 그 콘텐츠의 전부 또는 일부를 무단으로 복제하거나 전송하는 것은 콘텐츠산업 진흥법 외에도 저작권법에 의한 법적 책임을 질 수 있습니다.

계산시 참고사항

1. 삼각형의 외심

1) 외접원과 외심: 삼각형의 세 꼭짓점이 한 원 위에 있을 때, 원을 주어진 삼각형에 외접한다고 한다.
또 이 원을 삼각형의 외접원이라 하고,
이 외접원의 중심을 외심이라고 한다.

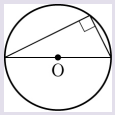
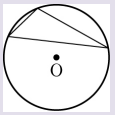


참고
◉ 삼각형의 외접원은 항상 존재한다.
◉ 외심의 성질에 의해
△OAB, △OBC, △OAC는
모두 이등변삼각형이다.

2. 삼각형의 외심의 성질

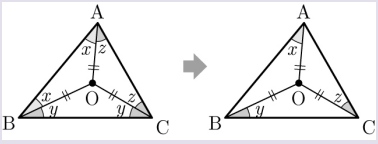
1) 삼각형의 세 변의 수직이등분선은 한 점(외심)에서 만난다.
2) 삼각형의 외심에서 세 꼭짓점에 이르는 거리는 같다.
⇨ $\overline{OA}=\overline{OB}=\overline{OC}$=(외접원 O의 반지름의 길이)

3. 삼각형의 외심의 위치

1) 예각삼각형: 삼각형의 내부	2) 직각삼각형: 빗변의 중점	3) 둔각삼각형: 삼각형의 외부
		

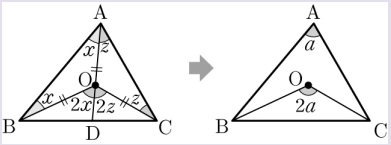
참고
◉ 직각삼각형에서
외심은 빗변의 중점이므로
(외접원의 반지름의 길이)
$=\frac{1}{2}\times$(빗변의 길이)

4. 삼각형의 외심의 활용(1)



점 O가 삼각형 ABC의 외심일 때,
$\overline{OA}=\overline{OB}=\overline{OC}$ 이고, $\angle OAB=\angle OBA$,
$\angle OBC=\angle OCB$, $\angle OCA=\angle OAC$ 이므로
$\angle A+\angle B+\angle C=2\angle x+2\angle y+2\angle z=180^\circ$
$\therefore\ \angle x+\angle y+\angle z=90^\circ$

5. 삼각형의 외심의 활용(2)



점 O가 삼각형 ABC의 외심일 때,
△OAB에서
$\angle BOD=\angle OAB+\angle OBA=2\angle OAB$
△OAC에서
$\angle COD=\angle OAC+\angle OCA=2\angle OAC$
$\therefore\ \angle BOC=\angle BOD+\angle COD$
$=2(\angle OAB+\angle OAC)=2\angle A$

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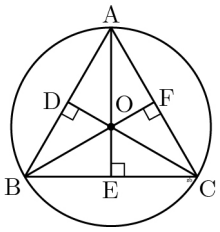
삼각형의 외심의 성질

◪ 다음 그림에서 O가 △ABC의 외심일 때, 옳은 것은 O표, 옳지 않은 것은 X표를 하여라.



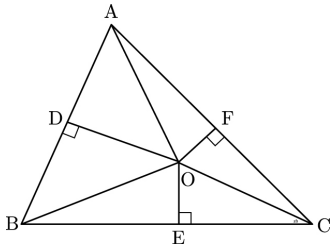
1. $\overline{OA}=\overline{OB}=\overline{OC}$ ( )

2. $\overline{OD}=\overline{OE}=\overline{OF}$ ( )

3. $\angle OBE=\angle OCE$ ( )

4. $\triangle ADO\equiv\triangle AFO$ ( )

◪ 다음 그림에서 점 O가 △ABC의 외심일 때, 옳은 것은 O표, 옳지 않은 것은 X표를 하여라.



5. $\overline{BE}=\overline{BD}$ ( )

6. $\angle OCF=\angle OCE$ ( )

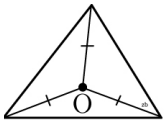
7. $\triangle OAD\equiv\triangle OBD$ ( )

8. $\overline{OA}=\overline{OB}=\overline{OC}$ ( )

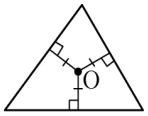
9. $\overline{OD}=\overline{OE}=\overline{OF}$ ( )

◪ 다음 그림에 점 O가 삼각형의 외심인 것은 O표, 외심이 아닌 것은 X표를 하여라.

10. ( )



11. ( )



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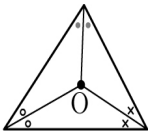
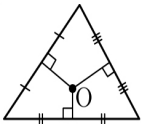
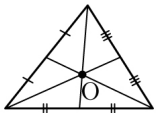


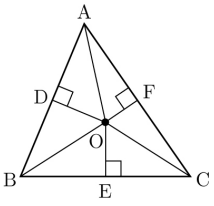
13. ( )



14. ( )



◪ 다음 그림에서 점 O는 △ABC의 외심이다. 다음 □ 안에 알맞은 것을 써넣어라.



15. $\overline{AD}=$ □

16. $\overline{OA}=\overline{OB}=$ □

17. $\angle BOE=$ □

18. $\triangle OAD\equiv$ □

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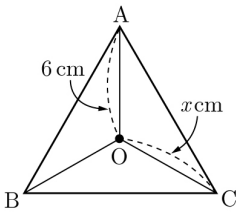
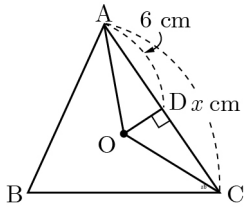
◪ 다음 그림에서 점 O가 △ABC의 외심일 때, x의 값을 구하여라.

19.



20.



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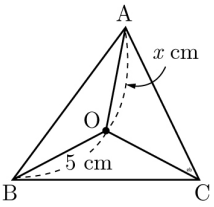

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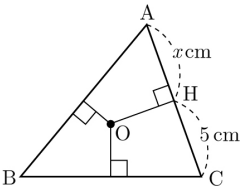
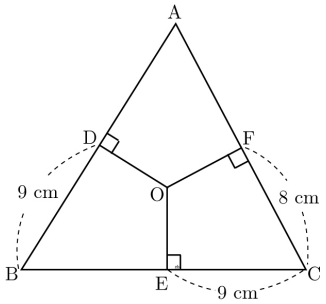


◪ 점 O가 직각삼각형 ABC의 외심일 때, △ABC의 둘레의 길이를 구하여라.

23.



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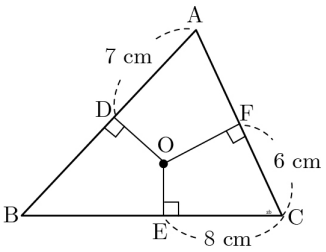

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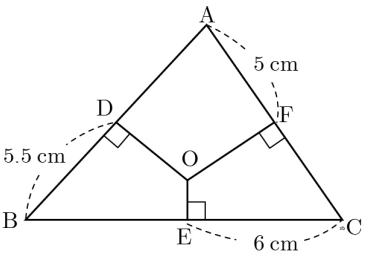

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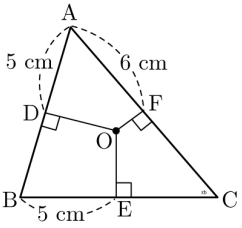

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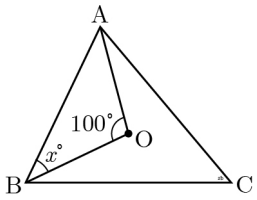
◪ 다음 그림에서 점 O가 △ABC의 외심일 때, x의 값을 구하여라.

27.



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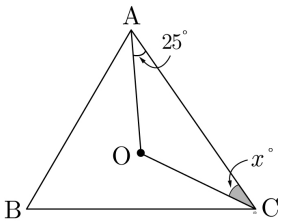

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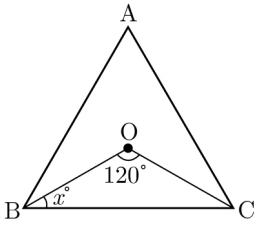

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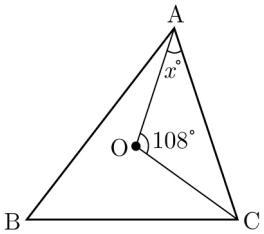
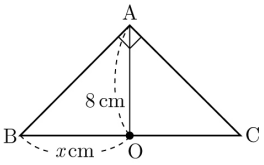


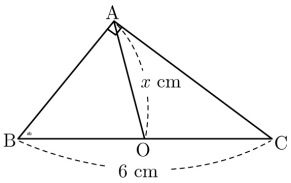
삼각형의 외심의 위치

◪ 다음 그림에서 점 O가 직각삼각형 ABC의 외심일 때, x의 값을 구하여라.

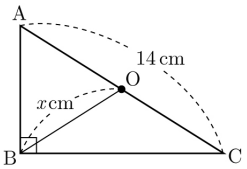
31.



32.



33.



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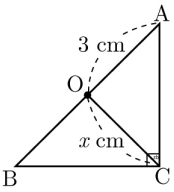

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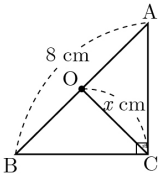

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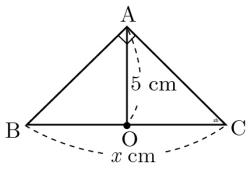
36.



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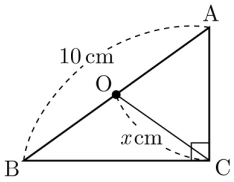
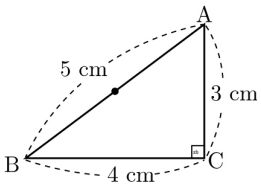


◪ 다음 그림과 같은 직각삼각형 ABC의 외접원의 둘레의 길이를 구하여라.

38.



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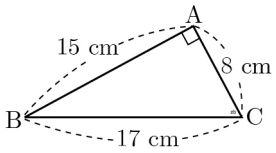

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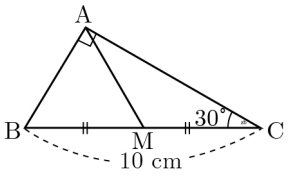
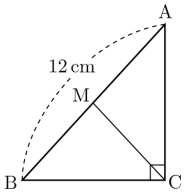


◪ 다음 그림과 같이 $\angle C = 90^\circ$인 직각삼각형 ABC에서 점 M이 $\overline{AB}$의 중점일 때, $\triangle ABC$의 외접원의 넓이를 구하여라.

41.



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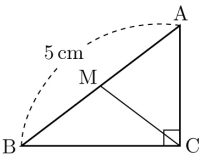
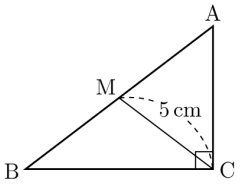
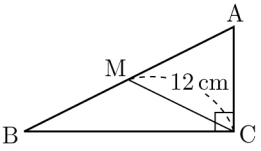


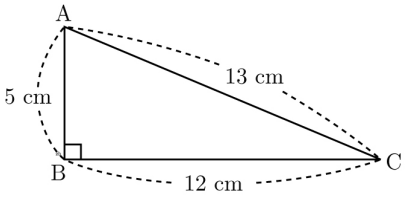
43.



44.



45.



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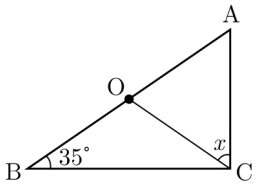
삼각형의 외심의 활용

◪ 다음 그림에서 점 O가 $\triangle ABC$의 외심일 때, $\angle x$의 크기를 구하여라.

46.



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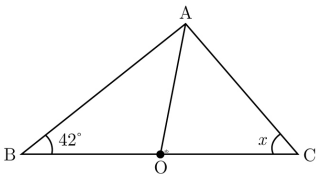
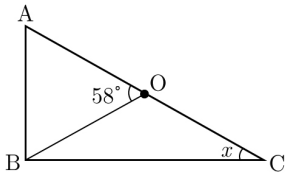
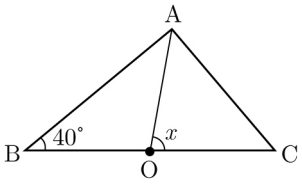


48.



49.



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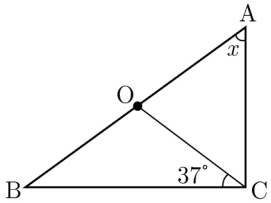
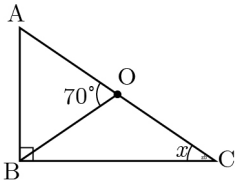
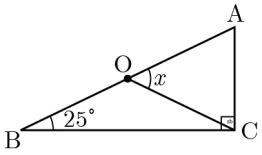


51.

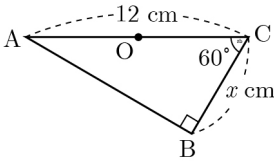


52.

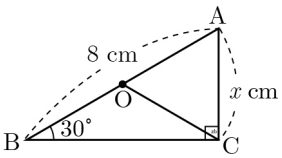


◪ 다음 그림에서 점 O가 직각삼각형 ABC의 외심일 때, x의 값을 구하여라.

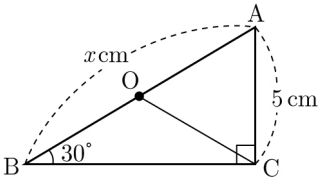
53.



54.



55.



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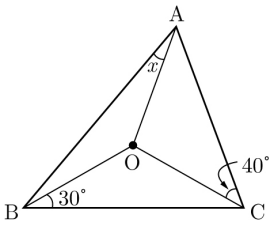
◪ **다음 그림에서 점 O가 △ABC의 외심일 때, ∠x의 크기를 구하여라.**

56.



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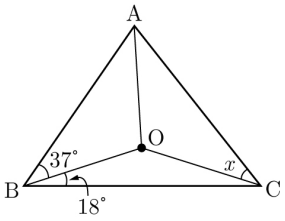
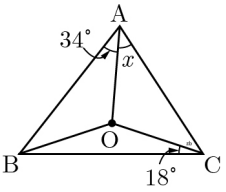
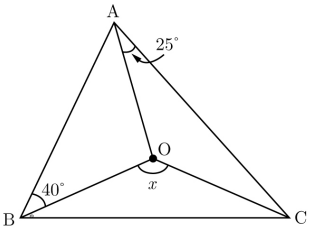


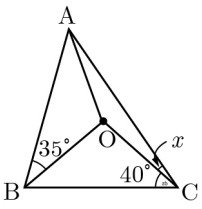
58.



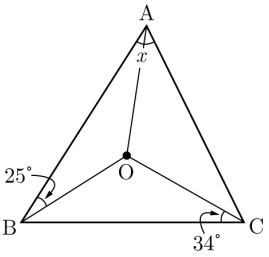
59.



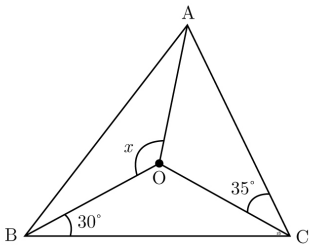
60.



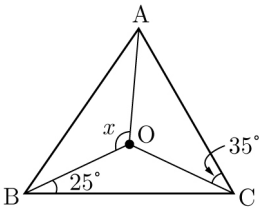
61.



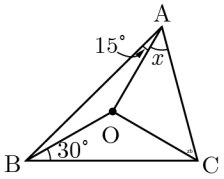
62.



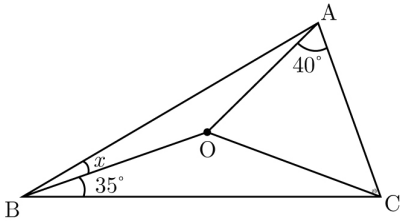
63.



64.



65.



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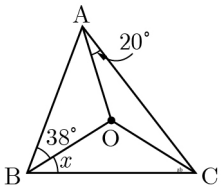
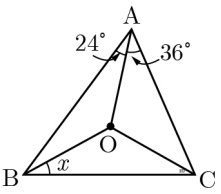
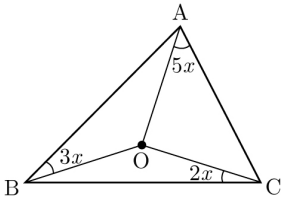
66.



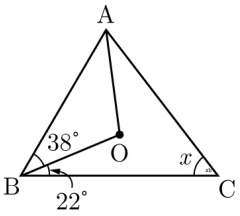
67.



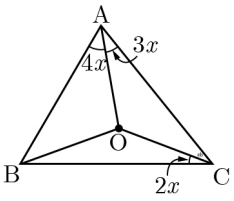
68.



69.

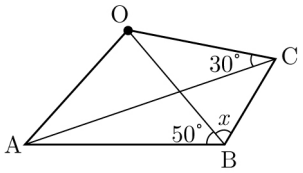


70.

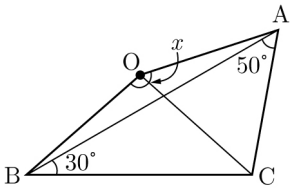


◪ **다음 그림에서 점 O가 △ABC의 외심일 때, ∠x의 크기를 구하여라.**

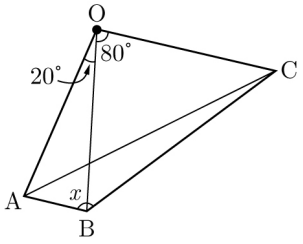
71.



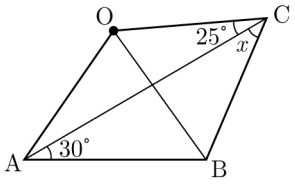
72.



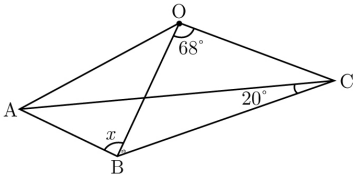
73.



74.



75.



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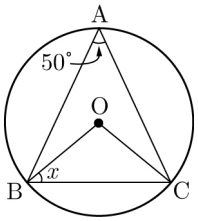
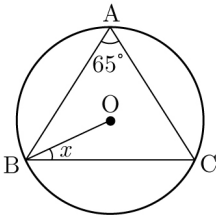
◪ 다음 그림에서 점 O가 △ABC의 외심일 때, $\angle x$의 크기를 구하여라.

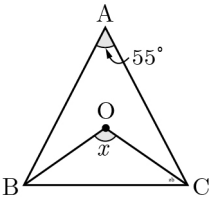
76.



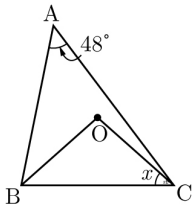
77.



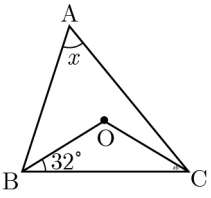
78.



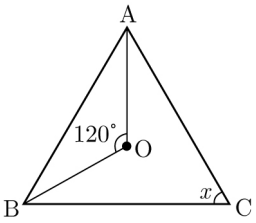
79.



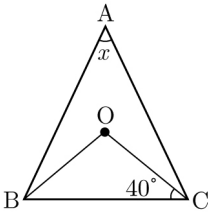
80.



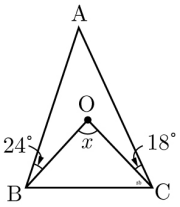
81.



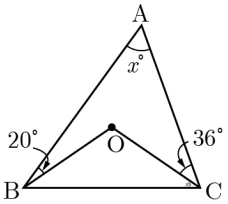
82.



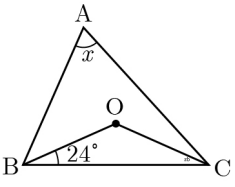
83.



84.



85.



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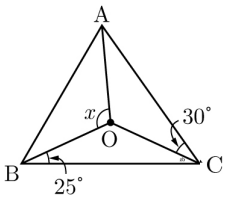
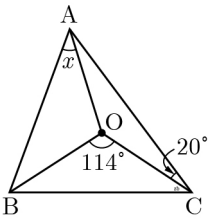
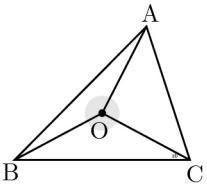
86.



87.



◪ 다음 그림에서 점 O가 △ABC의 외심일 때, 다음을 구하여라.



$\angle AOB + \angle BOC + \angle COA = 360^\circ$

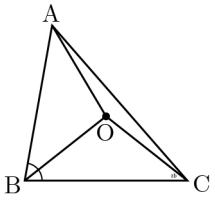
88. $\angle AOB : \angle BOC : \angle COA = 3 : 2 : 4$일 때, $\angle BAC$의 크기

89. $\angle BAC : \angle ABC : \angle BCA = 3 : 5 : 7$일 때, $\angle BOC$의 크기

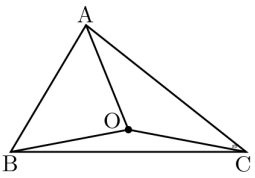
90. $\angle OAB : \angle OBC : \angle OCA = 2 : 3 : 5$일 때, $\angle AOC$의 크기

◪ 다음 물음에 답하여라.

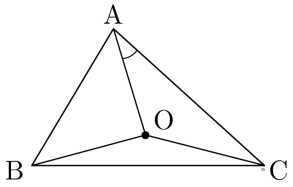
91. 다음 그림의 △ABC에서 점 O는 △ABC의 외심이고 $\angle AOB : \angle BOC : \angle COA = 2 : 3 : 4$일 때, $\angle ABC$의 크기를 구하여라.



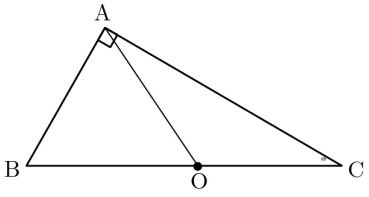
92. 다음 그림에서 점 O는 △ABC의 외심이다. $\angle AOB : \angle BOC : \angle COA = 2 : 4 : 3$일 때, $\angle ABC$의 크기를 구하여라.



93. 다음 그림에서 점 O는 삼각형 ABC의 외심이고, $\angle AOB : \angle BOC : \angle COA = 3 : 5 : 4$일 때, $\angle OAC$의 크기를 구하여라.



94. 다음 그림과 같은 직각삼각형 ABC에서 점 O는 변 BC의 중점이다. $\angle OAB : \angle OAC = 3 :$일 때, $\angle BOA$의 크기를 구하여라.



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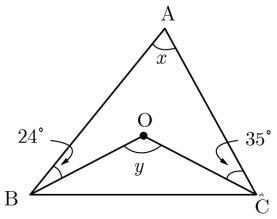
◪ **다음 그림에서 점 O가 직각삼각형 ABC의 외심일 때, $\angle x+\angle y$의 크기를 구하여라.**

95.



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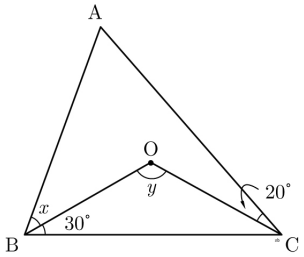

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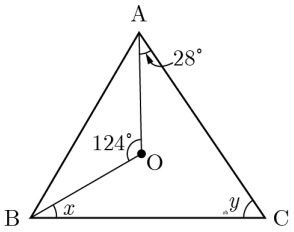

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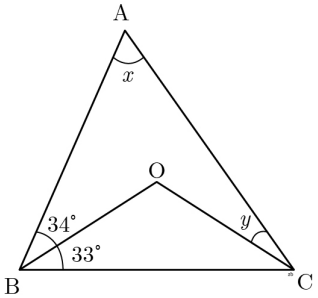

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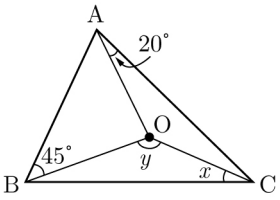
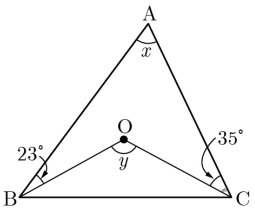


100.



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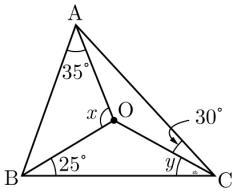
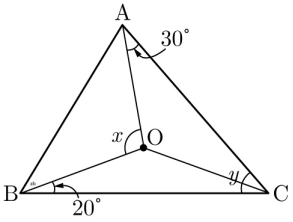
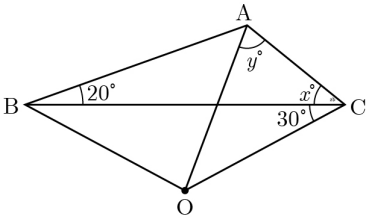


102.



103.



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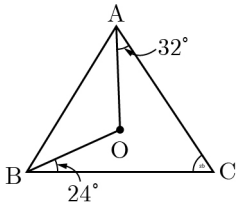
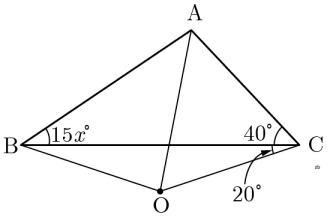
◪ 점 O가 직각삼각형 ABC의 외심일 때, 다음 물음에 답하여라.

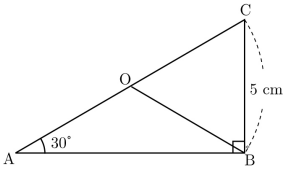
104 ∠C의 크기를 구하여라.



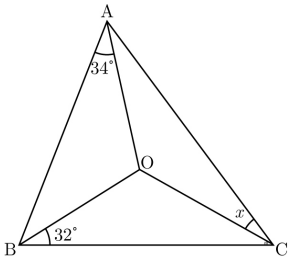
105 x값을 구하여라.



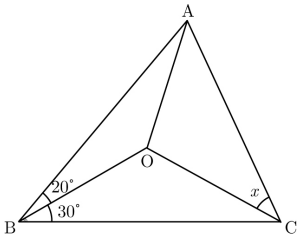
106 $\overline{BC}=5\text{cm}$일 때, $\overline{AC}$의 길이를 구하여라.



107 $\angle x$의 크기를 구하여라.

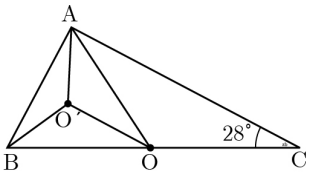


108 $\angle x$의 크기를 구하여라.

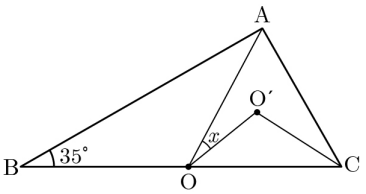


◪ 다음 물음에 답하여라.

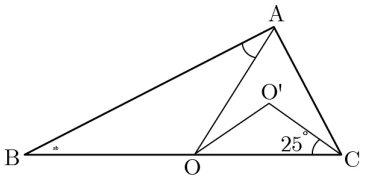
109 다음 그림에서 점 O는 △ABC의 외심이고, 점 O′은 △AOB의 외심이다. ∠C = 28°일 때, ∠BO′O의 크기를 구하여라.



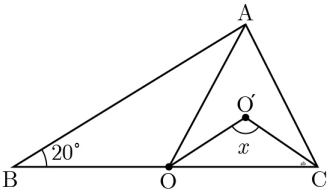
110 다음 그림에서 점 O는 △ABC의 외심이고, 점 O′는 △AOC의 외심이다. ∠ABO = 35°일 때, ∠AOO′의 크기를 구하여라.



111 다음 그림에서 점 O는 △ABC의 외심이고, 점 O′은 △AOC의 외심이다. ∠O′CO = 25°일 때, ∠OAB의 크기는?



112 다음 그림에서 점 O는 △ABC의 외심이고, 점 O′은 △AOC의 외심이다. ∠B = 20°일 때, ∠OO′C의 크기를 구하여라.



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정답 및 해설

1) O

2) X

3) O

4) X

5) ×

6) ×

7) ○

8) ○

9) ×

10) ○

11) ×

12) ×

13) ○

14) ×

15) $\overline{BD}$

16) $\overline{OC}$

17) $\angle COE$

18) $\triangle OBD$

19) 6

20) 12

21) 5

22) 5

23) 52cm

⇨ $\overline{AD}=\overline{BD}=9cm$, $\overline{AF}=\overline{CF}=8cm$, $\overline{BE}=\overline{CE}=9cm$

$\therefore(\triangle ABC$의 둘레의 길이$)=(9+9+8)\times 2=52(cm)$

24) 42cm

⇨ 외심 O의 성질에 의해서 $\overline{BD}=7cm$, $\overline{BE}=8cm$, $\overline{AF}=6cm$이다.

$\therefore$ $(\triangle ABC$의 둘레$)=14+16+12=42(cm)$

25) 33cm

26) 32cm

27) 40

⇨ $\overline{OA}=\overline{OB}$이므로

$\angle ABO=\frac{1}{2}\times(180^\circ-100^\circ)=40^\circ$

$\therefore\ x=40$

28) 25°

29) 30

⇨ $\triangle OBC$에서 $\overline{OB}=\overline{OC}$이므로

$\angle OBC=\frac{1}{2}\times(180^\circ-120^\circ)=30^\circ$ $\therefore x=30$

30) 36

⇨ $\triangle OCA$에서 $\overline{OC}=\overline{OA}$이므로

$\angle OAC=\frac{1}{2}\times(180^\circ-108^\circ)=36^\circ$ $\therefore x=36$

31) 8

32) 3

⇨ $\overline{AO}=\overline{BO}=\overline{CO}$이므로 $x=3$이다.

33) 7

34) 3

35) 4

36) 10

37) 5

38) 5π cm

⇨ (외접원의 둘레의 길이)$=2\pi\times\frac{5}{2}=5\pi(cm)$

39) 17π cm

⇨ (외접원의 둘레의 길이)$=2\pi\times\frac{17}{2}=17\pi(cm)$

40) 10π cm

⇨ (외접원의 둘레의 길이)$=2\pi\times\frac{10}{2}=10\pi(cm)$

41) $36\pi cm^2$

42) $\frac{25}{4}\pi cm^2$

43) $25\pi cm^2$

44) $144\pi cm^2$

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45) $\frac{169}{4}\pi\,\mathrm{cm}^2$

46) 55°

⇨ $\overline{OB}=\overline{OC}$ 이므로 $\angle OCB=\angle OBC=35^\circ$

$\overline{OA}=\overline{OB}$ 이므로 $\angle ACB=90^\circ$

$\therefore \angle x=90^\circ-35^\circ=55^\circ$

47) 48°

⇨ 직각삼각형의 외심은 빗변의 중심에 위치하므로 삼각형 ABC는 $\angle A=90^\circ$ 인 직각삼각형이다.

$\therefore\ \angle C=90^\circ-42^\circ=48^\circ$

48) 29°

⇨ $\overline{OB}=\overline{OC}$ 이므로 $\angle OBC=\angle OCB=\angle x$

$\triangle OBC$ 에서 $\angle x+\angle x=58^\circ$ $\therefore \angle x=29^\circ$

49) 80°

⇨ $\overline{OA}=\overline{OB}$ 이므로 $\angle OAB=\angle OBA=40^\circ$

$\triangle OAB$ 에서 $\angle x=40^\circ+40^\circ=80^\circ$

50) 53°

⇨ $\overline{OA}=\overline{OB}$ 이므로 $\angle ACB=90^\circ$

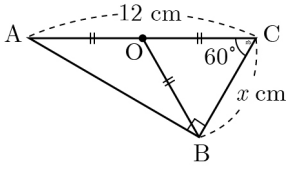
$\therefore \angle OCA=90^\circ-37^\circ=53^\circ$

$\overline{OA}=\overline{OC}$ 이므로 $\angle x=\angle OCA=53^\circ$

51) 35°

52) 50°

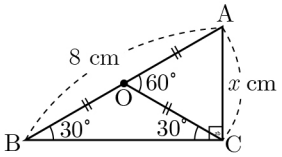
53) 6

⇨ 

$\overline{OB}$ 를 그으면 $\overline{OA}=\overline{OB}=\overline{OC}$ 이고

$\triangle OBC$ 가 정삼각형이므로 $x=\frac{1}{2}\times 12=6$

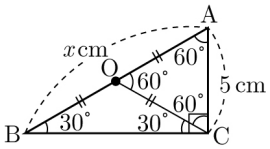
54) 4

⇨ 

$\overline{OA}=\overline{OB}=\overline{OC}$ 이고 $\triangle AOC$ 가 정삼각형이므로

$x=\frac{1}{2}\times 8=4$

55) 10

⇨ 

$\overline{OB}=\overline{OC}$ 이므로 $\angle OCB=\angle OBC=30^\circ$

$\therefore \angle AOC=30^\circ+30^\circ=60^\circ$

$\overline{OA}=\overline{OC}$ 이므로 $\triangle OCA$ 에서

$\angle OAC=\angle OCA=\frac{1}{2}\times(180^\circ-60^\circ)=60^\circ$

따라서 $\triangle OCA$ 는 정삼각형이므로 $\overline{AO}=\overline{AC}=5(\mathrm{cm})$

이때 $\overline{BO}=\overline{AO}=5\mathrm{cm}$ 이므로 $x=\overline{AO}+\overline{BO}=5+5=10$

56) 20°

⇨ $\angle x+30^\circ+40^\circ=90^\circ$ $\therefore \angle x=20^\circ$

57) 35°

⇨ $37^\circ+18^\circ+\angle x=90^\circ$ $\therefore \angle x=35^\circ$

58) 38°

⇨ $34^\circ+18^\circ+\angle x=90^\circ$ $\therefore\ \angle x=38^\circ$

59) 130°

60) 15°

⇨ $35^\circ+40^\circ+\angle x=90^\circ$ $\therefore\ \angle x=15^\circ$

61) 56°

⇨ $\angle CAO+25^\circ+34^\circ=90^\circ$ 이므로 $\angle CAO=31^\circ$

이때 $\angle BAO=\angle ABO=25^\circ$ 이므로

$\angle x=25^\circ+31^\circ=56^\circ$

62) 130°

63) 120°

⇨ $\triangle OBC$ 에서 $\angle OCB=\angle OBC=25^\circ$ 이므로

$\angle ACB=35^\circ+25^\circ=60^\circ$

$\therefore \angle x=2\angle ACB=2\times 60^\circ=120^\circ$

64) 45°

⇨ $15^\circ+30^\circ+\angle x=90^\circ$ $\therefore \angle x=45^\circ$

65) 15°

66) 32°

⇨ $38^\circ+\angle x+20^\circ=90^\circ$ $\therefore\ \angle x=32^\circ$

67) 30°

⇨ $24^\circ+\angle x+36^\circ=90^\circ$ $\therefore\ \angle x=30^\circ$

68) 9°

⇨ $5\angle x+3\angle x+2\angle x=90^\circ$ 에서

$10\angle x=90^\circ$ $\therefore \angle x=9^\circ$

69) 52°

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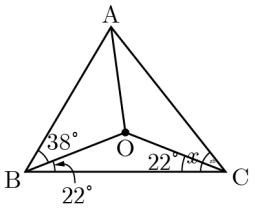


$\overline{OC}$를 그으면 $\angle OCB = 22^\circ$

$38^\circ + 22^\circ + \angle OCA = 90^\circ$ $\therefore \angle OCA = 30^\circ$

$\therefore \angle x = 22^\circ + 30^\circ = 52^\circ$

70) 10°

⇨ $4\angle x + 2\angle x + 3\angle x = 90^\circ$

$9\angle x = 90^\circ$ $\therefore \angle x = 10^\circ$

71) 70°

⇨ $\overline{OA} = \overline{OC}$이므로 $\angle OAC = 30^\circ$

$\therefore \angle AOC = 180^\circ - (30^\circ + 30^\circ) = 120^\circ$

$\overline{OA} = \overline{OB}$이므로 $\angle OAB = \angle OBA = 50^\circ$

$\therefore \angle AOB = 180^\circ - (50^\circ + 50^\circ) = 80^\circ$

따라서 $\angle BOC = 120^\circ - 80^\circ = 40^\circ$이고, $\overline{OB} = \overline{OC}$이므로 $\angle x = \frac{1}{2} \times (180^\circ - 40^\circ) = 70^\circ$

72) 160°

⇨ $\overline{OA} = \overline{OB} = \overline{OC}$이므로

$\angle OBC = \angle OCB$, $\angle OCA = \angle OAC$

이때 $\angle ACB = 180^\circ - (30^\circ + 50^\circ) = 100^\circ$이므로

$\angle OBC + \angle OAC$

$= \angle OBA + 30^\circ + \angle OAB + 50^\circ = 100^\circ$

즉, $\angle OBA + \angle OAB = 20^\circ$이므로

$\angle x = 180^\circ - 20^\circ = 160^\circ$

73) 130°

⇨ $\overline{OA} = \overline{OB} = \overline{OC}$이므로 $\triangle OAB$에서

$\angle ABO = \frac{1}{2} \times (180^\circ - 20^\circ) = 80^\circ$

$\triangle OBC$에서 $\angle OBC = \frac{1}{2} \times (180^\circ - 80^\circ) = 50^\circ$

$\therefore \angle x = \angle ABO + \angle OBC = 80^\circ + 50^\circ = 130^\circ$

74) 35°

⇨ $\overline{OA} = \overline{OC}$이므로 $\angle OAC = \angle OCA = 25^\circ$

$\angle AOC = 180^\circ - (25^\circ + 25^\circ) = 130^\circ$

$\overline{OA} = \overline{OB}$이므로

$\angle AOB = 180^\circ - (55^\circ + 55^\circ) = 70^\circ$

$\therefore \angle BOC = 130^\circ - 70^\circ = 60^\circ$

$\overline{OB} = \overline{OC}$이므로 $\angle x + 25^\circ = \frac{1}{2} \times (180^\circ - 60^\circ)$

$\therefore \angle x = 35^\circ$

75) 70°

⇨ $\overline{OB} = \overline{OC}$이므로

$\angle OBC = \angle OCB = \frac{180^\circ - 68^\circ}{2} = 56^\circ$이다.

$\therefore \angle OAC = \angle OCA = 56^\circ - 20^\circ = 36^\circ$

$\therefore \angle AOC = 180^\circ - 36^\circ \times 2 = 108^\circ$

$\therefore \angle AOB = 108^\circ - 68^\circ = 40^\circ$

$\therefore \angle OBA = \angle OAB = \frac{180^\circ - 40^\circ}{2} = 70^\circ$

76) 40°

⇨ $\angle BOC = 2\angle A = 2 \times 50^\circ = 100^\circ$

$\triangle OBC$에서 $\overline{OB} = \overline{OC}$이므로

$\angle x = \frac{1}{2} \times (180^\circ - 100^\circ) = 40^\circ$

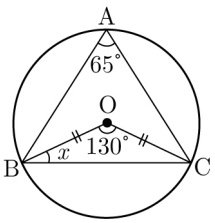
77) 25°

⇨ 다음 그림과 같이 $\overline{OC}$를 그으면

$\angle BOC = 2\angle BAC = 2 \times 65^\circ = 130^\circ$

$\triangle OBC$에서 $\overline{OB} = \overline{OC}$이므로

$\angle x = \frac{1}{2} \times (180^\circ - 130^\circ) = 25^\circ$



78) 110°

⇨ $\angle x = 2 \times 55^\circ = 110^\circ$

79) 42°

⇨ $\angle BOC = 2 \times 48^\circ = 96^\circ$

$\triangle OBC$에서 $\overline{OB} = \overline{OC}$이므로

$\angle x = \frac{1}{2} \times (180^\circ - 96^\circ) = 42^\circ$

80) 58°

⇨ $\triangle OBC$에서 $\overline{OB} = \overline{OC}$이므로

$\angle BOC = 180^\circ - 2 \times 32^\circ = 116^\circ$

$\therefore \angle x = \frac{1}{2} \times 116^\circ = 58^\circ$

81) 60°

82) 50°

⇨ $\triangle OBC$에서 $\angle OBC = \angle OCB = 40^\circ$이므로

$\angle BOC = 180^\circ - (40^\circ + 40^\circ) = 100^\circ$

$\therefore \angle x = \frac{1}{2}\angle BOC = \frac{1}{2} \times 100^\circ = 50^\circ$

83) 84°

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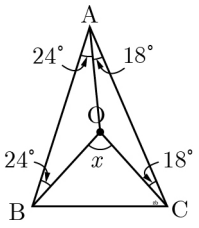
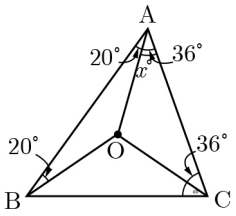
⇨ 

$\overline{OA}$를 그으면 $\angle OAB=\angle OBA=24^\circ$,
$\angle OAC=\angle OCA=18^\circ$이므로
$\angle BAC=24^\circ+18^\circ=42^\circ$
$\therefore\ \angle x=2\times42^\circ=84^\circ$

84) 56

⇨ 

$\overline{OA}$를 그으면 $\overline{OA}=\overline{OB}$이므로
$\angle OAB=\angle OBA=20^\circ$
또, $\overline{OA}=\overline{OC}$이므로 $\angle OAC=\angle OCA=36^\circ$
$\therefore\ \angle BAC=20^\circ+36^\circ=56^\circ$
$\therefore\ x=56$

85) 66°

⇨ $\triangle OBC$에서 $\overline{OB}=\overline{OC}$이므로
$\angle BOC=180^\circ-2\times24^\circ=132^\circ$
$\therefore\ \angle x=\frac{1}{2}\times132^\circ=66^\circ$

86) 110°

⇨ $\angle OCB=\angle OBC=25^\circ$이므로
$\angle ACB=25^\circ+30^\circ=55^\circ$
$\therefore\ \angle x=2\times55^\circ=110^\circ$

87) 37°

⇨ $\angle BAC=\frac{1}{2}\times114^\circ=57^\circ$
$\angle OAC=\angle OCA=20^\circ$이므로 $\angle x=57^\circ-20^\circ=37^\circ$

88) 40°

⇨ $\angle BOC=\frac{2}{3+2+4}\times360^\circ=80^\circ$이므로
$\angle BAC=\frac{1}{2}\times80^\circ=40^\circ$

89) 72°

⇨ $\angle BAC=\frac{3}{3+5+7}\times180^\circ=36^\circ$이므로
$\angle BOC=2\times36^\circ=72^\circ$

90) 90°

⇨ $\angle OBA=\angle OAB=\frac{2}{2+3+5}\times90^\circ=18^\circ$,
$\angle OBC=\frac{3}{2+3+5}\times90^\circ=27^\circ$이므로
$\angle AOC=2\times(18^\circ+27^\circ)=90^\circ$

91) 80°

⇨ $\angle AOC=\frac{4}{2+3+4}\times360^\circ=160^\circ$
$\therefore\ \angle ABC=\frac{1}{2}\times160^\circ=80^\circ$

92) 60°

⇨ 점 O가 외심이므로 $\angle COA=2\angle ABC$가 성립한다.
$\angle AOB:\angle BOC:\angle COA=2:4:3$일 때,
$\angle COA=\frac{3}{9}\times360^\circ=120^\circ$이다.
따라서 $\angle ABC=\frac{1}{2}\times120^\circ=60^\circ$이다.

93) 30°

94) 72°

95) 177°

96) 160°

⇨ $\angle x=40^\circ, \angle y=120^\circ$

97) 96°

98) 80°

⇨ $\overline{OB}=\overline{OC}$이므로 $\angle OCB=33^\circ$, $\angle BOC=114^\circ$이다. 외심의 성질에 의해서 $\angle BOC=2\angle A$이므로 $\angle x=57^\circ$이다.
삼각형의 세 내각의 크기의 합은 180°이다.
따라서 $57^\circ+67^\circ+33^\circ+\angle y=180^\circ$, $\angle y=23^\circ$이다.

99) 155°

⇨ $20^\circ+45^\circ+\angle x=90^\circ$ $\therefore\angle x=25^\circ$
$\overline{OB}=\overline{OC}$이므로 $\angle OBC=\angle OCB=25^\circ$
따라서 $\angle y=180^\circ-(25^\circ+25^\circ)=130^\circ$이므로
$\angle x+\angle y=25^\circ+130^\circ=155^\circ$

100) 174°

101) 135°

102) 150°

⇨ $\overline{OA}=\overline{OB}=\overline{OC}$이므로 $\angle OCA=30^\circ$, $\angle OCB=20^\circ$이다. 따라서 $\angle y=50^\circ$이다.
또, 외심의 성질에 의해서 $\angle AOB=2\angle C$이므로
$\angle x=2y=100^\circ$이다.
이 때, $\angle x+\angle y=150^\circ$이다.

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103) 110°

⇨ $\overline{OA}=\overline{OB}=\overline{OC}$이므로

$\angle OBC=30^\circ$, $\angle OAB=\angle OBA=50^\circ$

$\triangle ABC$의 내각의 크기의 합은 180°이므로

$x+y+20^\circ+50^\circ=180^\circ$

$\therefore\ x+y=110^\circ$

104) 56°

⇨ $\angle OCB=\angle OBC=24^\circ$, $\angle OCA=\angle OAC=32^\circ$

$\angle C=32^\circ+24^\circ=56^\circ$

105) 2

⇨ $\angle OBC=\angle OCB=20^\circ$이므로 $\angle BOC=140^\circ$

따라서 $\angle BAC=\frac{360^\circ-140^\circ}{2}=110^\circ$이므로

$15x^\circ=30^\circ$에서 $x=2$

106) 10cm

⇨ $\angle OBA=\angle OAB=30^\circ$,

$\angle AOB=180^\circ-30^\circ-30^\circ=120^\circ$,

$\angle COB=\angle OBC=\angle BCO=60^\circ$

$\triangle OBC$가 정삼각형이므로 $\overline{OC}=\overline{OB}=\overline{BC}$이고, 점 O가 $\triangle ABC$의 외심이므로 $\overline{OA}=\overline{OC}=\overline{OB}=5$ cm이다.

$\therefore \overline{AC}=10$ cm

107) 24°

⇨ $\angle OBA=\angle OAB=34^\circ$, $\angle OCB=\angle OBC=32^\circ$

$\angle x=90^\circ-34^\circ-32^\circ=24^\circ$

108) 40°

⇨ $\angle OBA=\angle OAB=20^\circ$, $\angle OBC=\angle OCB=30^\circ$

$\therefore \angle x=40^\circ$

109) 124°

⇨ $\overline{OA}=\overline{OB}=\overline{OC}$이므로 $\angle OAC=28^\circ$이다.

또, 삼각형의 한 외각은 이웃하지 않는 두 내각의 크기의 합과 같다.

즉, $\angle AOB=56^\circ$이고, $\angle BAO=\angle ABO=62^\circ$이다.

이 때, $\angle BO'O=2\angle BAO$이므로 $\angle BO'O=124^\circ$이다.

110) 35°

111) 25°

⇨ 외심의 성질에 의해 $\overline{O'O}=\overline{O'C}$이므로

$\angle O'OC=25^\circ$, $\angle OO'C=130^\circ$이고,

$\angle OO'C=2\angle A$이므로 $\angle A=65^\circ$이다.

또, $\overline{AO}=\overline{BO}=\overline{CO}$이므로 $\angle ACO=65^\circ$이고,

$\angle AOB=2\angle ACO$이므로 $\angle AOB=130^\circ$이다.

따라서 $\angle OAB=\frac{1}{2}(180^\circ-130^\circ)=25^\circ$이다.

112) 140°

⇨ $\overline{OA}=\overline{OB}=\overline{OC}$이므로 $\angle BAO=20^\circ$, $\angle AOC=40^\circ$이다. 따라서 $\angle OAC=\angle OCA=70^\circ$이다.

이 때, $\angle OO'C=2\angle OAC$이므로 $\angle OO'C=140^\circ$이다.

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