

공학수학 에센스

연습문제 풀이 이용 안내

- 본 문제 풀이의 저작권은 마인속과 한빛아카데미(주)에 있습니다.
- 이 자료를 무단으로 전제하거나 배포할 경우 저작권법 136조에 의거하여 최고 5년 이하의 징역 또는 5천만원 이하의 벌금에 처할 수 있고 이를 병과(併科)할 수도 있습니다.

CHAPTER 14 복소함수

last updated : 2024-10-11

[14.1 복소수]

1. $-\frac{y}{x^2+y^2}$

2. x^2-y^2

3. $-\frac{2xy}{(x^2+y^2)^2}$

4. $\frac{x^2-y^2}{x^2+y^2}$

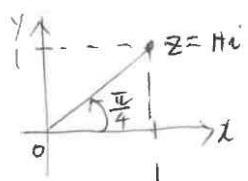
5. $\sqrt{(x-2)^2+(y-1)^2}$

6. $\sqrt{x^2+9y^2}$

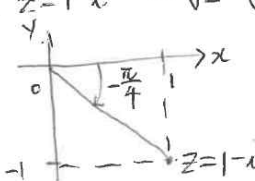
7. $\frac{2\sqrt{5}}{15}$

[14.2 거듭제곱과 거듭제곱근]

8.

$$z = i = \sqrt{2} \left(\cos\left(\frac{\pi}{4} + 2k\pi\right) + i \sin\left(\frac{\pi}{4} + 2k\pi\right) \right), k=0, \pm 1, \pm 2, \dots$$


9.

$$z = -i = \sqrt{2} \left(\cos\left(-\frac{\pi}{4} + 2k\pi\right) + i \sin\left(-\frac{\pi}{4} + 2k\pi\right) \right), k=0, \pm 1, \pm 2, \dots$$


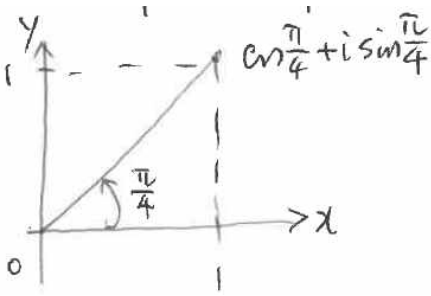
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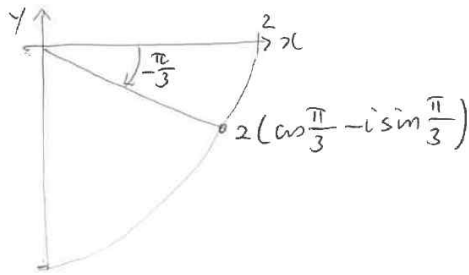
10. $-\frac{5\pi}{6}$

11. $\frac{5\pi}{6}$

12. $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}i$



13. $1 - \sqrt{3}i$



14. $\omega_1 = \sqrt[6]{2} \left(\cos \frac{\pi}{12} - i \sin \frac{\pi}{12} \right)$

$\omega_2 = \sqrt[6]{2} \left(\cos \frac{7\pi}{12} + i \sin \frac{7\pi}{12} \right)$

$\omega_3 = \sqrt[6]{2} \left(\cos \frac{15\pi}{12} + i \sin \frac{15\pi}{12} \right)$

15. $\omega_0 = \frac{\sqrt{2}}{2} + i \frac{\sqrt{2}}{2}, \omega_1 = -\frac{\sqrt{2}}{2} + i \frac{\sqrt{2}}{2}, \omega_2 = -\frac{\sqrt{2}}{2} - i \frac{\sqrt{2}}{2}, \omega_3 = \frac{\sqrt{2}}{2} - i \frac{\sqrt{2}}{2}$

16. $\omega_0 = \sqrt{2} \left(\frac{\sqrt{3}}{2} - \frac{1}{2}i \right), \omega_1 = \sqrt{2} \left(\frac{\sqrt{3}}{2} + \frac{1}{2}i \right)$

17. (a) $3888 \left(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6} \right)$ (b) $3888 \left(-\frac{\sqrt{3}}{2} - \frac{1}{2}i \right)$

18. (a) $\frac{4}{27} \left(\cos \left(-\frac{\pi}{3} \right) + i \sin \left(-\frac{\pi}{3} \right) \right)$ (b) $\frac{4}{27} \left(\frac{1}{2} - \frac{\sqrt{3}}{2}i \right)$

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19. $\frac{\sqrt{3}}{2} + \frac{1}{2}i, -\frac{\sqrt{3}}{2} + \frac{1}{2}i, -i$

20. $\sqrt[6]{2}\left(\cos\frac{\pi}{12} + i\sin\frac{\pi}{12}\right), \sqrt[6]{2}\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right), \sqrt[6]{2}\left(\cos\frac{7\pi}{12} + i\sin\frac{7\pi}{12}\right)$

21. $2\left(\cos\frac{\pi}{12} - i\sin\frac{\pi}{12}\right), 2\left(\cos\frac{11\pi}{12} + i\sin\frac{11\pi}{12}\right)$

22. $\cos\frac{\pi}{5} + i\sin\frac{\pi}{5}, \cos\frac{3\pi}{5} + i\sin\frac{3\pi}{5}, -1, \cos\frac{7\pi}{5} + i\sin\frac{7\pi}{5}, \cos\frac{9\pi}{5} + i\sin\frac{9\pi}{5}$

23. $z = \pm 1$ (증근)

[14.3 복소수 집합]

24. 열린집합도 닫힌집합도 아님

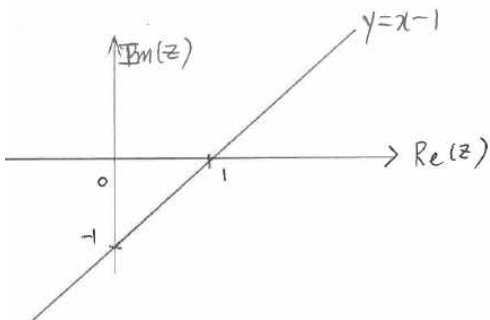
25. 닫힌집합

26. 열린집합

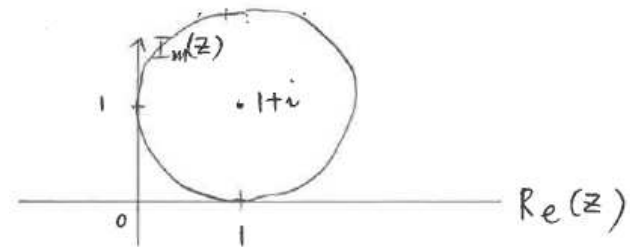
27. 열린집합

28. 닫힌집합

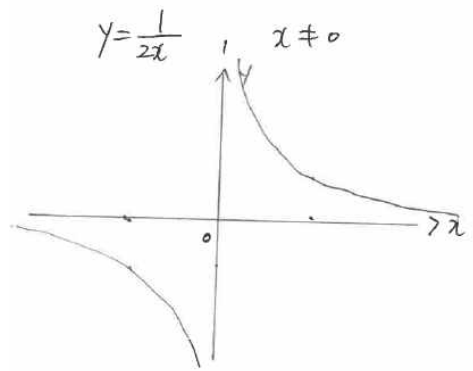
29.



30.



31.



[14.4 복소함수]

32. $u = 1 - \frac{v^2}{4}$

33. $u = \frac{v^2}{16} - 4$

34. 원점을 포함한 양의 v 축 위의 점들의 집합

35. i

36. 1

37. $3 - 2i$

38. $2i$

39. 연속이 아니다.

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40. 연속이다.

41. $6z^2(z^3 - 4i)$

42. $(-3z - 1) + i(5z^4 + 7z^2)$

43. $\frac{2+i}{(z+i)^2}$

44. $z = i$

45. $z = 2 + \sqrt{5}i, 2 - \sqrt{5}i$

[14.5 코시-리만 방정식]

46. 해석적이다.

47. 해석적이다.

48. 해석적이지 않다.

49. 해석적이지 않다.

50. $z \neq 0$ 인 모든 점에서 해석적이다.

51. 켈레조화함수 $v = -2xy + c$

52. 켈레조화함수 $v = y^2 + y - x^2 + c$

53. $a = \pm 2$, 켈레조화함수 $v = \pm e^{2x} \cos 2y + c$

54. b 는 모든 실수, 켈레조화함수 $v = -\frac{by}{x^2 + y^2} + c$

[14.6 지수함수와 로그함수]

55. $-e$

56. $\frac{\sqrt{2}}{2}e^\pi - \frac{\sqrt{2}}{2}e^{\pi i}$

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57. $e^{0.5}\cos 1 + e^{0.5}\sin 1i$

58. $z = \log_e 2 + i\left(\frac{\pi}{4} + 2ki\right), k = 0, \pm 1, \pm 2, \dots$

59. $z = \frac{1}{2}(\log_e 4 + i2k\pi), k = 0, \pm 1, \pm 2, \dots$

60.
$$\begin{aligned} L_n(-1 + \sqrt{3}i) &= \log_e 2 + \frac{2\pi}{3}i \\ \left(\ln(-1 + \sqrt{3}i) = \log_e 2 + i\left(\frac{2\pi}{3} + 2k\pi\right) \right) \end{aligned}$$

61.
$$\begin{aligned} L_n(1-i) &= \log_e \sqrt{2} - \frac{\pi}{4}i \\ \left(\ln(1-i) = \log_e \sqrt{2} + i\left(-\frac{\pi}{4} + 2k\pi\right) \right) \end{aligned}$$

62.
$$\begin{aligned} L_n(\sqrt{6} + \sqrt{2}i) &= \log_e 2\sqrt{2} + \frac{\pi}{6}i \\ \left(\ln(\sqrt{6} + \sqrt{2}i) = \log_e \sqrt{8} + i\left(\frac{\pi}{6} + 2k\pi\right) \right) \end{aligned}$$

63. $-e^{-\frac{\pi}{2}}$

64. $e^{3\left(\frac{\pi}{4} + 2k\pi\right)} \left(\cos \frac{3\ln 2}{2} - i \sin \frac{3\ln 2}{2} \right)$

65. $2e^{-\pi - 6k\pi} \left\{ \cos \left(3\ln 2 + \frac{\pi}{3} \right) + i \sin \left(3\ln 2 + \frac{\pi}{3} \right) \right\}$

[14.7 삼각함수와 쌍곡선함수]

66. $i \frac{e^3 - e^{-3}}{2}$

67. $-i \coth 1$

68. $-\frac{1}{\cosh 1}$

69. $\sin 1 \cosh 4 + i \cos 1 \sinh 4$

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70. $\cos 3 \cosh 2 + i \sin 3 \sinh 2$

71. $-i \coth 2$

72. $-i$

73. $\frac{\cosh 1 + i \sqrt{3} \sinh 1}{2}$

74. $\frac{2}{(e - e^{-1}) \cos 1 + i(e - e^{-1}) \sin 1}$

75. $(-\cot 3)i$

76. $z = \frac{2n+1}{2} \pi + i(-1)^{n+1} \sinh^{-1} 1$

77. $z = \left(\frac{\pi}{2} + 2ki \right) + i \ln(10 \pm \sqrt{99})$

[14.8 역삼각함수와 역쌍곡선함수]

78. $\frac{\pi}{2} + 2k\pi - i \log_e(1 + \sqrt{2}), \quad k = 0, \pm 1, \pm 2, \dots$

79. $2k\pi - i \log_e(1 + \sqrt{2}), \quad k = 0, \pm 1, \pm 2, \dots$

80. $-\frac{\pi}{2} - k\pi + i \log_2 \sqrt{3}, \quad k = 0, \pm 1, \pm 2, \dots$

81. $-i \{ \log_e(2 + \sqrt{3}) + i2k\pi \}, \quad k = 0, \pm 1, \pm 2, \dots$

82. $\frac{\pi}{2} + 2k\pi - i \log_e(2 \pm \sqrt{3}), \quad k = 0, \pm 1, \pm 2, \dots$

83. $-\frac{1}{2} \tan^{-1} \frac{4}{3} - k\pi, \quad k = 0, \pm 1, \pm 2, \dots$

84. $\log_e(1 + \sqrt{2}) + i \left(\frac{\pi}{2} + 2k\pi \right), \quad k = 0, \pm 1, \pm 2, \dots$

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85. $i\left(-\frac{\pi}{2} + 2k\pi\right), k = 0, \pm 1, \pm 2, \dots$

86. $i\left(\frac{\pi}{4} + k\pi\right), k = 0, \pm 1, \pm 2, \dots$

87. $\log_e(2 + \sqrt{3}) + i2k\pi, k = 0, \pm 1, \pm 2, \dots$

88. $\log_e(2 + \sqrt{5}) + i2k\pi, k = 0, \pm 1, \pm 2, \dots$

89. $\log_e \sqrt{3} + i\left(\frac{\pi}{2} + k\pi\right), k = 0, \pm 1, \pm 2, \dots$

90. $\frac{1}{2}$

91. $\frac{1}{\sqrt{2}}$

92. $-\frac{1}{2}$

93. 증명생략