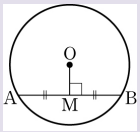
◇「콘텐츠산업 진흥법 시행령」제33조에 의한 표시
1) 제작연월일 : 2016-10-25
2) 제작자 : 교육지대㈜
3) 이 콘텐츠는 「콘텐츠산업 진흥법」에 따라 최초 제작일부터 5년간 보호됩니다.

◇「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.

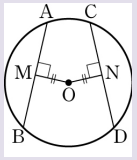
계산시 참고사항

1. 중심각의 크기와 호, 현의 길이: 한 원 또는 합동인 두 원에서
1) 크기가 같은 두 중심각에 대한 호의 길이와 현의 길이는 각각 같다.
2) 길이가 같은 두 호 또는 두 현에 대한 중심각의 크기는 같다.
3) 중심각의 크기와 호의 길이는 정비례한다.
4) 중심각의 크기와 현의 길이는 정비례하지 않는다.

2. 원의 중심과 현의 수직이등분선
1) 원의 중심에서 현에 내린 수선은 그 현을 이등분한다.
⇨ $\overline{AB}\perp\overline{OM}$이면 $\overline{AM}=\overline{BM}$
2) 원에서 현의 수직이등분선은 그 원의 중심을 지난다.



3. 현의 길이
1) 한 원의 중심으로부터 같은 거리에 있는 두 현의 길이는 같다.
⇨ $\overline{OM}=\overline{ON}$이면 $\overline{AB}=\overline{CD}$
2) 한 원에서 길이가 같은 두 현은 두 원의 중심으로 부터 같은 거리에 있다.
⇨ $\overline{AB}=\overline{CD}$이면 $\overline{OM}=\overline{ON}$

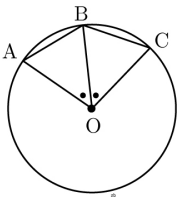


현의 수직이등분선의 증명
◉ $\overline{OA}=\overline{OB}$(원의 반지름)이고,
$\angle OMA=\angle OMB=90^\circ$,
$\overline{OM}$은 공통이므로
$\triangle OAM\equiv\triangle OBM$(RHS 합동)
따라서 $\overline{AM}=\overline{BM}$이다.

현의 길이의 증명
◉ $\angle OMA=\angle ONC=90^\circ$,
$\overline{OA}=\overline{OC}$(원의 반지름),
$\overline{OM}=\overline{ON}$이므로
$\triangle OAM\equiv\triangle OCN$(RHS 합동)
따라서 $\overline{AM}=\overline{CN}$이고,
현의 수직이등분선의 성질에 의해
$\overline{AB}=2\overline{AM}$, $\overline{CD}=2\overline{CN}$이므로
$\overline{AB}=\overline{CD}$이다.

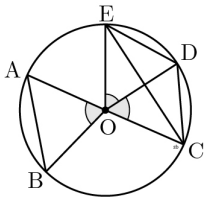
중심각의 크기와 호, 현의 길이의 관계

◪ **다음 그림의 원 O에서 $\angle AOB=\angle BOC$일 때, 다음 설명 중 옳은 것에는 ○표, 옳지 않은 것에는 ×표를 하여라.**



1. $\overset{\frown}{AB}=\overset{\frown}{BC}$ ( )
2. $\overline{AB}=\overline{BC}$ ( )
3. $\overset{\frown}{AC}=2\overset{\frown}{AB}$ ( )
4. $\overline{AC}=2\overline{AB}$ ( )
5. $\triangle AOB=\triangle BOC$ ( )
6. $\triangle AOC=2\triangle AOB$ ( )

◪ **다음 그림의 원 O에 대한 설명 중 옳은 것에는 ○표, 옳지 않은 것에는 ×표 하여라.**



7. $\angle AOB=\angle COD$**일 때,** $\overline{AB}\neq\overline{CD}$ ( )
8. $\angle AOB=\angle COD$**일 때,** $\overset{\frown}{AB}=\overset{\frown}{CD}$ ( )
9. $\overline{AB}=\overline{CD}$**일 때,** $\angle AOB=\angle COD$ ( )
10. $\overset{\frown}{AB}=\overset{\frown}{CD}$**일 때,** $\angle AOB=\angle COD$ ( )
11. $\angle COE=2\angle AOB$**일 때,** $\overline{CE}=2\overline{AB}$ ( )
12. $\angle COE=2\angle AOB$**일 때,** $\overset{\frown}{CE}=2\overset{\frown}{AB}$ ( )

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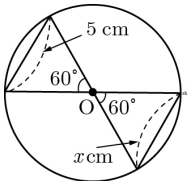
◪ 다음 그림의 원 O에서 x의 값을 구하여라.

13.



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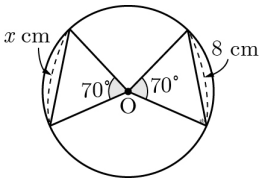

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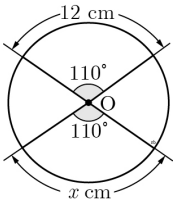

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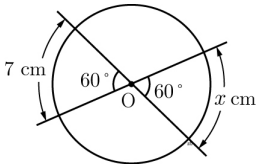

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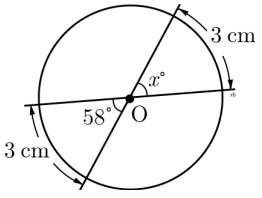

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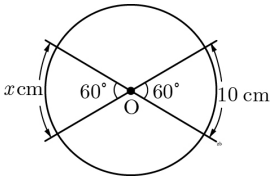

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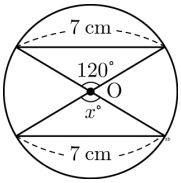

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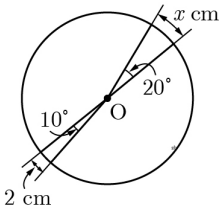

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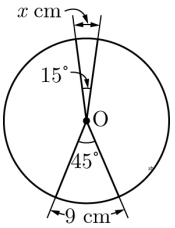

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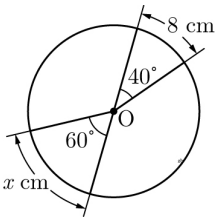

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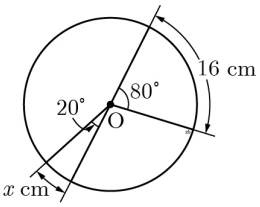

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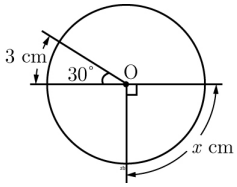

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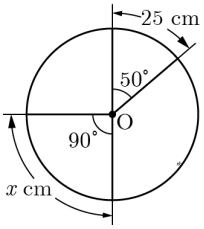

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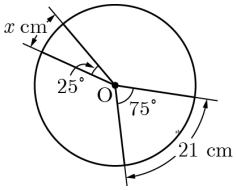

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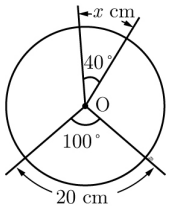

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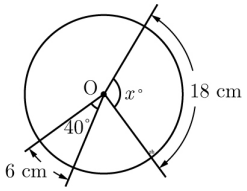

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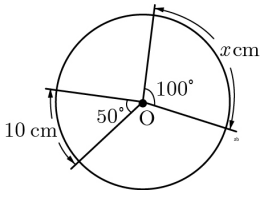

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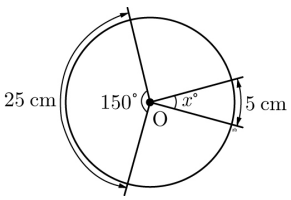

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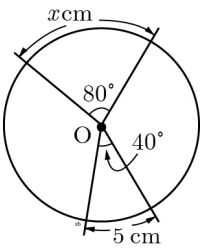

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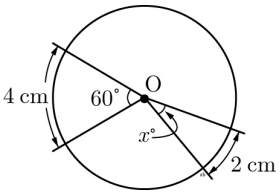

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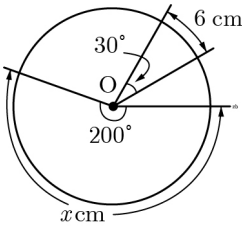

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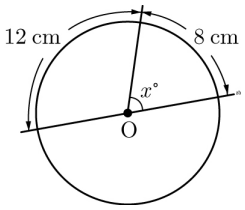

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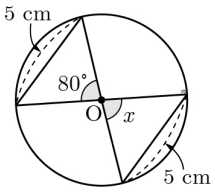
◪ 다음 그림의 원 O에서 $\angle x$의 크기를 구하여라.

35.



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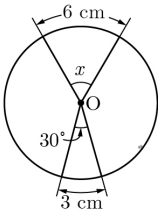

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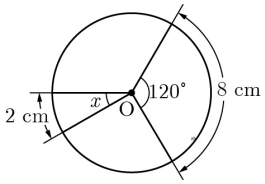

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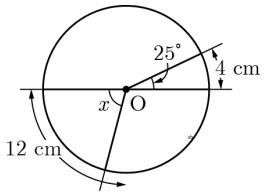

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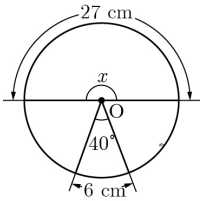

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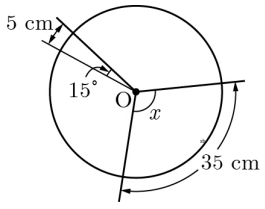

현의 수직이등분선

◪ 다음 그림의 원 O에서 x의 값을 구하여라.

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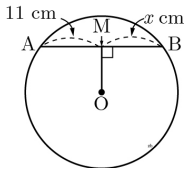

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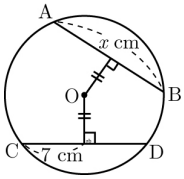

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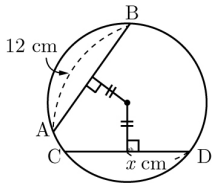

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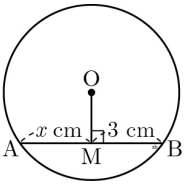

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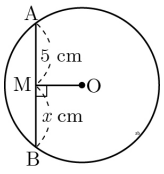

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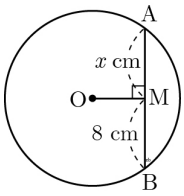

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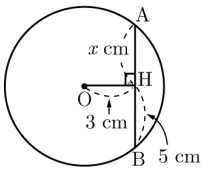

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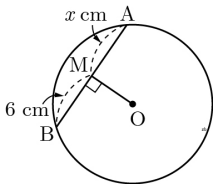

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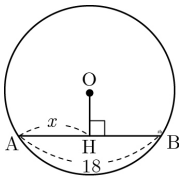
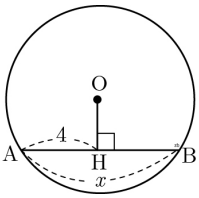
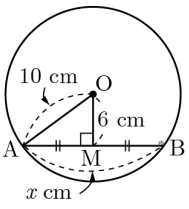


50.

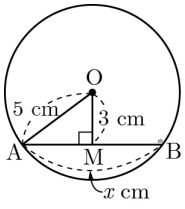


◪ 다음 그림에서 x의 값을 구하여라.

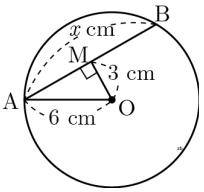
51.



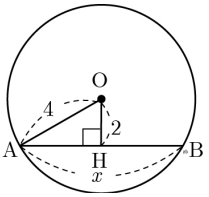
52.



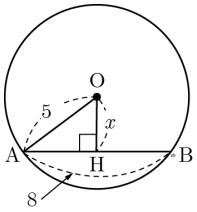
53.



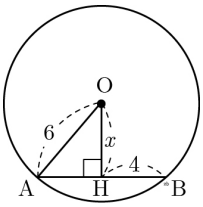
54.



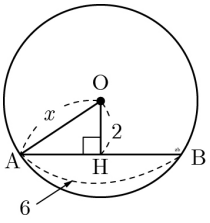
55.



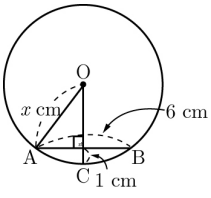
56.



57.



58.



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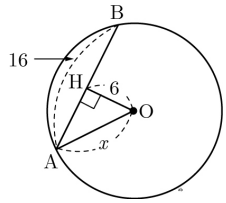
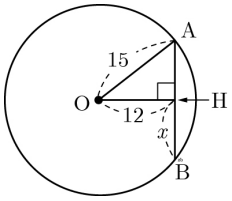
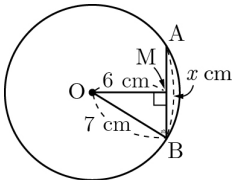
59.



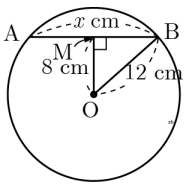
60.



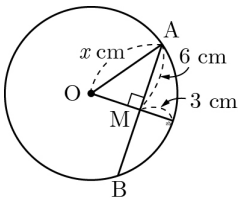
61.



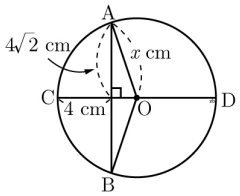
62.



63.

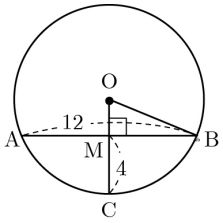


64.

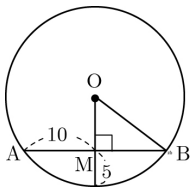


◪ 다음 그림의 원 O에서 반지름의 길이를 구하여라.

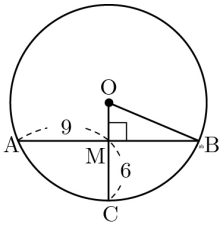
65.



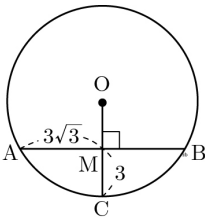
66.



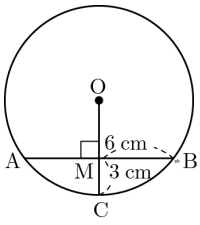
67.



68.



69.



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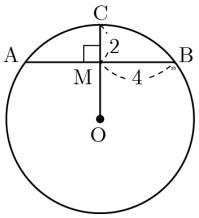
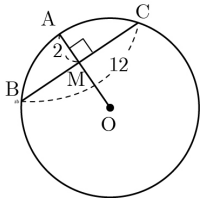
70.

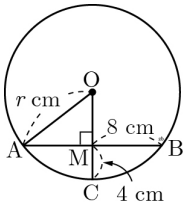


71.

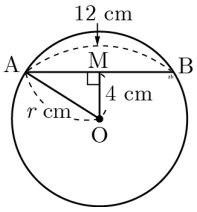


◪ 다음 그림의 원 O에서 r의 값을 구하여라.

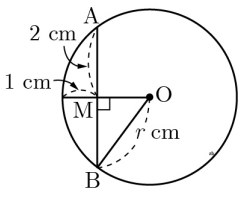
72.



73.

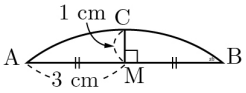


74.

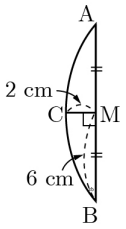


◪ 다음 그림에서 $\widehat{AB}$는 원의 일부분이다.
$\overline{AM}=\overline{BM}$, $\overline{AB}\perp\overline{CM}$일 때, 이 원의 반지름의 길이를 구하여라.

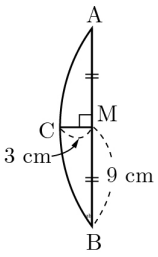
75.



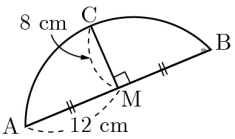
76.



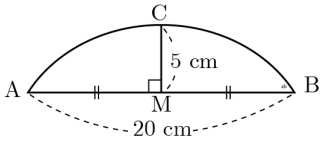
77.



78.



79.



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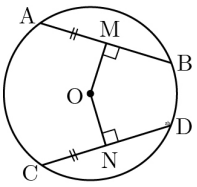
현의 길이

◪ 다음 그림과 같이 원 O에서 $\overline{AB} \perp \overline{OM}$, $\overline{CD} \perp \overline{ON}$이고, $\overline{AM} = \overline{CN}$일 때, 다음 중 옳은 것에는 ○표, 옳지 않은 것에는 ×를 하여라.



80. $\overline{AB} = \overline{CD}$ ( )

81. $\overline{OM} = \overline{BM}$ ( )

82. $\widehat{AB} \neq \widehat{CD}$ ( )

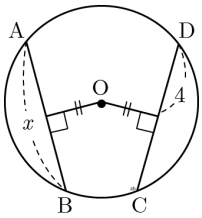
83. $\overline{OM} = \overline{ON}$ ( )

84. $\overline{CD} = 3\overline{AM}$ ( )

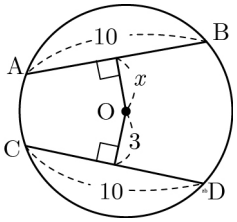
85. $\triangle OAB \equiv \triangle OCD$ ( )

◪ 다음 그림의 원 O에서 x의 값을 구하여라.

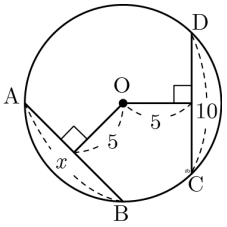
86.



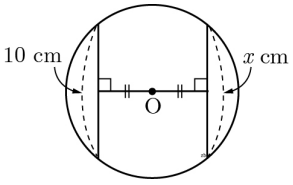
87.



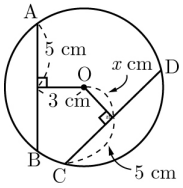
88.



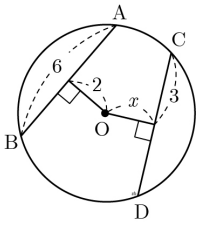
89.



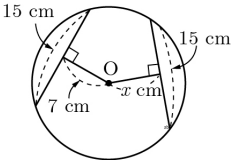
90.



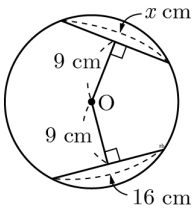
91.



92.



93.



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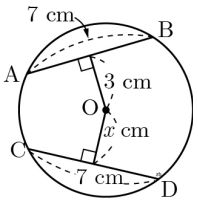
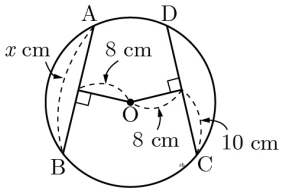
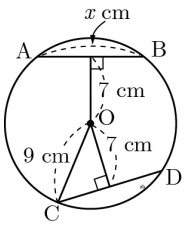
94.



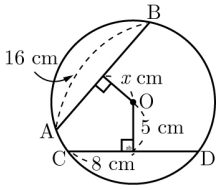
95.



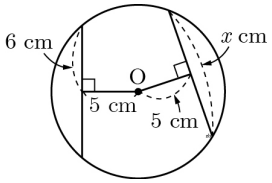
96.



97.

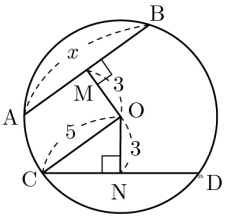


98.

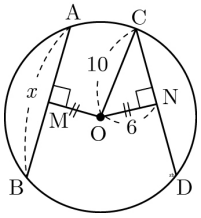


◪ 다음 그림의 원 O에서 x의 값을 구하여라.

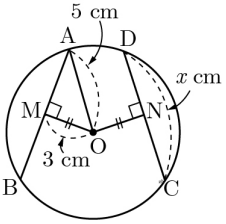
99.



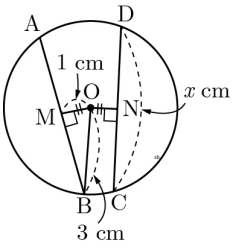
100.



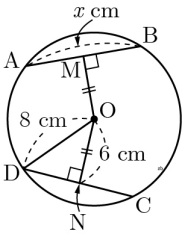
101.



102.



103.



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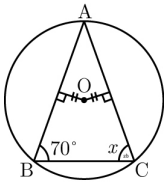
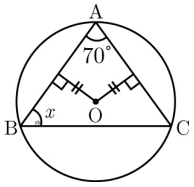
◪ 다음 그림에서 $\angle x$의 크기를 구하여라.

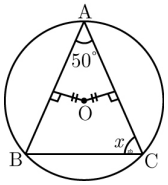
104



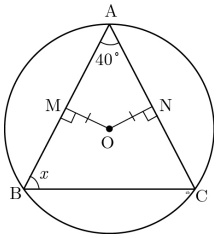
105



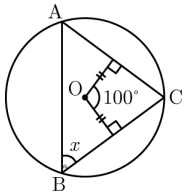
106



107

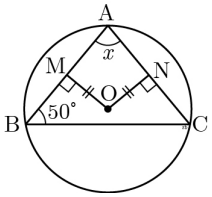


108

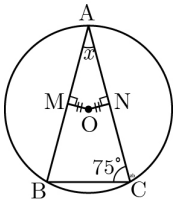


◪ 다음 그림과 같이 원 O에서 $\triangle ABC$가 내접하고 있다. $\overline{OM}=\overline{ON}$일 때, $\angle x$의 크기를 구하여라.

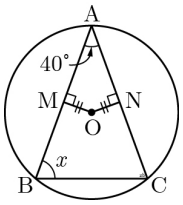
109



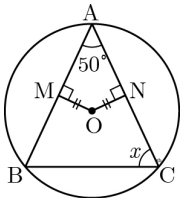
110



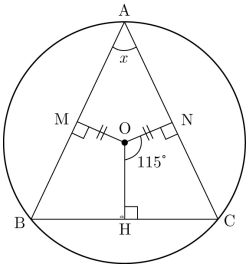
111



112



113



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정답 및 해설

1) ○

2) ○

3) ○

4) ×
⇨ 중심각의 크기와 현의 길이는 정비례하지 않으므로 $\overline{AC} \neq 2\overline{AB}$ (거짓)

5) ○

6) ×
⇨ $\triangle ABC = \triangle BOC$이므로 $2\triangle AOB = \square AOCB$
이때 $\triangle AOC < \square AOCB$이므로 $\triangle AOC < 2\triangle AOB$(거짓)

7) ×
⇨ $\angle AOB = \angle COD$일 때, $\overline{AB} = \overline{CD}$

8) ○

9) ○

10) ○

11) ×
⇨ 중심각의 크기와 현의 길이는 정비례하지 않는다.

12) ○

13) 5
⇨ 크기가 같은 두 중심각에 대한 현의 길이는 같으므로 $x = 5$

14) 8
⇨ 크기가 같은 두 중심각에 대한 현의 길이는 같다.

15) 12
⇨ 크기가 같은 두 중심각에 대한 호의 길이는 같다.

16) 7

17) 58
⇨ 길이가 같은 두 호에 대한 중심각의 크기는 같으므로 $x = 58$

18) 10
⇨ 크기가 같은 두 중심각에 대한 호의 길이는 같으므로 $x = 10$

19) 120
⇨ 길이가 같은 두 현에 대한 중심각의 크기는 같으므로 $x = 120$

20) 4
⇨ $2 : x = 10^\circ : 20^\circ$ $\therefore x = 4$

21) 3
⇨ $x : 9 = 15^\circ : 45^\circ$ $\therefore x = 3$

22) 12
⇨ $8 : x = 40^\circ : 60^\circ$ $\therefore x = 12$

23) 4
⇨ $x : 16 = 20^\circ : 80^\circ$ $\therefore x = 4$

24) 9

25) 45
⇨ $25 : x = 50^\circ : 90^\circ$ $\therefore x = 45$

26) 7
⇨ $x : 21 = 25^\circ : 75^\circ$ $\therefore x = 7$

27) 8
⇨ $40^\circ : 100^\circ = x : 20$이므로 $x = 8$

28) 120
⇨ $40^\circ : x^\circ = 6 : 18$이므로 $x = 120$

29) 20
⇨ $10 : x = 50^\circ : 100^\circ$ $\therefore x = 20$

30) 30
⇨ $25 : 5 = 150^\circ : x^\circ$ $\therefore x = 30$

31) 10
⇨ $x : 5 = 80^\circ : 40^\circ$ $\therefore x = 10$

32) 30
⇨ $4 : 2 = 60^\circ : x^\circ$ $\therefore x = 30$

33) 40
⇨ $x : 6 = 200^\circ : 30^\circ$ $\therefore x = 40$

34) 72
⇨ $12 : 8 = (180^\circ - x^\circ) : x^\circ$ 이므로 $12x = 8(180 - x)$
$20x = 1440$ $\therefore x = 72$

35) 80°
⇨ 길이가 같은 두 현에 대한 중심각의 크기는 같다.

36) 60°
⇨ $6 : 3 = \angle x : 30^\circ$ $\therefore \angle x = 60^\circ$

37) 30°
⇨ $2 : 8 = \angle x : 120^\circ$ $\therefore x = 30^\circ$

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38) 75°

⇨ $12:4=\angle x:25^\circ$ $\therefore x=75^\circ$

39) 180°

⇨ $27:6=\angle x:40^\circ$ $\therefore x=180^\circ$

40) 105°

⇨ $5:35=15^\circ:\angle x$ $\therefore x=105^\circ$

41) 11

⇨ $\overline{AM}=\overline{BM}=11\text{cm}$ $\therefore x=11$

42) 14

43) 6

44) 3

⇨ $\overline{AM}=\overline{BM}=3\text{cm}$ $\therefore x=3$

45) 5

⇨ $\overline{AM}=\overline{BM}=5\text{cm}$ $\therefore x=5$

46) 8

⇨ $\overline{AM}=\overline{BM}=8\text{cm}$ $\therefore x=8$

47) 5

48) 6

⇨ $\overline{AM}=\overline{BM}=6\text{cm}$ $\therefore x=6$

49) 9

⇨ $\overline{AH}=\frac{1}{2}\overline{AB}=9$이므로 $x=9$

50) 8

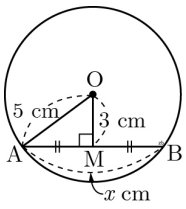
⇨ $\overline{AB}=2\overline{AH}=8$이므로 $x=8$

51) 16

⇨ $\overline{AM}=\sqrt{10^2-6^2}=8(\text{cm})$

$\therefore x=2\overline{AM}=16$

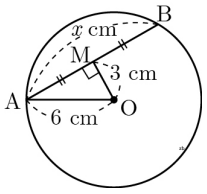
52) 8

⇨ 

$\overline{AM}=\sqrt{5^2-3^2}=4(\text{cm})$

$\therefore x=2\overline{AM}=8$

53) $6\sqrt{3}$

⇨ 

$\overline{AM}=\sqrt{6^2-3^2}=3\sqrt{3}(\text{cm})$

$\therefore x=2\overline{AM}=6\sqrt{3}$

54) $4\sqrt{3}$

⇨ $\overline{AH}=\sqrt{4^2-2^2}=2\sqrt{3}$이므로 $x=2\overline{AH}=4\sqrt{3}$

55) 3

⇨ $\overline{AH}=\frac{1}{2}\overline{AB}=4$이므로 $x=\sqrt{5^2-4^2}=3$

56) $2\sqrt{5}$

⇨ $\overline{AH}=\overline{BH}=4$이므로 $x=\sqrt{6^2-4^2}=2\sqrt{5}$

57) $\sqrt{13}$

⇨ $\overline{AH}=\frac{1}{2}\overline{AB}=3$이므로 $x=\sqrt{3^2+2^2}=\sqrt{13}$

58) 5

⇨ $x^2=3^2+(x-1)^2$이므로 $x=5$

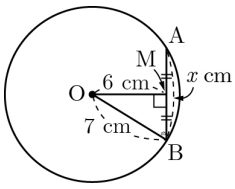
59) 10

⇨ $\overline{AH}=\frac{1}{2}\overline{AB}=8$이므로 $x=\sqrt{8^2+6^2}=10$

60) 9

⇨ $\overline{AH}=\sqrt{15^2-12^2}=9$이므로 $x=\overline{AH}=9$

61) $2\sqrt{13}$

⇨ 

$\overline{BM}=\sqrt{7^2-6^2}=\sqrt{13}(\text{cm})$

$\therefore x=2\overline{BM}=2\sqrt{13}$

62) $8\sqrt{5}$

⇨ $\overline{BM}=\sqrt{12^2-8^2}=4\sqrt{5}$ $\therefore x=2\overline{BM}=8\sqrt{5}$

63) $\frac{15}{2}$

⇨ $\overline{OM}=(x-3)\,\text{cm}$이므로 $\triangle AOM$에서

$(x-3)^2+6^2=x^2$ $\therefore x=\frac{15}{2}$

64) 6

⇨ $x^2=(4\sqrt{2})^2+(x-4)^2$이므로 $x=6$

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65) $\frac{13}{2}$

⇨ $\overline{MB}=\frac{1}{2}\overline{AB}=6$이고, 반지름의 길이를 r라 하면 $\overline{OB}=r$, $\overline{OM}=r-4$이므로 직각삼각형 OMB에서

$(r-4)^2+6^2=r^2$, $8r=52$ $\therefore r=\frac{13}{2}$

66) $\frac{25}{2}$

⇨ $\overline{MB}=\overline{MA}=10$이고, 반지름의 길이를 r라 하면 $\overline{OB}=r$, $\overline{OM}=r-5$이므로 직각삼각형 OMB에서

$(r-5)^2+10^2=r^2$, $10r=125$ $\therefore r=\frac{25}{2}$

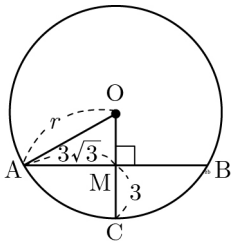
67) $\frac{39}{4}$

⇨ $\overline{MB}=\overline{MA}=9$이고, 반지름의 길이를 r라 하면 $\overline{OB}=r$, $\overline{OM}=r-6$이므로 직각삼각형 OMB에서

$(r-6)^2+9^2=r^2$, $12r=117$ $\therefore r=\frac{39}{4}$

68) 6

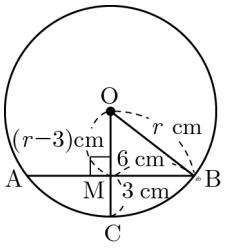
⇨ 원의 중심 O에서 보조선 OA를 긋고, 반지름의 길이를 r라 하면 $\overline{OA}=r$, $\overline{OM}=r-3$이므로 직각삼각형 OMA에서



$(3\sqrt{3})^2+(r-3)^2=r^2$, $6r=36$ $\therefore r=6$

69) $\frac{15}{2}$cm

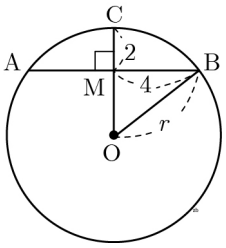
⇨ 원의 중심 O에서 보조선 OB를 긋고, 원 O의 반지름의 길이를 $r$cm라 하면 $\overline{OB}=r$(cm), $\overline{OM}=r-3$(cm)이므로 직각삼각형 OMB에서



$(r-3)^2+6^2=r^2$, $6r=45$ $\therefore r=\frac{15}{2}$

70) 5

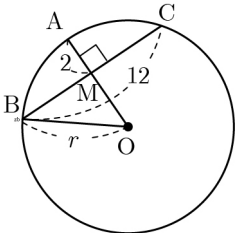
⇨ 원의 중심 O에서 보조선 OB를 긋고, 반지름의 길이를 r라 하면 $\overline{OB}=r$, $\overline{OM}=r-2$이므로 직각삼각형 OMB에서



$4^2+(r-2)^2=r^2$, $4r=20$ $\therefore r=5$

71) 10

⇨ 원의 중심 O에서 보조선 OB를 긋고, 반지름의 길이를 r라 하면 $\overline{OB}=r$, $\overline{OM}=r-2$, $\overline{BM}=6$이므로 직각삼각형 OMB에서



$6^2+(r-2)^2=r^2$, $4r=40$ $\therefore r=10$

72) 10

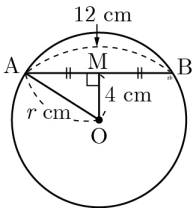
⇨ 원 O에서 반지름의 길이인 $\overline{OA}=\overline{OB}=\overline{OC}=r$cm이므로 $\overline{OM}=(r-4)$cm

피타고라스 정리에 의해

$(r-4)^2+8^2=r^2$ $\therefore\ r=10$

73) $2\sqrt{13}$

⇨

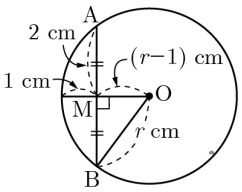


$\overline{AM}=6$cm이므로 △OAM에서

$r=\sqrt{6^2+4^2}=2\sqrt{13}$

74) $\frac{5}{2}$

⇨



$\overline{OM}=(r-1)$cm이므로 △OBM에서

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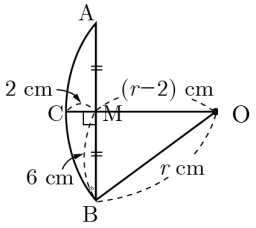
$(r-1)^2+2^2=r^2 \qquad \therefore r=\frac{5}{2}$

75) 5 cm

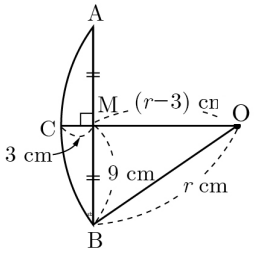
⇨ 원의 중심을 점 O, 반지름의 길이를 r cm라 하면
$\overline{OM}=(r-1)$ cm
피타고라스의 정리에 의하여
$(r-1)^2+3^2=r^2 \qquad \therefore r=5$
따라서 반지름의 길이는 5 cm이다.

76) 10 cm

⇨ 

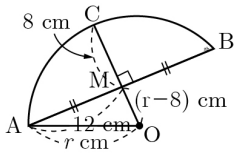
원의 중심을 O, 반지름의 길이를 r cm라 하면
$\overline{OM}=(r-2)$ cm이므로 △OBM에서
$(r-2)^2+6^2=r^2 \qquad \therefore r=10$

77) 15*cm*

⇨ 

원의 중심을 점 O, 반지름의 길이를 r cm라 하면
$\overline{OM}=(r-3)$cm, △OBM에서
$(r-3)^2+9^2=r^2 \qquad \therefore r=15$
따라서 반지름의 길이는 15 cm이다.

78) 13*cm*

⇨ 

원의 중심을 점 O, 반지름의 길이를 r cm라 하면
$\overline{OM}=(r-8)$cm, △OBM에서
$(r-8)^2+12^2=r^2 \qquad \therefore r=13$
따라서 반지름의 길이는 13 cm이다.

79) 12.5 cm

80) ○

81) ×

⇨ $\overline{OM}=\overline{BM}$인지 알 수 없다.

82) ×

⇨ 중심각의 크기가 같으므로 $\overset{\frown}{AB}=\overset{\frown}{CD}$이다.

83) ○

84) ×

⇨ $\overline{CD}=2\overline{AM}$

85) ○

86) 8

87) 3

88) 10

⇨ 원의 중심으로부터 같은 거리에 있는 두 현의 길이는 같으므로 $x=\overline{CD}=10$

89) 10

⇨ 한 원에서 원의 중심으로부터 같은 거리에 있는 두 현의 길이는 서로 같다.

90) 3

91) 2

⇨ $\overline{CD}=2\times3=6$이므로 $\overline{AB}=\overline{CD}$
따라서 길이가 같은 두 현은 원의 중심으로부터 같은 거리에 있으므로 $x=2$

92) 7

⇨ 한 원에서 길이가 같은 두 현은 원의 중심으로부터 같은 거리에 있다.

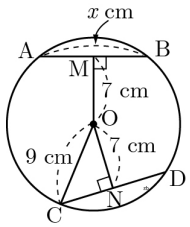
93) 16

94) 3

95) 20

⇨ $x=10\times2=20$

96) $8\sqrt{2}$

⇨ 

$\overline{CN}=\sqrt{9^2-7^2}=4\sqrt{2}\,(\text{cm})$
$\overline{AB}=\overline{CD}=2\overline{CN}=8\sqrt{2}\,(\text{cm})$

97) 5

98) 12

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⇨ $x=6\times2=12$

99) 8

⇨ 직각삼각형 ONC에서 $\overline{CN}=\sqrt{5^2-3^2}=4$
$\therefore \overline{CD}=2\overline{CN}=8$
이때 $\overline{ON}=\overline{OM}=3$이므로 $\overline{AB}=\overline{CD}$
$\therefore x=8$

100) 16

⇨ 직각삼각형 ONC에서 $\overline{CN}=\sqrt{10^2-6^2}=8$
$\therefore \overline{CD}=2\overline{CN}=16$
이때 $\overline{OM}=\overline{ON}$이므로 $\overline{AB}=\overline{CD}$
$\therefore x=16$

101) 8

⇨ △AMO에서 $\overline{AM}=\sqrt{5^2-3^2}=4\,(\mathrm{cm})$
원의 중심에서 현에 내린 수선은 그 현을 이등분하므로
$\overline{AB}=2\overline{AM}=8\,(\mathrm{cm})$
원의 중심으로부터 같은 거리에 있는 두 현의 길이는 서로 같으므로 $x=8$

102) $4\sqrt{2}$

⇨ $\overline{BM}=\sqrt{3^2-1^2}=2\sqrt{2}\,(\mathrm{cm})$
$\overline{AB}=2\overline{BM}=4\sqrt{2}\,(\mathrm{cm})$ $\therefore x=4\sqrt{2}$

103) $4\sqrt{7}$

⇨ $\overline{DN}=\sqrt{8^2-6^2}=2\sqrt{7}\,(\mathrm{cm})$
$\overline{CD}=2\overline{DN}=4\sqrt{7}\,(\mathrm{cm})$ $\therefore x=4\sqrt{7}$

104) 70°

105) 55°

⇨ $\angle x=\frac{1}{2}\times(180^\circ-70^\circ)=55^\circ$

106) 65°

⇨ $\angle x=\frac{1}{2}\times(180^\circ-50^\circ)=65^\circ$

107) 70°

⇨ $\overline{OM}=\overline{ON}$이면 $\overline{AB}=\overline{AC}$이므로 △ABC는 이등변삼각형이다.
$\therefore \angle x=\frac{1}{2}\times(180^\circ-40^\circ)=70^\circ$

108) 50°

⇨ $\angle C=180^\circ-100^\circ=80^\circ$이므로
$\angle x=\frac{1}{2}\times(180^\circ-80^\circ)=50^\circ$

109) 80°

⇨ $\overline{OM}=\overline{ON}$이므로 $\overline{AB}=\overline{AC}$
따라서 △ABC는 이등변삼각형이다.
이등변삼각형의 두 밑각의 크기는 서로 같으므로
$\angle ACB=50^\circ$
삼각형의 세 각의 크기의 합은 180°이므로
$\angle x=180^\circ-2\times50^\circ=80^\circ$

110) 30°

⇨ $\overline{OM}=\overline{ON}$이므로 $\overline{AB}=\overline{AC}$
즉 △ABC는 이등변 삼각형이다.
$\therefore \angle x=180^\circ-2\times75^\circ=30^\circ$

111) 70°

⇨ $\overline{OM}=\overline{ON}$이므로 $\overline{AB}=\overline{AC}$
즉 △ABC는 이등변 삼각형이다.
$\therefore \angle x=\frac{1}{2}\times(180^\circ-40^\circ)=70^\circ$

112) 65°

⇨ $\overline{OM}=\overline{ON}$이므로 $\overline{AB}=\overline{AC}$
즉, △ABC는 이등변삼각형이다.
$\therefore\ x=\frac{1}{2}\times(180^\circ-50^\circ)=65^\circ$

113) 50°

⇨ □OHCN에서
$\angle HCN=360^\circ-(115^\circ+90^\circ+90^\circ)=65^\circ$
원의 중심 O에서 현까지 이르는 거리가 같으면
$\overline{AB}=\overline{AC}$가 되어서 △ABC는 이등변삼각형이므로
$\angle HCN=\angle ABC=65°$이다.
$\therefore\ \angle x=180^\circ-(65^\circ+65^\circ)=180^\circ-130^\circ=50^\circ$

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