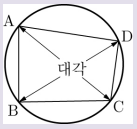
◇「콘텐츠산업 진흥법 시행령」제33조에 의한 표시
1) 제작연월일 : 2016-10-25
2) 제작자 : 교육지대㈜
3) 이 콘텐츠는 「콘텐츠산업 진흥법」에 따라 최초 제작일부터 5년간 보호됩니다.

◇「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.

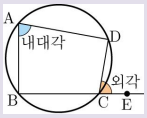
계산시 참고사항

1. 원에 내접하는 사각형의 성질



1) 원에 내접하는 사각형의 한 쌍의 대각의 크기의 합은 180° 이다.
⇨ $\angle A+\angle C=\angle B+\angle D=180^\circ$

2) 원에 내접하는 사각형의 한 외각의 크기는 그 내대각의 크기와 같다.
⇨ $\angle DCE=\angle A$



2. 사각형이 원에 내접하기 위한 조건

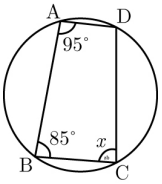
1) 한 쌍의 대각의 크기의 합이 180° 인 사각형은 원에 내접한다.
즉, $\angle A+\angle C=\angle B+\angle D=180^\circ$ 이면 $\square ABCD$는 원에 내접한다.

2) 한 외각의 크기가 그와 이웃한 내각의 대각의 크기와 같은 사각형은 원에 내접한다.
즉, $\angle BAD=\angle DCE$이면 $\square ABCD$는 원에 내접한다.

원에 내접하는 사각형의 성질

◪ 다음 그림에서 $\square ABCD$가 원에 내접할 때, $\angle x$의 크기를 구하여라.

1.



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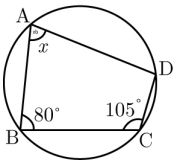

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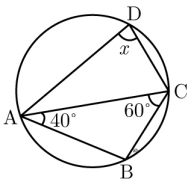

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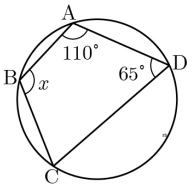

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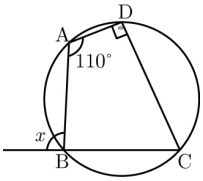

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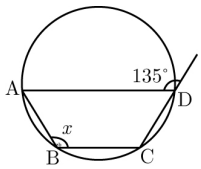

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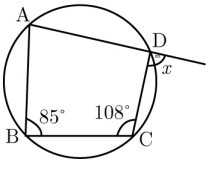

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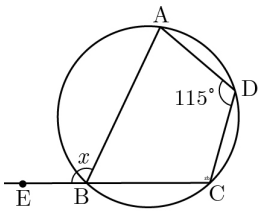

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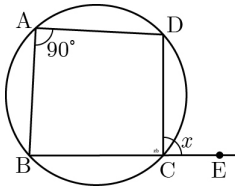

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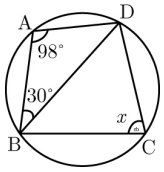

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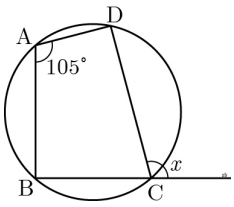

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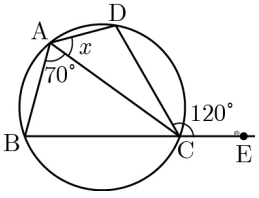

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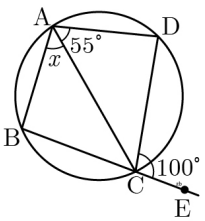

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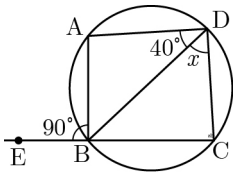

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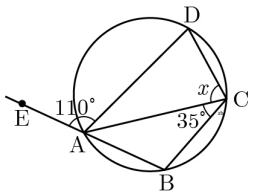

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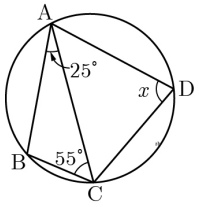

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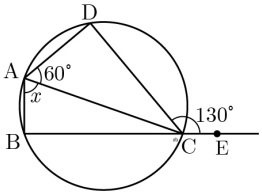

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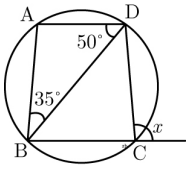

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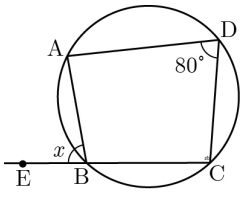

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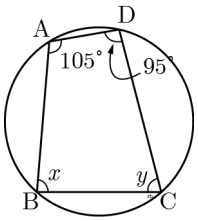
◪ 다음 그림에서 □ABCD가 원에 내접할 때, $\angle x$, $\angle y$의 크기를 각각 구하여라.

20.



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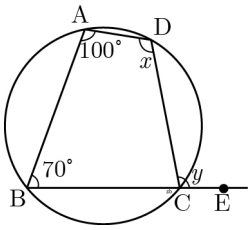

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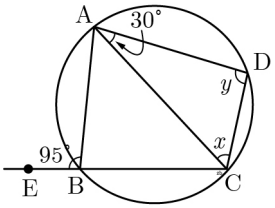

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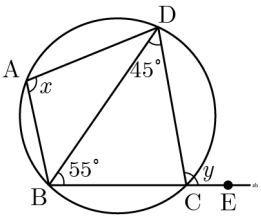

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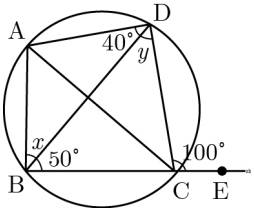

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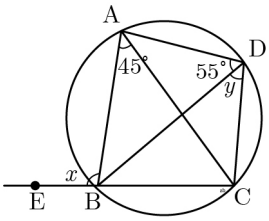

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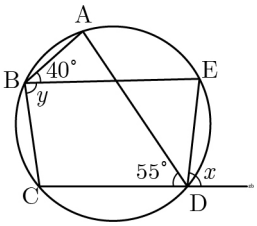

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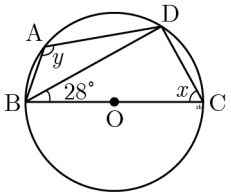

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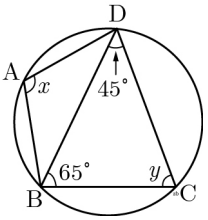

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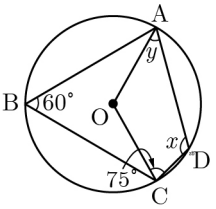

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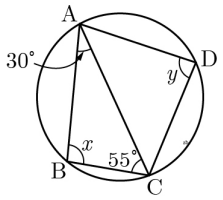

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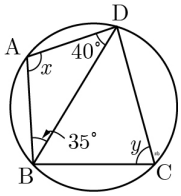

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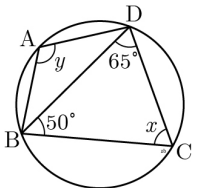

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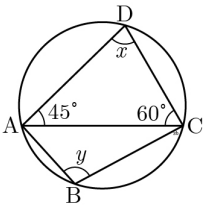

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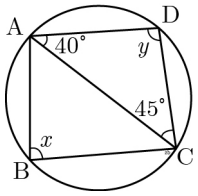

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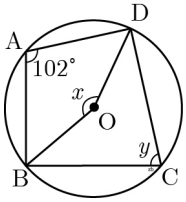

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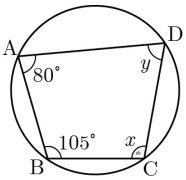

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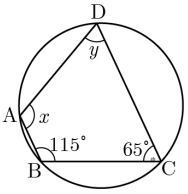

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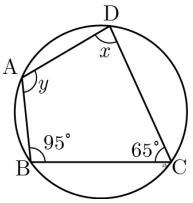

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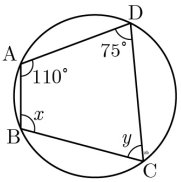

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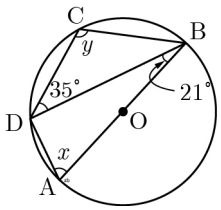

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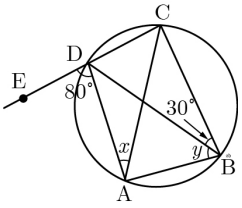

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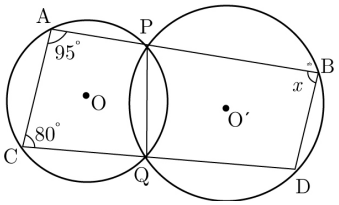
◪ 다음 그림에서 두 원 O, O′의 교점을 P, Q라 할 때, $\angle x$의 크기를 구하여라.

42.



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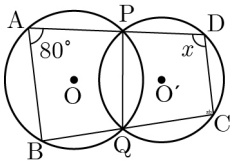

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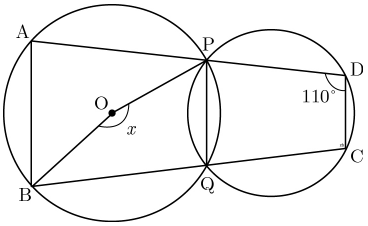

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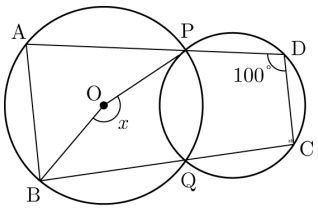
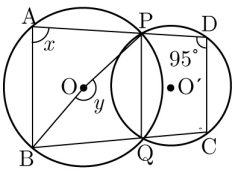
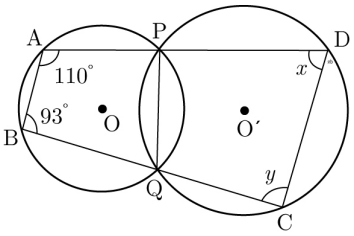


◪ 다음 그림에서 두 원 O, O′의 교점을 P, Q라 할 때, $\angle x$, $\angle y$의 크기를 각각 구하여라.

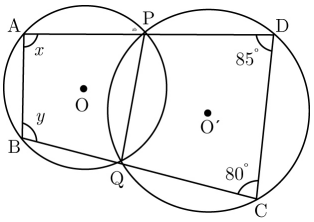
46.



47.

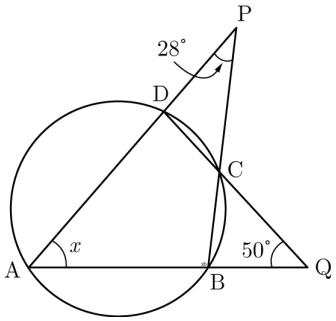


48.

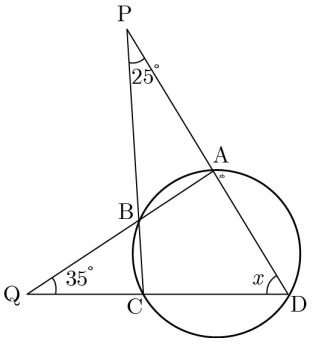


◪ 다음 그림에서 □ABCD가 원에 내접할 때, $\angle x$의 크기를 구하여라.

49.



50.



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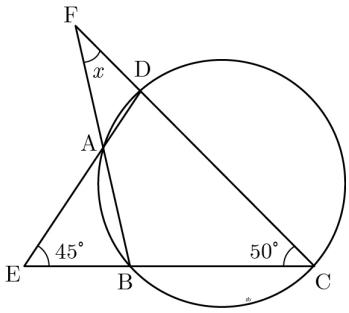
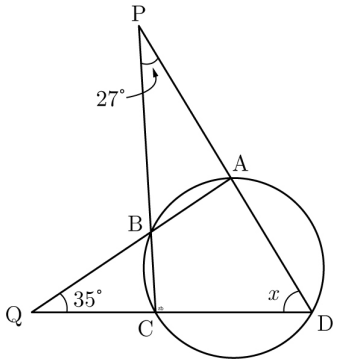
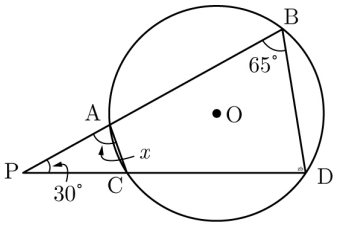
51.



52.

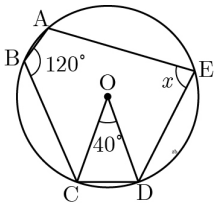


53.

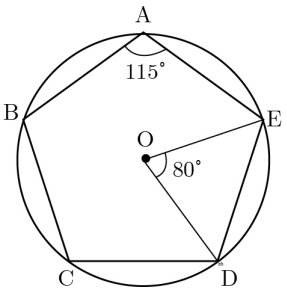


◪ 다음 물음에 답하여라.

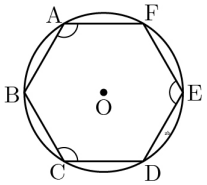
54. 다음 그림과 같이 원 O에 내접하는 오각형 ABCDE에서 $\angle x$의 크기를 구하여라.



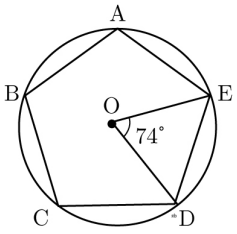
55. 원 O에 내접하는 오각형 ABCDE에서 $\angle BAE = 115^\circ$, $\angle DOE = 80^\circ$일 때, $\angle BCD$의 크기를 구하여라.



56. 다음 그림과 같이 원 O에 내접하는 육각형 ABCDEF에서 $\angle A + \angle C + \angle E$의 크기를 구하여라.



57. 다음 그림과 같이 원 O에 내접하는 오각형 ABCDE에서 $\angle DOE = 74^\circ$일 때, $\angle A + \angle C$의 값을 구하여라.



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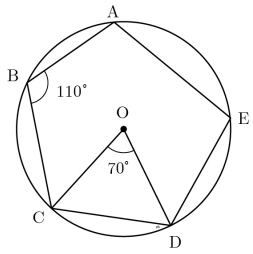
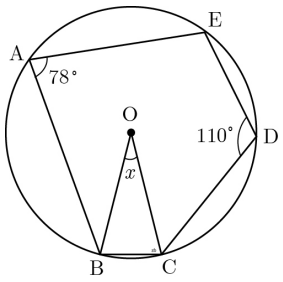
58. **오각형 ABCDE가 원 O에 내접하고 $\angle ABC=110^\circ$, $\angle COD=70^\circ$ 일 때, $\angle AED$의 크기를 구하여라.**



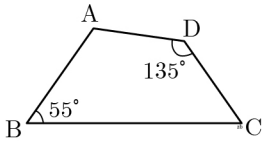
59. **다음 그림에서 오각형 ABCDE가 원 O에 내접하고 $\angle CDE=110^\circ$, $\angle BAE=78^\circ$, $\angle BOC$의 크기를 구하여라.**



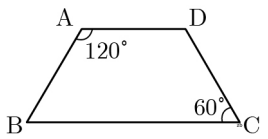
사각형이 원에 내접하기 위한 조건

◪ **다음 □ABCD 중 원에 내접하는 것은 ○표, 내접하지 않는 것은 ×표를 하여라.**

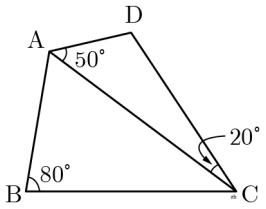
60. ( )



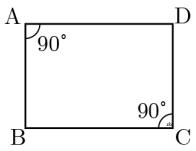
61. ( )



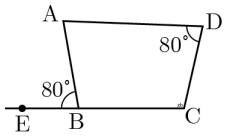
62. ( )



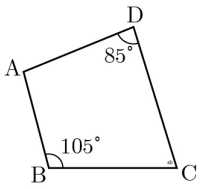
63. ( )



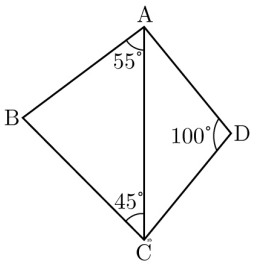
64. ( )



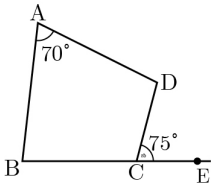
65. ( )



66. ( )



67. ( )



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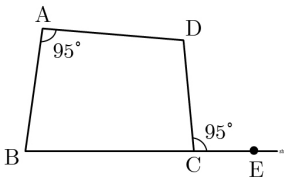
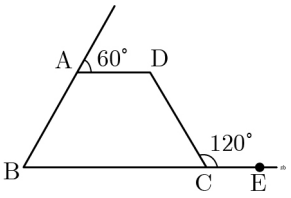
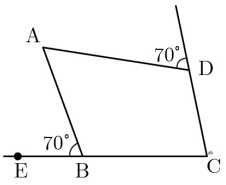
68. ( )



69. ( )

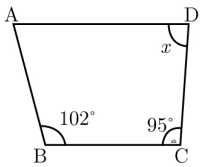


70. ( )

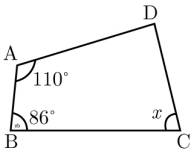


◪ **다음 그림에서 □ABCD가 원에 내접하도록 하는 $\angle x$의 크기를 구하여라.**

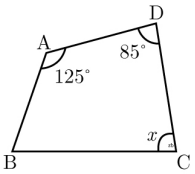
71.



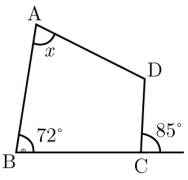
72.



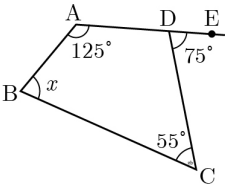
73.



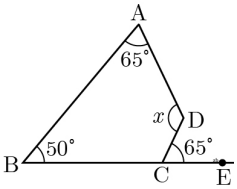
74.



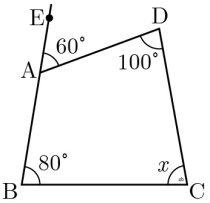
75.



76.



77.



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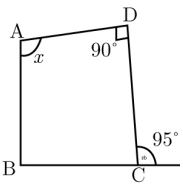
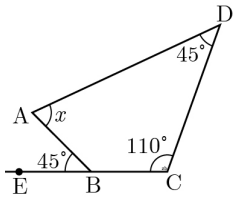
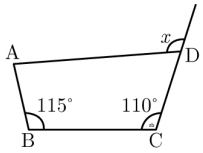
78.



79.



80.



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정답 및 해설

1) 85°
⇨ $\angle x = 180^\circ - 95^\circ = 85^\circ$

2) 75°
⇨ $\angle x = 180^\circ - 105^\circ = 75^\circ$

3) 100°
⇨ $\angle B = 180^\circ - (40^\circ + 60^\circ) = 80^\circ$
$\therefore \angle x = 180^\circ - 80^\circ = 100^\circ$

4) 115°
⇨ $\angle x = 180^\circ - 65^\circ = 115^\circ$

5) 90°

6) 135°

7) 85°

8) 115°
⇨ $\angle x = \angle D = 115^\circ$

9) 90°
⇨ $\angle x = \angle A = 90^\circ$

10) 82°
⇨ $\angle x = 180^\circ - 98^\circ = 82^\circ$

11) 105°
⇨ $\angle x = \angle A = 105^\circ$

12) 50°
⇨ $\angle BAD = \angle BAC + \angle DAC = 70^\circ + \angle x = 120^\circ$
$\therefore \angle x = 120^\circ - 70^\circ = 50^\circ$

13) 45°
⇨ $\angle BAD = \angle BAC + \angle DAC = \angle x + 55^\circ = 100^\circ$
$\therefore \angle x = 100^\circ - 55^\circ = 45^\circ$

14) 50°
⇨ $\angle ADC = \angle ADB + \angle CDB = 40^\circ + \angle x = 90^\circ$
$\therefore \angle x = 90^\circ - 40^\circ = 50^\circ$

15) 75°
⇨ $\angle DCB = \angle DCA + \angle ACB = \angle x + 35^\circ = 110^\circ$
$\therefore \angle x = 110^\circ - 35^\circ = 75^\circ$

16) 80°
⇨ $\angle ABC = 180^\circ - (25^\circ + 55^\circ) = 100^\circ$
$\therefore \angle x = 180^\circ - 100^\circ = 80^\circ$

17) 70°
⇨ $\angle x = \angle DCE - \angle CAD = 130^\circ - 60^\circ = 70^\circ$

18) 95°
⇨ $\angle x = 180^\circ - (50^\circ + 35^\circ) = 95^\circ$

19) 80°
⇨ $\angle x = \angle D = 80^\circ$

20) $\angle x = 85^\circ, \angle y = 75^\circ$
⇨ $\angle x + 95^\circ = 180^\circ$ $\therefore \angle x = 85^\circ$
$105 + \angle y = 180^\circ$ $\therefore \angle y = 75^\circ$

21) $\angle x = 110^\circ, \angle y = 100^\circ$
⇨ $70^\circ + \angle x = 180^\circ$ $\therefore \angle x = 110^\circ$
$\angle y = \angle BAD = 100^\circ$

22) $\angle x = 55^\circ, \angle y = 95^\circ$
⇨ $\angle y = \angle ABE = 95^\circ$
△ACD에서
$\angle x = 180^\circ - (30^\circ + \angle y) = 180^\circ - (30^\circ + 95^\circ) = 55^\circ$

23) $\angle x = 100^\circ, \angle y = 100^\circ$
⇨ $\angle y = 55^\circ + 45^\circ = 100^\circ$, $\angle x = \angle y = 100^\circ$

24) $\angle x = 40^\circ, \angle y = 50^\circ$
⇨ $\angle y = 100^\circ - 50^\circ = 50^\circ$
$(\angle x + 50^\circ) + (40^\circ + \angle y) = 180^\circ$ 이므로
$(\angle x + 50^\circ) + (40^\circ + 50^\circ) = 180^\circ$
$\therefore \angle x = 40^\circ$

25) $\angle x = 100^\circ, \angle y = 45^\circ$
⇨ $\angle y = \angle BAC = 45^\circ$
$\angle x = \angle ADC = 55^\circ + 45^\circ = 100^\circ$

26) $\angle x = 85^\circ, \angle y = 85^\circ$
⇨ □ABCD에서
$(40^\circ + \angle y) + 55^\circ = 180^\circ$ $\therefore \angle y = 85^\circ$
□BCDE에서 $\angle x = \angle y = 85^\circ$

27) $\angle x = 62^\circ, \angle y = 118^\circ$
⇨ $\angle BDC = 90^\circ$ 이므로 △BCD에서
$\angle x = 180^\circ - (28^\circ + 90^\circ) = 62^\circ$
$\angle x + \angle y = 62^\circ + \angle y = 180^\circ$ 이므로 $\angle y = 118^\circ$

28) $\angle x = 110^\circ, \angle y = 70^\circ$
⇨ △BCD에서 $\angle y = 180^\circ - (65^\circ + 45^\circ) = 70^\circ$
$\angle x + \angle y = \angle x + 70^\circ = 180^\circ$ 이므로 $\angle x = 110^\circ$

29) $\angle x = 120^\circ, \angle y = 45^\circ$
⇨ $\angle x + 60^\circ = 180^\circ$ 이므로 $\angle x = 120^\circ$
$\angle AOC = 2 \times 60^\circ = 120^\circ$ 이므로

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□AOCD에서
$\angle y = 360^\circ - (120^\circ + 75^\circ + 120^\circ) = 45^\circ$

30) $\angle x = 95^\circ, \angle y = 85^\circ$
⇨ $\angle x = 180^\circ - (30^\circ + 55^\circ) = 95^\circ$
$\angle y = 180^\circ - 95^\circ = 85^\circ$

31) $\angle x = 105^\circ, \angle y = 75^\circ$
⇨ $\angle x = 180^\circ - (35^\circ + 40^\circ) = 105^\circ$
$\angle y = 180^\circ - 105^\circ = 75^\circ$

32) $\angle x = 65^\circ, \angle y = 115^\circ$
⇨ $\angle x = 180^\circ - (50^\circ + 65^\circ) = 65^\circ$
$\angle y = 180^\circ - 65^\circ = 115^\circ$

33) $\angle x = 75^\circ, \angle y = 105^\circ$
⇨ $\angle x = 180^\circ - (45^\circ + 60^\circ) = 75^\circ$
$\angle y = 180^\circ - 75^\circ = 105^\circ$

34) $\angle x = 85^\circ, \angle y = 95^\circ$
⇨ △ACD에서 $\angle y = 180^\circ - (40^\circ + 45^\circ) = 95^\circ$
$\angle x + \angle y = \angle x + 95^\circ = 180^\circ$ 이므로 $\angle x = 85^\circ$

35) $\angle x = 156^\circ, \angle y = 78^\circ$
⇨ $102^\circ + \angle y = 180^\circ$ 이므로 $\angle y = 78^\circ$
$\angle x = 2\angle y = 2 \times 78^\circ = 156^\circ$

36) $\angle x = 100^\circ, \angle y = 75^\circ$
⇨ $\angle x = 180^\circ - 80^\circ = 100^\circ, \angle y = 180^\circ - 105^\circ = 75^\circ$

37) $\angle x = 115^\circ, \angle y = 65^\circ$
⇨ $\angle x = 180^\circ - 65^\circ = 115^\circ, \angle y = 180^\circ - 115^\circ = 65^\circ$

38) $\angle x = 85^\circ, \angle y = 115^\circ$
⇨ $\angle x = 180^\circ - 95^\circ = 85^\circ, \angle y = 180^\circ - 65^\circ = 115^\circ$

39) $\angle x = 105^\circ, \angle y = 70^\circ$
⇨ $\angle x = 180^\circ - 75^\circ = 105^\circ, \angle y = 180^\circ - 110^\circ = 70^\circ$

40) $\angle x = 69^\circ$, $\angle y = 111^\circ$
⇨ $\overline{AB}$가 원 O의 지름이므로 $\angle ADB = 90^\circ$
△ABD에서 $\angle x = 180^\circ - (90^\circ + 21^\circ) = 69^\circ$
$\angle A + \angle C = 180^\circ$ 이므로
$69^\circ + \angle y = 180^\circ$ $\therefore \angle y = 111^\circ$

41) $\angle x = 30^\circ$, $\angle y = 50^\circ$
⇨ $\angle x = \angle DBC = 30^\circ$
$\angle ABC = \angle ADE = 80^\circ$ 이므로
$\angle y + 30^\circ = 80^\circ$ $\therefore \angle y = 50^\circ$

42) 85°
⇨ $\angle PQD$(내대각) $= \angle CAP = 95^\circ$

□PQDB가 원에 내접하고 있으므로
$\angle x = 180^\circ - 95^\circ = 85^\circ$
따라서 $\angle PBD = 85^\circ$ 가 된다.

43) 100°

44) 140°

45) 160°

46) $\angle x = 85^\circ$, $\angle y = 170^\circ$
⇨ □PQCD는 원 O′에 내접하므로 $\angle PQB = \angle PDC = 95^\circ$
또 □ABQP는 원 O에 내접하므로
$\angle x = 180^\circ - 95^\circ = 85^\circ$, $\angle y = 2\angle x = 170^\circ$

47) $\angle x = 70^\circ$, $\angle y = 87^\circ$

48) $\angle x = 95^\circ$, $\angle y = 100^\circ$
⇨ □PQCD가 원 O′에 내접하고 있으므로
$\angle PQC = 180^\circ - 85^\circ = 95^\circ$
$\angle x = \angle PQC$(내대각)$= 95^\circ$
$\angle QPD = 180^\circ - 80^\circ = 100^\circ$
$\angle y = \angle QPD$(내대각)$= 100^\circ$

49) 51°
⇨ □ABCD는 원에 내접하므로 $\angle BCQ = \angle DAB = \angle x$
△ABP의 한 외각의 크기는 $\angle CBQ = \angle x + 28^\circ$
따라서 △BCQ에서 $\angle x + 28^\circ + \angle x + 50^\circ = 180^\circ$ 이므로
$2\angle x = 102^\circ$ $\therefore \angle x = 51^\circ$

50) 60°
⇨ △PCD의 두 내각의 합이 한 외각의 크기와 같으므로
$\angle BCQ = \angle x + 25^\circ$
이때 $\angle BCQ = \angle BAD = \angle x + 25^\circ$
이제 △ADQ에서 $35^\circ + (\angle x + 25^\circ) + \angle x = 180^\circ$
$2\angle x = 120^\circ$ $\therefore \angle x = 60^\circ$

51) 35°
⇨ $\angle EBA$는 △BCF의 외각이므로 $\angle EBA = \angle x + 50^\circ$
□ABCD는 원에 내접하므로 $\angle EAB = \angle DCB = 50^\circ$ 이고,
△ABE의 세 내각의 합에서
$45^\circ + 50^\circ + (\angle x + 50^\circ) = 180^\circ$ $\therefore \angle x = 35^\circ$

52) 59°
⇨ △PCD에서 한 외각인 $\angle PCQ = \angle x + 27^\circ$
△BCQ에서 한 외각인
$\angle ABC = \angle x + 27^\circ + 35^\circ = \angle x + 62^\circ$
□ABCD는 원에 내접하는 사각형이므로
$\angle ABC + \angle ADC = 180^\circ$
$2\angle x + 62^\circ = 180^\circ$, $2\angle x = 118^\circ$ $\therefore \angle x = 59^\circ$

53) 85°
⇨ △PBD에서 $\angle D = 180^\circ - 65^\circ - 30^\circ = 85^\circ$

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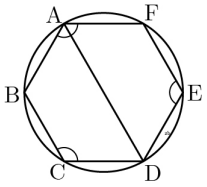
□ABCD가 원에 내접하므로
$\angle BAC = 180^\circ - 85^\circ = 95^\circ$
$\therefore \angle x = 180^\circ - 95^\circ = 85^\circ$

54) 80°
⇨ $\overline{CE}$를 그으면 □ABCE가 원 O에 내접하므로
$\angle ABC + \angle AEC = 180^\circ$
$\therefore \angle AEC = 180^\circ - 120^\circ = 60^\circ$
한 원에서 한 호에 대한 원주각의 크기는 그 호에 대한 중심각의 크기의 $\frac{1}{2}$이므로
$\angle CED = \frac{1}{2}\angle COD = \frac{1}{2} \times 40^\circ = 20^\circ$
$\angle x = \angle AEC + \angle CED = 60^\circ + 20^\circ = 80^\circ$

55) 105°
⇨ 원주각은 중심각의 $\frac{1}{2}$이므로
$\angle ECD = \frac{1}{2}\angle EOD = \frac{1}{2} \times 80^\circ = 40^\circ$
□ABCE가 내접사각형이 되어서
$\angle BCE = 180^\circ - 115^\circ = 65^\circ$
$\therefore \angle BCD = 65^\circ + 40^\circ = 105^\circ$

56) 360°
⇨ 

$\overline{AD}$를 그으면 □ABCD와 □ADEF가 원 O에 내접하므로
$\angle C + \angle BAD = 180^\circ, \angle E + \angle DAF = 180^\circ$
$\angle A + \angle C + \angle E = \angle C + \angle BAD + \angle E + \angle DAF$
$= 180^\circ + 180^\circ = 360^\circ$

57) 217°
⇨ 원주각은 중심각의 $\frac{1}{2}$이 되어서
$\angle ECD = \frac{1}{2}\angle EOD = \frac{1}{2} \times 74^\circ = 37^\circ$
□ABCE가 원의 내접사각형이 되어서
$\angle BCE + \angle A = 180^\circ$
$\therefore \angle A + \angle C = \angle A + \angle BCE + \angle ECD$
$= 180^\circ + 37^\circ = 217^\circ$

58) 105°
⇨ 사각형 BCEA는 원 O에 내접하므로
$\angle AEC = 180^\circ - 110^\circ = 70^\circ$
$\angle CED = \frac{1}{2}\angle COD = 35^\circ$
$\therefore \angle AED = 70^\circ + 35^\circ = 105^\circ$

59) 16°
⇨ $\overline{BD}$를 그으면 원에 내접하는 사각형 ABDE에서
$78^\circ + \angle BDE = 180^\circ$ $\therefore \angle BDE = 102^\circ$
따라서 $\angle BDC = 110^\circ - 102^\circ = 8^\circ$이므로
$\widehat{BC}$의 중심각인 $\angle BOC = 8^\circ \times 2 = 16^\circ$이다.

60) ×
⇨ $\angle B + \angle D = 55^\circ + 135^\circ = 190^\circ$이므로 □ABCD는 원에 내접하지 않는다.

61) ○
⇨ $\angle A + \angle C = 120^\circ + 60^\circ = 180^\circ$이므로 □ABCD는 원에 내접한다.

62) ×
⇨ △ACD에서 $\angle D = 180^\circ - (50^\circ + 20^\circ) = 110^\circ$이므로
$\angle B + \angle D = 80^\circ + 110^\circ = 190^\circ$
따라서 □ABCD는 원에 내접하지 않는다.

63) ○
⇨ $\angle A + \angle C = 90^\circ + 90^\circ = 180^\circ$이므로
□ABCD는 원의 내접한다.

64) ○
⇨ $\angle ADC = \angle ABE$이므로 □ABCD는 원의 내접한다.

65) ×
⇨ $\angle B + \angle D = 105^\circ + 85^\circ = 190^\circ$이므로
□ABCD는 원의 내접하지 않는다.

66) ○
⇨ $\angle ABC = 180^\circ - (55^\circ + 45^\circ) = 80^\circ$일 때
사각형 ABCD의 두 대각의 합은 $\angle B + \angle D = 180^\circ$이므로 원에 내접한다.

67) ×
⇨ $\angle BAD \neq \angle DCE$이므로
□ABCD는 원의 내접하지 않는다.

68) ○
⇨ $\angle BAD = \angle DCE$이므로 □ABCD는 원에 내접한다.

69) ○
⇨ $\angle BAD = 180^\circ - 60^\circ = 120^\circ$이므로
$\angle BAD = \angle DCE$
따라서 □ABCD는 원에 내접한다.

70) ×
⇨ $\angle ADC = 180^\circ - 70^\circ = 110^\circ$이므로
$\angle ABE \neq \angle ADC$
따라서 □ABCD는 원에 내접하지 않는다.

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71) 78°

72) 70°

73) 55°

74) 85°

75) 75°

⇨ $\angle BAD + \angle DCB = 180^\circ$이므로 사각형이 원에 내접한다.

$\therefore \angle x = \angle CDE = 75^\circ$

76) 130°

⇨ $\angle BAD = \angle DCE$이므로 사각형이 원에 내접한다.

$\therefore \angle x = 180^\circ - 50^\circ = 130^\circ$

77) 60°

⇨ $\angle ABC + \angle CDA = 180^\circ$이므로 사각형이 원에 내접한다.

$\therefore \angle x = \angle DAE = 60^\circ$

78) 95°

79) 70°

⇨ $\angle ABE = \angle CDA$이므로 사각형이 원에 내접한다.

$\therefore \angle x = 180^\circ - 110^\circ = 70^\circ$

80) 115°

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