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HSSC-I NATIONAL BOOK FOUNDATION FBISE

MATHEMATICS TEST - CHAPTER 1: COMPLEX NUMBERS

Name:		Roll No.		Section:

Total Time: 3:20 Hour
Time Allowed: 200 Minutes

Total Marks: 200

PAPER OBJECTIVE
SECTION-A (MARKS 200)

NOTE: Section-A is compulsory. All parts of this section are to be answered on these pages and handed over to the center superintendent. Deleting / overwriting is not allowed. Do not use lead pencil.

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

Questions	A	B	C	D	A B C D
1. Every real number is also a:	complex number	prime number	pure imaginary number	natural number only	●○○○
2. Every complex number has how many parts?	No part	One	Three	Two	○○○●
3. In the complex plane, the imaginary part of a complex number is drawn along the:	x-axis	y-axis	origin only	xy-plane only	○●○○
4. The diagram representing a complex number is called a(n):	ordered-pair diagram	vector diagram	Argand diagram	Venn diagram	○○●○
5. Geometrically, the conjugate of a complex number is its mirror image about the:	x-axis	y-axis	origin	line y = x	●○○○
6. The magnitude of a complex number z is its distance from the:	point (1, 1)	point (1, 0)	origin (0, 0)	point (0, 1)	○○●○
7. The Euler's notation for the imaginary unit i was introduced to deal with the square root of:	1	−1	2	0	○●○○
8. The need for complex numbers in mathematics arises to solve polynomials such as $x^2 + 1 = 0$ which have no solution in the set of:	real numbers	complex numbers	integers only	natural numbers only	●○○○
9. The set of all complex numbers is denoted by:	C	Q	R	Z	●○○○
10. A complex number x + iy corresponds one-to-one with the:	number x + y	number xy	ordered pair (y, x)	ordered pair (x, y)	○○○●
11. If the real part of a complex number is zero, then it is called a:	pure imaginary number	rational number	natural number	real number	●○○○
12. If the imaginary part of a complex number is zero, then it is called a:	pure imaginary number	polar number	conjugate number	real number	○○○●
13. Which relation between the sets of real numbers R and complex numbers C is correct?	R = C	R ∩ C = ∅	R ⊂ C	C ⊂ R	○○●○
14. For $z_1 = 3 + 2i$ and $z_2 = 5 + 6i$, which of the following is correct?	$z_1 = z_2$	$\|z_1\| < \|z_2\|$	$\|z_1\| > \|z_2\|$	$z_1 > z_2$	○●○○

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Questions	A	B	C	D	A B C D
15. Which of the following is NOT mentioned in the book as an application of complex numbers?	Cryptography	Baking recipes	Voltage and current in circuits	Wave phenomena	○●○○
16. The branch of physics that heavily depends upon complex numbers is:	fluid statics only	thermodynamics only	quantum mechanics	optics only	○○●○
17. A system of equations which has at least one solution is called:	consistent	inconsistent	homogeneous only	polar	●○○○
18. A system of equations which has no solution is called:	consistent	inconsistent	dependent	unique	○●○○
19. The equation az + bw = p, where a and b are complex numbers, is called a linear equation in two variables with:	no coefficients	complex coefficients	integer coefficients only	real coefficients only	○●○○
20. In the equation az + bw = p, the coefficients a and b:	must be real	cannot be zero at the same time	must be equal	must both be zero	○●○○
21. A complex polynomial $a_0 + a_1z + \dots + a_nz^n$ has degree n if:	$a_n \neq 0$	all coefficients are real	$a_0 = 0$	n is negative	●○○○
22. A complex polynomial with n = 1 is called a:	linear polynomial	constant polynomial	quadratic polynomial	cubic polynomial	●○○○
23. The polar coordinate system consists of a fixed point O, called the pole, and a horizontal line called the:	argument line	y-axis	initial line (polar axis)	modulus line	○○●○
24. In the polar coordinates (r, θ) of a point P, the angle θ is measured:	only in degrees	clockwise from the pole	anticlockwise from the initial line	from the y-axis	○○●○
25. For which complex number is the argument undefined?	z = i	z = 0	z = 1	z = −1	○●○○
26. In Example 1, the complex number z = 2 + 3i has real part and imaginary part respectively:	5 and 1	2 and 3i	3 and 2	2 and 3	○○○●
27. The sum of $z_1 = 2 + 3i$ and $z_2 = 6 + 8i$ is:	4 − 5i	12 + 24i	8 + 11i	8 + 5i	○○●○
28. If $z_1 = 4 - 3i$ and $z_2 = 7 + 6i$, then $z_1 - z_2$ is:	−3 + 9i	11 + 3i	3 + 9i	−3 − 9i	○○○●
29. The product of the complex numbers (2, −6) and (4, 9) is the ordered pair:	(−46, 6)	(8, −54)	(62, 6)	(62, −6)	○○○●
30. If $z_1 = 3 + 7i$ and $z_2 = -4 + 6i$, then $z_1 + z_2$ is:	−1 − 13i	−1 + 13i	7 + i	−7 − i	○●○○
31. If $z_1 = 3 + 7i$ and $z_2 = -4 + 6i$, then $z_1 - z_2$ is:	−7 − i	7 + 13i	−1 + 13i	7 + i	○○○●

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Questions	A	B	C	D	A B C D
32. If $z_1 = 3 + 7i$ and $z_2 = -4 + 6i$, then z_1z_2 is:	$-54 - 10i$	$-30 - 10i$	$-12 + 42i$	$-54 + 10i$	●○○○
33. If $z_1 = 3 + 7i$ and $z_2 = -4 + 6i$, then z_1/z_2 is:	$(30 - 46i)/26$	$(15 + 23i)/26$	$(15 - 23i)/26$	$(-15 - 23i)/26$	○○●○
34. The complex number $(2 + 3i)(2 + i)/(1 - i)$ in the form $x + iy$ is:	$-7/2 - (9/2)i$	$9/2 - (7/2)i$	$7/2 + (9/2)i$	$-7/2 + (9/2)i$	○○○●
35. To divide two complex numbers, we multiply and divide by the:	conjugate of the numerator	modulus of the numerator	square of the denominator	conjugate of the denominator	○○○●
36. After rationalisation, the denominator of the quotient $(x_1 + iy_1)/(x_2 + iy_2)$ becomes:	$x_2 + y_2$	$x_2^2 - y_2^2$	$2x_2y_2$	$x_2^2 + y_2^2$	○○○●
37. The real part of the product $(x_1 + iy_1)(x_2 + iy_2)$ is:	$x_1x_2 - y_1y_2$	$x_1x_2 + y_1y_2$	$x_1y_2 - x_2y_1$	$x_1y_2 + x_2y_1$	●○○○
38. The imaginary part of the product $(x_1 + iy_1)(x_2 + iy_2)$ is:	$x_1y_2 + x_2y_1$	$x_1y_2 - x_2y_1$	$x_1x_2 - y_1y_2$	$y_1y_2 - x_1x_2$	●○○○
39. The product $(2 + i)(3 - 2i)$ is:	$4 - i$	$6 - 2i$	$8 - i$	$8 + i$	○○●○
40. The value of $(3 + i)^2$ is:	$9 + i$	$8 + 6i$	$8 + 3i$	$10 + 6i$	○●○○
41. The sum $(2 + i)^2 + (2 - i)^2$ is:	$6 + 8i$	0	6	8	○○●○
42. For $z_1 = 3 + 2i$ and $z_2 = 1 - 3i$, the product z_1z_2 is:	$9 + 7i$	$-3 - 7i$	$9 - 7i$	$3 - 6i$	○○●○
43. For $z_1 = 3 + 2i$ and $z_2 = 1 - 3i$, the sum $z_1 + z_2$ is:	$4 + 5i$	$2 + 5i$	$4 + i$	$4 - i$	○○○●
44. For $z_1 = 3 + 2i$ and $z_2 = 1 - 3i$, the quotient z_1/z_2 is:	$(9 - 7i)/10$	$(-3 - 11i)/10$	$(-3 + 11i)/10$	$(3 + 11i)/10$	○○●○
45. If $z = x + iy$, its conjugate $\bar{z}$ is defined as:	$y + ix$	$-x - iy$	$-x + iy$	$x - iy$	○○○●
46. If $z = 3 + 4i$, then $\bar{z}$ is:	$3 - 4i$	$-3 + 4i$	$4 + 3i$	$-3 - 4i$	●○○○
47. The magnitude of $z = x + iy$ is obtained using the:	factor theorem	binomial theorem	Pythagoras theorem	remainder theorem	○○●○
48. The modulus of $z = x + iy$ can also be written as:	$\sqrt{[(\text{Re } z)^2 + (\text{Im } z)^2]}$	Re z + Im z	(Re z)(Im z)	Re z − Im z	●○○○

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Questions	A	B	C	D	A B C D
49. The theorem on the magnitude of a complex number states that $\|z\| \geq 0$ and $\|z\| = 0$ if and only if:	$z = 0$	$z = i$	$z = 1$	z is real	●○○○
50. In the proof of the theorem $\|z\| \geq 0$, we use the fact that the square of any real number is:	imaginary	zero only	negative	non-negative	○○○●
51. The key fact about the modulus of a product states that $\|z_1 z_2\|$ equals:	$\|z_1\| - \|z_2\|$	$\|z_1\|\|z_2\|$	$\|z_1\|/\|z_2\|$	$\|z_1\| + \|z_2\|$	○●○○
52. To find the conjugate of a complex expression, we may:	only simplify first	never take the conjugate	only take the conjugate of the numerator	simplify first and then take the conjugate, or take the conjugate first	○○○●
53. The modulus of $z = 3 - 4i$ is:	1	5	25	7	○●○○
54. The magnitude of $(2 + 3i) - (2 + 6i)$ is:	3	5	$\sqrt{13}$	9	●○○○
55. For any complex number z, Re(iz) is equal to:	Im(z)	−Im(z)	Re(z)	−Re(z)	○●○○
56. For any complex number z, Im(iz) is equal to:	Re(z)	−Im(z)	−Re(z)	Im(z)	●○○○
57. A complex number z is real if and only if:	$\|z\| = 1$	$z = 0$	$z = \bar{z}$	$z = -\bar{z}$	○○●○
58. A complex number z is either real or pure imaginary if and only if:	$(\bar{z})^2 = z^2$	$(\bar{z})^2 = z$	$\bar{z} = 1/z$	$\|z\| = 1$	●○○○
59. If $z_1 = 2 - 3i$ and $\|z_1 z_2\| = 16$, then $\|z_2\|$ is:	$16\sqrt{13}$	$16/\sqrt{13}$	$16/13$	$\sqrt{13}/16$	○●○○
60. The inequality $2\|z\| \geq \|\text{Re}(z)\| + \|\text{Im}(z)\|$ is verified by starting with:	$\|x\| + \|y\| = 0$	$x^2 - y^2 = 0$	$(\|x\| - \|y\|)^2 \geq 0$	$xy = 0$	○○●○
61. The real part of $(3 + 4i)^{-1}$ is:	−3/25	4/25	3/25	−4/25	○○●○
62. The imaginary part of $(3 + 4i)^{-1}$ is:	−4/25	−3/25	3/25	4/25	●○○○
63. The real part of $(3 + 4i)^2$ is:	24	25	−7	7	○○●○
64. The imaginary part of $(3 + 4i)^2$ is:	−7	7	24	12	○○●○
65. The real part of $(3 + 4i)^{-2}$ is:	24/625	−24/625	−7/625	7/625	○○●○

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Questions	A	B	C	D	A B C D
66. The imaginary part of $(3 + 4i)^{-2}$ is:	$-24/625$	$24/625$	$7/625$	$-7/625$	● ○ ○ ○
67. For $z = x + iy$, the real part of z^{-1} is:	$-y/(x^2 + y^2)$	$x/(x^2 - y^2)$	$x/(x^2 + y^2)$	$-x/(x^2 + y^2)$	○ ○ ● ○
68. For $z = x + iy$, the imaginary part of z^{-1} is:	$x/(x^2 + y^2)$	$-y/(x^2 + y^2)$	$-x/(x^2 + y^2)$	$y/(x^2 + y^2)$	○ ● ○ ○
69. For $z = x + iy$, the real part of z^2 is:	xy	$2xy$	$x^2 + y^2$	$x^2 - y^2$	○ ○ ○ ●
70. In general, $Re(z_1)Re(z_2)$ is:	always zero	always equal to $Re(z_1z_2)$	always equal to $Re(z_1 + z_2)$	not equal to $Re(z_1z_2)$	○ ○ ○ ●
71. The real part of z_1/z_2 is:	$(x_1x_2 + y_1y_2)/(x_2^2 + y_2^2)$	$(x_1y_2 + x_2y_1)/(x_2^2 + y_2^2)$	$(x_2y_1 - x_1y_2)/(x_2^2 + y_2^2)$	$(x_1x_2 - y_1y_2)/(x_2^2 + y_2^2)$	● ○ ○ ○
72. The imaginary part of z_1/z_2 is:	$(x_1x_2 - y_1y_2)/(x_2^2 + y_2^2)$	$(x_2y_1 - x_1y_2)/(x_2^2 + y_2^2)$	$(x_1x_2 + y_1y_2)/(x_2^2 + y_2^2)$	$(x_1y_2 - x_2y_1)/(x_2^2 + y_2^2)$	○ ● ○ ○
73. If $z_1 = 12 + 5i$ and $z_2 = 3 + 2i$, then $Re(z_1/z_2)$ is:	$-9/13$	$46/13$	$9/169$	$46/169$	○ ● ○ ○
74. If $z_1 = 12 + 5i$ and $z_2 = 3 + 2i$, then $Im(z_1/z_2)$ is:	$9/169$	$46/13$	$-9/13$	$46/169$	○ ○ ● ○
75. If $z_1 = 12 + 5i$ and $z_2 = 3 + 2i$, then $Re(z_2/z_1)$ is:	$-9/13$	$9/169$	$46/13$	$46/169$	○ ○ ○ ●
76. If $z_1 = 12 + 5i$ and $z_2 = 3 + 2i$, then $Im(z_2/z_1)$ is:	$46/169$	$9/13$	$9/169$	$-9/169$	○ ○ ● ○
77. Writing the equation $\lvert z - 2i\rvert = \lvert\bar{z} + 3\rvert$ in terms of x and y gives:	$6x + 4y - 5 = 0$	$4x + 6y + 5 = 0$	$6x - 4y + 5 = 0$	$6x + 4y + 5 = 0$	○ ○ ○ ●
78. Writing the inequation $Re(z - 3) < 2$ in terms of x and y gives:	$x < -1$	$x < 1$	$y < 5$	$x < 5$	○ ○ ○ ●
79. Writing $Re(iz) = 4$ in terms of x and y gives:	$y = -4$	$x = -4$	$x = 4$	$y = 4$	● ○ ○ ○
80. Writing the equation $\lvert z - 4i\rvert + \lvert z + 4i\rvert = 10$ in terms of x and y gives the relation:	$x^2/25 + y^2/9 = 1$	$x^2 - y^2 = 10$	$x^2 + y^2 = 10$	$x^2/9 + y^2/25 = 1$	○ ○ ○ ●
81. If $\arg[(z - 1)/(z + 1)] = \pi/2$, then $x^2 + y^2$ equals:	0	1	2	-1	○ ● ○ ○
82. If $\arg(z - 2) - \arg(z + 2) = \pi/4$, the Cartesian equation is:	$x^2 + y^2 - 4y - 4 = 0$	$x^2 - y^2 - 4y = 0$	$x^2 + y^2 = 4$	$x^2 + y^2 + 4y - 4 = 0$	● ○ ○ ○

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Questions	A	B	C	D	A B C D
83. The first step in the elimination method for two linear equations is to:	substitute z = 0	take the conjugate of both equations	find the modulus of both equations	multiply the equations by suitable numbers to make the coefficients of one variable the same	○○○●
84. In the elimination method, after making a coefficient equal, we:	multiply again	add or subtract the equations to eliminate a variable	divide by zero	take the square root	○●○○
85. In the working rule of the elimination method, the final solution is written as:	a modulus	a set of three numbers	a single number	an ordered pair (z, w)	○○○●
86. In the substitution method, the first step is to:	take the modulus	add both equations	multiply by the conjugate	find the value of one variable in terms of the other from one equation	○○○●
87. The solution of z + w = 4 + 2i and z − w = 2 is (z, w) =	(3 + i, 1 + i)	(1 + i, 3 + i)	(2 + i, 2 + i)	(3 − i, 1 − i)	●○○○
88. The solution of 2z + w = 5 + i and z − w = 1 − i is (z, w) =	(2, 1 − i)	(2, 1 + i)	(1 + i, 2)	(3, i)	○●○○
89. The solution of iz = 2 + 3i is z =	−3 − 2i	3 + 2i	2 − 3i	3 − 2i	○○○●
90. The solution of (1 + i)z = 4 is z =	4 − 4i	2 − 2i	2 + 2i	1 − i	○●○○
91. The solution of z + iw = 2 and iz + w = 1 + i for z is:	(3 − i)/2	(1 − i)/2	(1 + i)/2	(3 + i)/2	●○○○
92. For the system z + iw = 2 and iz + w = 1 + i, the value of w is:	(3 − i)/2	2 − i	(1 − i)/2	(1 + i)/2	○○●○
93. The factorisation of $z^2 + a^2$ is:	(z + a)(z − a)	$(z - ia)^2$	(z + ia)(z − ia)	$(z + ia)^2$	○○●○
94. The factorisation of $z^2 + 169$ into linear factors is:	(z + 13i)(z − 13i)	$(z + 13i)^2$	(z + 169i)(z − 169i)	(z + 13)(z − 13)	●○○○
95. The factorisation of $2z^2 + 18$ into linear factors is:	2(z + 3)(z − 3)	2(z + 9i)(z − 9i)	(z + 3i)(z − 3i)	2(z + 3i)(z − 3i)	○○○●
96. The factorisation of $3x^2 + 108$ over the complex numbers is:	(x + 6i)(x − 6i)	3(x + 36i)(x − 36i)	3(x + 6)(x − 6)	3(x + 6i)(x − 6i)	○○○●
97. According to the factor theorem, z − a is a factor of the polynomial P(z) if and only if:	P(0) = a	P(a) = 0	P(a) = 1	P(a) = a	○●○○
98. For the polynomial $P(z) = 2z^3 + 3z^2 + 6z - 40$, the book shows that a factor is:	z + 2	z − 2	z + 1	z − 1	○●○○
99. For $P(z) = z^3 + 2z^2 - 5z - 6$, the possible roots are the factors of:	1	6	2	5	○●○○

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Questions	A	B	C	D	A B C D
100. For $P(z) = z^3 + 2z^2 - 5z - 6$, which value gives $P(z) = 0$?	$z = 6$	$z = -6$	$z = -1$	$z = 1$	○○●○
101. The complete factorisation of $z^3 + 2z^2 - 5z - 6$ is:	$(z + 1)(z - 3)(z + 2)$	$(z + 1)(z + 3)(z - 2)$	$(z - 1)(z + 3)(z - 2)$	$(z + 1)(z - 3)(z - 2)$	○●○○
102. After dividing $z^3 + 2z^2 - 5z - 6$ by $(z + 1)$ using synthetic division, the depressed quadratic is:	$z^2 - z - 6$	$z^2 + z + 6$	$z^2 + 3z - 2$	$z^2 + z - 6$	○○○●
103. The depressed equation is found by:	synthetic division	using Euler's formula	taking the conjugate	using the polar form	●○○○
104. The polynomial $z^3 - 7z + 6$ factorises as:	$(z - 1)(z - 2)(z - 3)$	$(z + 1)(z + 2)(z - 3)$	$(z - 1)(z + 2)(z + 3)$	$(z - 1)(z - 2)(z + 3)$	○○○●
105. The method of completing the square for $az^2 + bz + c = 0$ begins by dividing both sides by:	c	a	b	2	○●○○
106. The solutions of $2z^2 - 6z - 9 = 0$ by completing the square are:	$(3 \pm 3\sqrt{3})/2$	$3 \pm 3\sqrt{3}$	$(6 \pm 3\sqrt{3})/2$	$(3 \pm \sqrt{3})/2$	●○○○
107. The solutions of $z^2 - 6z + 2 = 0$ by completing the square are:	$3 \pm \sqrt{2}$	$-3 \pm \sqrt{7}$	$3 \pm \sqrt{7}$	$6 \pm \sqrt{7}$	○○●○
108. The solutions of $2z^2 - 5z + 2 = 0$ are:	1/2 and 2	1/2 and 1	1 and 2	−1/2 and −2	●○○○
109. The solutions of $2z^2 = 5z - 3$ are:	−1 and −3/2	1 and 2/3	1 and 3/2	2 and 3	○○●○
110. The solutions of $z^2 - 6z + 25 = 0$ are:	$3 \pm 4i$	$6 \pm 4i$	$3 \pm 25i$	$-3 \pm 4i$	●○○○
111. The solutions of $z^2 - 3z + 17 = 0$ are:	$(3 \pm i\sqrt{59})/2$	$(3 \pm \sqrt{59})/2$	$(3 \pm i\sqrt{17})/2$	$(-3 \pm i\sqrt{59})/2$	●○○○
112. The solutions of $2z^2 - 11z + 16 = 0$ are:	$(11 \pm \sqrt{7})/4$	$(11 \pm i\sqrt{7})/4$	$(11 \pm i\sqrt{7})/2$	$(-11 \pm i\sqrt{7})/4$	○●○○
113. The solutions of $z^2 - 2z + 5 = 0$ are:	$-1 \pm 2i$	$2 \pm i$	$1 \pm 2i$	$1 \pm 4i$	○○●○
114. The equation $z^2 - 2z + 5 = 0$ can be written as:	$(z + 1 + 2i)(z + 1 - 2i) = 0$	$(z - 1)^2 = 5$	$(z - 2 + i)(z - 2 - i) = 0$	$(z - 1 + 2i)(z - 1 - 2i) = 0$	○○○●
115. If the complex number $z = x + iy$ has polar coordinates (r, θ), then its conjugate has polar coordinates:	$(-r, -\theta)$	(r, θ)	$(-r, \theta)$	$(r, -\theta)$	○○○●
116. In the polar representation of $z = x + iy$, the relation between x and r, θ is:	$x = r/\theta$	$x = r \cos\theta$	$x = r \tan\theta$	$x = r \sin\theta$	○●○○

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Questions	A	B	C	D	A B C D
117. In the polar representation of z = x + iy, the relation between y and r, θ is:	y = r sin θ	y = θ/r	y = r cos θ	y = r tan θ	●○○○
118. The expression cos θ + i sin θ is also written as:	cosec θ	cis θ	sec θ	cot θ	○●○○
119. The formula $e^{i\theta}$ = cos θ + i sin θ is known as:	Euler's formula	De Moivre's formula	Pythagoras formula	Argand formula	●○○○
120. The polar form of a complex number z is:	z = r(cos θ − i sin θ)	z = r(cos θ + i sin θ)	z = r cos θ · i sin θ	z = θ(cos r + i sin r)	○●○○
121. In the polar form of z, r is equal to:	|z|	arg z	Im z	Re z	●○○○
122. The principal argument of a complex number lies in the interval:	−π/2 < θ < π/2	0 ≤ θ < 2π	−π < θ ≤ π	0 < θ < π/2	○○●○
123. The principal argument is denoted by the symbol:	Re(z)	arg(z)	Arg(z)	Im(z)	○○●○
124. The symbol arg(z) actually represents:	a set of values	only a negative value	a single value always	only a positive value	●○○○
125. If θ is the reference angle, the principal argument of a number in the second quadrant is:	θ − π	π − θ	θ	−θ	○●○○
126. If θ is the reference angle, the principal argument of a number in the third quadrant is:	π − θ	θ	θ − π	−θ	○○●○
127. If θ is the reference angle, the principal argument of a number in the fourth quadrant is:	θ − π	π − θ	θ	−θ	○○○●
128. The modulus and principal argument of √3 + i are:	2 and π/3	2 and 5π/6	2 and π/6	√3 and π/6	○○●○
129. The modulus and principal argument of −√3 + i are:	2 and −5π/6	2 and −π/6	2 and π/6	2 and 5π/6	○○○●
130. The modulus and principal argument of −√3 − i are:	2 and π/6	2 and −π/6	2 and −5π/6	2 and 5π/6	○○●○
131. The modulus and principal argument of √3 − i are:	2 and −5π/6	2 and 5π/6	2 and π/6	2 and −π/6	○○○●
132. In Example 18, all four complex numbers ±√3 ± i have equal moduli but different:	imaginary units	real parts only	arguments depending on the quadrant	conjugates	○○●○
133. The polar form of −1 − i using the principal argument is:	√2[cos(3π/4) + i sin(3π/4)]	√2[cos(−3π/4) + i sin(−3π/4)]	2[cos(−3π/4) + i sin(−3π/4)]	√2[cos(π/4) + i sin(π/4)]	○●○○

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Questions	A	B	C	D	A B C D
134. The polar form of 1 + i√3 is:	$2(\cos \pi/3 + i \sin \pi/3)$	$4(\cos \pi/3 + i \sin \pi/3)$	$\sqrt{3}(\cos \pi/3 + i \sin \pi/3)$	$2(\cos \pi/6 + i \sin \pi/6)$	●○○○
135. Since $\sin(\theta + 2k\pi) = \sin\theta$ and $\cos(\theta + 2k\pi) = \cos\theta$, the argument of a complex number is:	always π	always zero	always unique	not unique, it differs by multiples of 2π	○○○●
136. The relation $\text{Arg}(z_1z_2) = \text{Arg}(z_1) + \text{Arg}(z_2)$ holds:	up to a multiple of 2π	never	only for real numbers	only when $z_1 = z_2$	●○○○
137. The relation $\text{Arg}(z_1/z_2)$ equals:	$\text{Arg}(z_1) - \text{Arg}(z_2)$ (up to a multiple of 2π)	$\text{Arg}(z_1) \cdot \text{Arg}(z_2)$	$\text{Arg}(z_2) - \text{Arg}(z_1)$ always	$\text{Arg}(z_1) + \text{Arg}(z_2)$	●○○○
138. If $z = r(\cos\theta + i\sin\theta)$, then z^{-1} is:	$(1/r)(\cos\theta - i\sin\theta)$	$-r(\cos\theta + i\sin\theta)$	$(1/r)(\cos\theta + i\sin\theta)$	$r(\cos\theta - i\sin\theta)$	●○○○
139. The sum $z_1 + z_2$ of two complex numbers in polar form is:	$r_1r_2[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$	$(r_1 + r_2)(\cos\theta + i\sin\theta)$	$(r_1\cos\theta_1 + r_2\cos\theta_2) + i(r_1\sin\theta_1 + r_2\sin\theta_2)$	$r_1r_2(\cos\theta_1 + i\sin\theta_2)$	○○●○
140. The difference $z_1 - z_2$ of two complex numbers in polar form has real part:	$r_1\cos\theta_1 + r_2\cos\theta_2$	$r_1\cos\theta_1 - r_2\cos\theta_2$	$(r_1 - r_2)\cos\theta$	$r_1\sin\theta_1 - r_2\sin\theta_2$	○●○○
141. The product of two complex numbers in polar form is:	$r_1r_2[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$	$(r_1 + r_2)[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$	$r_1r_2[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)]$	$r_1r_2[\cos\theta_1\theta_2 + i\sin\theta_1\theta_2]$	●○○○
142. The product z_1z_2 can also be written as:	$r_1r_2e^{i(\theta_1 - \theta_2)}$	$r_1e^{i\theta_1} + r_2e^{i\theta_2}$	$(r_1 + r_2)e^{i\theta_1\theta_2}$	$r_1r_2e^{i(\theta_1 + \theta_2)}$	○○○●
143. The quotient z_1/z_2 in polar form is:	$(r_1/r_2)[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)]$	$(r_1/r_2)[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$	$(r_2/r_1)[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)]$	$(r_1 - r_2)[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)]$	●○○○
144. In the derivation of the quotient in polar form, we multiply numerator and denominator by:	i	$\cos\theta_2 - i\sin\theta_2$	$\sin\theta_2 - i\cos\theta_2$	$\cos\theta_2 + i\sin\theta_2$	○●○○
145. The product $2(\cos\pi/3 + i\sin\pi/3) \times 6(\cos 2\pi/3 + i\sin 2\pi/3)$ in rectangular form is:	$-12i$	$12i$	-12	12	○○●○
146. The quotient $6(\cos\pi/2 + i\sin\pi/2) \div 3(\cos\pi/2 + i\sin\pi/2)$ in rectangular form is:	$2i$	6	2	-2	○○●○
147. The polar form of $2 + 2\sqrt{3}\,i$ is:	$2(\cos \pi/3 + i \sin \pi/3)$	$2\sqrt{3}(\cos \pi/3 + i \sin \pi/3)$	$4(\cos \pi/6 + i \sin \pi/6)$	$4(\cos \pi/3 + i \sin \pi/3)$	○○○●
148. The polar form of $-2 - 2i$ using the principal argument is:	$2\sqrt{2}[\cos(-3\pi/4) + i\sin(-3\pi/4)]$	$2[\cos(-3\pi/4) + i\sin(-3\pi/4)]$	$2\sqrt{2}[\cos(3\pi/4) + i\sin(3\pi/4)]$	$2\sqrt{2}[\cos(\pi/4) + i\sin(\pi/4)]$	●○○○
149. The algebraic form of $2(\cos 315° + i\sin 315°)$ is:	$\sqrt{2} + \sqrt{2}\,i$	$\sqrt{2} - \sqrt{2}\,i$	$-\sqrt{2} + \sqrt{2}\,i$	$2 - 2i$	○●○○
150. The algebraic form of $5(\cos 210° + i\sin 210°)$ is:	$5\sqrt{3}/2 + (5/2)i$	$5\sqrt{3}/2 - (5/2)i$	$-5\sqrt{3}/2 - (5/2)i$	$-5/2 - (5\sqrt{3}/2)i$	○○●○

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Questions	A	B	C	D	A B C D
151. The algebraic form of cos 135° + i sin 135° is:	$\sqrt{2}/2 - (\sqrt{2}/2)i$	$-\sqrt{2}/2 + (\sqrt{2}/2)i$	$-\sqrt{2}/2 - (\sqrt{2}/2)i$	$\sqrt{2}/2 + (\sqrt{2}/2)i$	○●○○
152. The algebraic form of 2(cos π/2 + i sin π/2) is:	-2	$2i$	2	$-2i$	○●○○
153. The simple harmonic motion equation using complex numbers is:	$x = x_{max}e^{i\theta}$	$x = x_{max} + e^{i\theta}$	$x = x_{max}\cos\theta$ only	$x = x_{max}/e^{i\theta}$	●○○○
154. In $x = x_{max}e^{i\theta}$, the quantity x_{max} represents the:	impedance	frequency	time period	amplitude	○○○●
155. In $x = x_{max}e^{i\theta}$, the quantity x represents the:	current	voltage	frequency	displacement of the particle from the mean position	○○○●
156. A micro particle has amplitude 0.05 mm. Its position at angle π/2 is:	$-0.05i$ mm	-0.05 mm	$0.05i$ mm	0.05 mm	○○●○
157. A particle has amplitude 0.004 mm. Its position at angle π is:	$0.004i$ mm	0.004 mm	-0.004 mm	$-0.004i$ mm	○○●○
158. A particle has amplitude x_{max} and is observed at angle θ = 0. Its position is:	$-x_{max}$	$i\,x_{max}$	0	x_{max}	○○○●
159. The simple harmonic motion formula can also be written as $x = x_{max}e^{i\omega t}$, where ω is the:	amplitude	current	impedance	angular velocity	○○○●
160. The angular velocity ω is related to the frequency f by:	$\omega = 2f/\pi$	$\omega = 2\pi f$	$\omega = f/2\pi$	$\omega = \pi f$	○●○○
161. A particle is at position $\sqrt{2} + i\sqrt{2}$ nm at an angle of 45°. Its amplitude is:	1 nm	2 nm	$\sqrt{2}$ nm	4 nm	○●○○
162. Electrical engineers use which letter to represent the imaginary unit?	j	k	m	n	●○○○
163. In an electrical circuit, the relation between voltage E, current I and impedance Z is:	$E = Z/I$	$E = I/Z$	$E = I + Z$	$E = IZ$	○○○●
164. An engineer designs a circuit with current $(6 - 8i)$ A and impedance $(14 + 8i)$. The voltage is:	$84 - 64i$	$20 - 0i$	$148 - 64i$	$148 + 64i$	○○●○
165. When the current is $(6 - 2i)$ A and the voltage is $(50 + 10i)$ V, the impedance is:	$5 + 2i$	$8 + 4i$	$7 + 4i$	$7 - 4i$	○○●○
166. When adding two AC voltages V_1 and V_2 with different phases, simply adding them is:	equal to their ratio	always correct	not correct, so complex numbers are used	equal to their product	○○●○
167. For $V_1 = 3\cos(t + 30°)$ and $V_2 = 4\sin(t + 120°)$, the amplitude of the total potential difference in the book is:	5	7	1	3.5	●○○○

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Questions	A	B	C	D	A B C D
168. The total potential difference of V_1 = 3cos(t + 30°) and V_2 = 4sin(t + 120°) in the book is written as:	5cos(t + 106.94°)	5sin(t + 120°)	5cos(t + 30°)	7cos(t + 150°)	●○○○
169. The impedance of a resistor in an AC circuit is:	zero	a purely imaginary number	a real number R	infinite	○○●○
170. For a resistor, the AC voltage source $v(t) = V_0\cos(\omega t)$ is written in complex form as:	$V_0\sin(\omega t)$	$\mathrm{Re}(V_0 e^{i\omega t})$	$V_0 e^{\omega t}$	$\mathrm{Im}(V_0 e^{i\omega t})$	○●○○
171. The relation $v(t)_R = Ri$ for a resistor is similar to:	Boyle's law	Newton's second law	Hooke's law	Ohm's law in DC circuits	○○○●
172. The advantage of using complex impedance, voltage and current is that:	calculations become easier and the real part gives the final answer	calculations become impossible	no calculations are needed	only imaginary parts are needed	●○○○
173. In an AC circuit with v(t) = 3cos(t) and i = 10 A through a resistor, the impedance is:	0.3 Ω	30 Ω	13 Ω	3 Ω	●○○○
174. The current through an AC resistor circuit with impedance 5 Ω and voltage v(t) = 4cos(3t) is:	4cos(3t)	0.8cos(3t)	20cos(3t)	1.25cos(3t)	○●○○
175. The value of $(\sqrt{-25})(\sqrt{-4})$ is:	10	−10	−10i	10i	○●○○
176. The least positive integer n for which $[(1 + i)/(1 - i)]^n = 1$ is:	1	4	2	3	○●○○
177. For z = 3 + 4i, the value of z^{-1} is:	(−3 + 4i)/25	(3 − 4i)/5	(3 + 4i)/25	(3 − 4i)/25	○○○●
178. The value of i^{23} is:	1	−i	i	−1	○●○○
179. If (2 − 3i)(2 + 5i) = 19 + 4i, then the real part is:	−19	2	4	19	○○○●
180. The amplitude of a particle at position √2 + i√2 nm and angle 45° is obtained from $x = x_{max}e^{i\theta}$ by taking the:	modulus of x	argument of x	conjugate of x	real part of x	●○○○
181. For z = 3 + 4i, which of the following is true?	$z + \bar{z} = 8i$	$z\,\bar{z} = -7$	$z\,\bar{z} = 25$	$z - \bar{z} = 6$	○○●○
182. For z = 3 + 4i, the expression $z + \bar{z}$ equals:	8i	0	6 + 8i	6	○○○●
183. For z = 3 + 4i, the expression $z - \bar{z}$ equals:	6	8i	3 − 4i	0	○●○○
184. The sum of a complex number and its conjugate is always:	real	zero	undefined	purely imaginary	●○○○

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Questions	A	B	C	D	A B C D
185. The conjugate of the conjugate of z is:	$-z$	$1/z$	$\bar{z}$	z	○○○●
186. The sum of the ordered pairs (2, 3) and (6, 8) is:	$(4, -5)$	$(8, 11)$	$(8, 5)$	$(12, 24)$	○●○○
187. Addition of two complex numbers is done by adding their:	arguments	moduli	real parts and imaginary parts separately	conjugates	○○●○
188. The conjugate of the sum $z_1 + z_2$ is:	$-(z_1 + z_2)$	$\bar{z}_1 - \bar{z}_2$	$\bar{z}_1 + \bar{z}_2$	$\bar{z}_1 \bar{z}_2$	○○●○
189. The conjugate of the product $z_1 z_2$ is:	$\bar{z}_1 + \bar{z}_2$	z_1/z_2	$-z_1 z_2$	$\bar{z}_1 \bar{z}_2$	○○○●
190. For z = x + iy, the sum $z + \bar{z}$ equals:	$2i\,\mathrm{Im}(z)$	$2\,\mathrm{Im}(z)$	$2\,\mathrm{Re}(z)$	$\lvert z\rvert^2$	○○●○
191. For z = x + iy, the product $z\,\bar{z}$ equals:	$\mathrm{Im}(z)$	$2\,\mathrm{Re}(z)$	z^2	$\lvert z\rvert^2$	○○○●
192. The complex number 3 + 2i lies in the:	second quadrant	first quadrant	fourth quadrant	third quadrant	○●○○
193. The equation $\lvert z\rvert = 2$ means that the point z is at a distance 2 from the:	point (0, 2)	point (2, 0)	origin	point (1, 1)	○○●○
194. In polar coordinates (r, θ), the quantity r represents the:	angle of the point	ordinate of the point	abscissa of the point	distance of the point from the pole	○○○●
195. A complex polynomial with n = 2 is called a:	quadratic polynomial	constant polynomial	linear polynomial	cubic polynomial	●○○○
196. Putting θ = π in Euler's formula $e^{i\theta} = \cos\theta + i\sin\theta$ gives $e^{i\pi}$ equal to:	1	$-i$	i	-1	○○○●
197. Putting θ = π/2 in Euler's formula gives $e^{i\pi/2}$ equal to:	$-i$	i	1	-1	○●○○
198. In the search for roots of a polynomial with integer coefficients, we test the factors of the:	degree	sum of the coefficients	constant term	coefficient of the middle term	○○●○
199. The factor theorem in the book is applied to:	only polar equations	complex polynomials	only real numbers	only linear equations	○●○○
200. The modulus of the product (3 + 2i)(1 − 3i) is:	10	$\sqrt{130}$	13	$\sqrt{13} + \sqrt{10}$	○●○○

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