CHAPTER 1.5

Complex Numbers

Multiple-Choice Old Exam Questions

26 questions • 4 topics • options A–E • two questions per page

Topic 1 | Radicals of Negative Numbers and Powers of i

Simplifying expressions with √(−n), cube roots, and powers of i • Questions 1–8

Q **1**

For $i = \sqrt{-1}$, which ONE of the following is FALSE?

A) $\sqrt{-5}\sqrt{-2} = \sqrt{10}$

B) $\sqrt{-9} = 3i$

C) $\sqrt[3]{-8} = -2$

D) $i^{43} = -i$

E) $\frac{\sqrt{-12}}{\sqrt{-3}} = 2$

Q **2**

If $\sqrt{-4}\sqrt{-9} + 2i^{99} - \sqrt[3]{-27} = a + bi$, where $i = \sqrt{-1}$, then $a + b =$

A) -5

B) -11

C) 5

D) 11

E) 7

Q
3

If $z = i$, then $z^{1001} + 2z^{1000} + 3z^{999} + 4z^{998} =$

A) $-2 - 2i$

B) $-2 + 2i$

C) $2 - 2i$

D) $2 - i$

E) $3 + 2i$

Q
4

The sum of the real and imaginary parts of the complex number $(1 - 2i)\left(\sqrt{-4} - \sqrt[3]{-27}\right) + i^{11}$ is equal to

A) 2

B) 4

C) 8

D) 10

E) 12

Q
5

Let $i = \sqrt{-1}$. If $\left(\sqrt{2} - \sqrt{-2}\right)\left(\sqrt{8} + \sqrt{-2}\right) + \sqrt[3]{-8} = a + bi$, then $a + b =$

A) 2

B) 4

C) 6

D) -2

E) 0

Q
6

The expression $\left(\sqrt{-2} + \sqrt{-3}\right)\left(\sqrt{-8} - \sqrt{-27}\right) + \frac{1}{i^{86}}$ simplifies to

A) $4 + \sqrt{6}$

B) $-4 + \sqrt{5}$

C) $-3 + \sqrt{6}$

D) $4 + \sqrt{6}\, i$

E) $4 - \sqrt{6}$

Q
7

For $i = \sqrt{-1}$, the expression $\left(\sqrt[3]{-8}\right)\left(\sqrt{-9}\right) - \frac{1+i^7}{1+i} =$

A) $-5i$

B) $-6 + i$

C) $-6 - i$

D) $-7i$

E) $6 + i$

Q
8

The value of $\left(\sqrt[3]{-3^3}\right)\left(\sqrt[4]{(-2)^4}\right) + \left(\frac{1+i}{1-i}\right)^{154}$ is

A) $-7i$

B) $-1 - 6i$

C) -7

D) 5

E) $1 - 6i$

Topic 2 | Division, Reciprocals and Conjugates

Writing quotients in standard form and finding complex conjugates • Questions 9–18

Q **9**

The conjugate of the complex number $(2-3i)^{-1}$ is

A) $\frac{2}{13}-\frac{3}{13}i$

B) $\frac{2}{13}+\frac{3}{13}i$

C) $\frac{1}{2}+\frac{1}{3}i$

D) $\frac{1}{2}-\frac{1}{3}i$

E) $-\frac{2}{5}+\frac{3}{5}i$

Q **10**

The conjugate of $\frac{3+2i}{5-i}$ is

A) $\frac{1}{3}-\frac{1}{3}i$

B) $\frac{1}{2}+\frac{1}{2}i$

C) $\frac{1}{5}-\frac{1}{5}i$

D) $\frac{1}{5}+\frac{1}{5}i$

E) $\frac{1}{2}-\frac{1}{2}i$

Q
11

The conjugate of the complex number $\frac{8+i^7}{2+3i^{13}}$ in standard form is

A) $1+2i$

B) $1-2i$

C) $2+i$

D) $-1+2i$

E) $2-i$

Q
12

If $z=-\sqrt{-4}+\frac{1-3i}{1+i}$, where $i=\sqrt{-1}$, then the conjugate of z is

A) $-1+4i$

B) $1-4i$

C) $1+4i$

D) -1

E) 1

Q
13

If $i = \sqrt{-1}$ and $z = \frac{7-3i}{1+i} - i^{51}$, then the conjugate of z in standard form is

A) $\overline{z} = 2 + 4i$

B) $\overline{z} = 2 - 2i$

C) $\overline{z} = -2 - 4i$

D) $\overline{z} = -2 + 4i$

E) $\overline{z} = 2 - 4i$

Q
14

If a is the real part and b is the imaginary part of the complex number $z = \frac{(3-4i)(3+4i)}{10-5i}$, where $i = \sqrt{-1}$, then $a + b =$

A) 3

B) 15

C) 5

D) 1

E) -5

Q
15

The standard form of the complex number $\frac{2-3i}{1-2i}+\frac{\sqrt{-36}}{\sqrt{-4}\sqrt{-9}}$ is

A) $\frac{8}{5}-\frac{4}{5}i$

B) $\frac{3}{5}+\frac{4}{5}i$

C) $\frac{1}{5}-\frac{2}{5}i$

D) $\frac{4}{5}-\frac{3}{5}i$

E) $\frac{6}{5}+\frac{4}{5}i$

Q
16

If $\frac{10}{2+i}+\frac{6\sqrt[3]{-8}}{\sqrt{-9}\sqrt{-4}}=a+bi$, where $i=\sqrt{-1}$, then $a+b=$

A) -2

B) 6

C) 2

D) 4

E) -1

Q
17

The sum of the real part and the imaginary part of the complex number $\frac{\sqrt{-4}\left(\sqrt[3]{-27}-\sqrt{-16}\right)}{(1+i)^2}$ is equal to

A) -7

B) -1

C) 1

D) $4i$

E) -2

Q
18

Let $i=\sqrt{-1}$. If $\frac{\sqrt{-2}\sqrt{-8}-i^{23}}{\sqrt[3]{-8}+i}=A+Bi$, then $A+B=$

A) $\frac{11}{5}$

B) -2

C) $\frac{13}{5}$

D) 1

E) $\frac{7}{5}$

Topic 3 | Products and Powers of Complex Numbers

Expanding and simplifying products and squares in standard form • Questions 19–22

Q **19**

If $i(3-2i)^2 = x + yi$, where x and y are real numbers, then the value of $x + y$ is equal to

A) 17

B) -7

C) 19

D) -19

E) 5

Q **20**

If $z = \frac{(2+i)^2}{i^7}$, then z in standard form is

A) $-4 + 3i$

B) $4 - 3i$

C) $4 + 3i$

D) $-4 - 3i$

E) $3 + 4i$

Q
21

If $i = \sqrt{-1}$ and $z = 1 + i\sqrt{3}$, then $\frac{1}{i}(z^2 - 2z)$ is equal to

A) $4i$

B) $-2 + 3i$

C) $-3i$

D) $1 - 3i$

E) $6i$

Q
22

The expression $(3 - 2i)^2(1 - 3i) + \sqrt[3]{-8}\sqrt{-9}$ simplifies to

A) $-31 - 33i$

B) $-31 + 33i$

C) $31 - 33i$

D) $-31 - 27i$

E) $29 - 33i$

Topic 4 | Equations with Complex Solutions

Nonreal solutions of cubic and quadratic equations • *Questions 23–26*

Q **23**

If $a \pm bi$ are the nonreal complex solutions of the equation $x^3 + 1 = 0$, then $a \cdot b =$

A) $\frac{\sqrt{3}}{4}$

B) 1

C) $\frac{\sqrt{3}}{2}$

D) $\frac{1}{2}$

E) $\frac{1}{4}$

Q **24**

One of the nonreal complex solutions of the equation $x^3 - 8 = 0$ is

A) $-1 + \sqrt{3}\,i$

B) $1 + \sqrt{3}\,i$

C) $-1 + 3i$

D) $-2 + \sqrt{3}\,i$

E) $2i$

Q
25

The solutions of the equation $\frac{1}{2}x^2 + \frac{4}{3}x + 1 = 0$ are

A) $-\frac{4}{3} \pm \frac{\sqrt{2}}{3}i$

B) $-\frac{4}{3} \pm \frac{2\sqrt{2}}{3}i$

C) $-\frac{8}{3} \pm \frac{\sqrt{2}}{3}i$

D) $\frac{4}{3} \pm \frac{\sqrt{2}}{3}i$

E) $-\frac{4}{3} \pm \sqrt{2}\,i$

Q
26

If the quadratic equation $x^2 + 2kx + 2k = -3$ has two nonreal complex solutions, then the set of all values of k is

A) $(-\infty, 0) \cup (2, \infty)$

B) $(-1, 3)$

C) $(-\infty, -1) \cup (3, \infty)$

D) $[-1, 3]$

E) $(-3, 1)$

Answer Key

"Original" shows the question number in the source worksheet.

Q	Original	Ans.	Value	Q	Original	Ans.	Value
1	20	**A**	$\sqrt{-5}\sqrt{-2} = \sqrt{10}$	**14**	2	**A**	3
2	1	**A**	-5	**15**	3	**A**	$\frac{8}{5} - \frac{4}{5}i$
3	9	**A**	$-2 - 2i$	**16**	19	**D**	4
4	4	**A**	2	**17**	13	**A**	-7
5	21	**A**	2	**18**	18	**A**	$\frac{11}{5}$
6	12	**A**	$4 + \sqrt{6}$	**19**	8	**A**	17
7	24	**A**	$-5i$	**20**	22	**A**	$-4 + 3i$
8	25	**C**	-7	**21**	10	**A**	$4i$
9	5	**A**	$\frac{2}{13} - \frac{3}{13}i$	**22**	15	**A**	$-31 - 33i$
10	16	**E**	$\frac{1}{2} - \frac{1}{2}i$	**23**	6	**A**	$\frac{\sqrt{3}}{4}$
11	17	**A**	$1 + 2i$	**24**	14	**A**	$-1 + \sqrt{3}\,i$
12	7	**A**	$-1 + 4i$	**25**	23	**A**	$-\frac{4}{3} \pm \frac{\sqrt{2}}{3}i$
13	11	**A**	$\overline{z} = 2 + 4i$	**26**	26	**B**	$(-1, 3)$