The acronym NOTA denotes that "none of these answers" are correct. DNE stands for Does Not Exist. $i = \sqrt{-1}$. *For a complex number* $z = a + bi$, $Re(z) = a$ *and* $Im(z) = b$. *The notation cis(x) is defined as cos(x) + isin(x)*

1. Find the real part of $(2 + i^{18})^{2008}$.
A. 1 B. 2^{2008} C. $2^{2008} + 2^{1004}$ D. $2(3^{2008})$
E. NOTA

2.Evaluate: $i^{13} + i^{29} - i^{2008}$
A. $2 - i$ B. $3i$ C. $-1 + 2i$ D. 1
E. NOTA

3. $\left|\frac{2i+5}{1-i}\right|$
A. $\frac{\sqrt{2}}{2}$ B. $\frac{\sqrt{29}}{2}$ C. $\frac{\sqrt{10}}{2}$ D. $\sqrt{10}$
E. NOTA

4.Which of the following is NOT a 6th root of unity?
A. $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$ B. $\frac{1}{2} + \frac{\sqrt{3}}{2}i$ C. $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$ D. 1
E. NOTA

5. Evaluate: $(2i - 3)^2 + (5 + i) - (8 - 2i)(3i + 4)$
A. $-28 - 27i$ B. $48 - 11i$ C. $28 + 11i$ D. $27 - 28i$
E. NOTA

6. If z_1 and z_2 are complex numbers which satisfy the following equations, what could z_1 and z_2 be?

$z_1 + z_2 = 3 + i$
$z_1\overline{z_2} = -18 + 13i$

A. $z_1 = 4 + 2i, \quad z_2 = -1 - i$ B. $z_1 = 2 + 5i, \quad z_2 = 1 - 4i$ C. $z_1 = 1 + \frac{i}{2}, \quad z_2 = 2 + \frac{i}{2}$
D. $z_1 = 2 - 3i, \quad z_2 = 1 + 4i$ E. NOTA

7. $\left|\frac{(3+i)(2i-2)}{4i+1}\right|$
A. $\frac{4\sqrt{170}}{15}$ B. $\frac{4\sqrt{85}}{17}$ C. $\frac{2\sqrt{85}}{17}$ D. $\frac{4\sqrt{85}}{15}$
E. NOTA

For problems 8 and 9, let $f(x) = 3x^2 - x + 41$**.**
8. $f(1 - i) =?$
A. $40 - 5i$ B. $42 + 7i$ C. $5 + i$ D. $44 - 7i$
E. NOTA

9. $f(1) - f(i) = ?$
A. $-1 + i$ B. $81 - i$ C. $5 + i$ D. $40 - 5i$
E. NOTA

10. What is the range of $f(x) = i^x$?
A. $[-1, 1]$ B. $(-1, 1)$ C. $(-\infty, 1] \cup [1, \infty)$ D. $(-\infty, 1) \cup (1, \infty)$
E. NOTA

11. $\frac{11-23i}{2i+6} = yi + 5\sqrt{x}$, where y and x are real. Find $\frac{y}{x}$.
A. $\frac{7\sqrt{10}}{2}$ B. -8 C. 8 D. -400
E. NOTA

12. Evaluate: $\prod_{k=1}^{10} i^{k-1}$.
A. i B. -1 C. 1 D. $-i$
E. NOTA

13. Given that $(2i + 7)^3 = a + bi$, find $\frac{a}{b}$ to the nearest integer.
A. 3 B. -2 C. 2 D. 0
E. NOTA

14. Let S = 0. For each of the following entries, add 7 to S if the number is complex, and add 5 to S if the number is real. What is the value of S after these six entries?
I. $2 + i$ II. 14 III. i^2 IV. $5\pi + 6i$ V. $\sqrt{11} + 2$ VI. $4i + \frac{3}{i}$
A. 36 B. 42 C. 57 D. 67
E. NOTA

15. On an Argand diagram (or Argand plane), what is the distance between $7 + 2i$ and $4 - 11i$?
A. $\sqrt{178}$ B. $\sqrt{290}$ C. $\sqrt{90}$ D. $\sqrt{202}$
E. NOTA

16. Evaluate: $|6 - 2i|$
A. $4\sqrt{5}$ B. $2\sqrt{2}$ C. $2\sqrt{10}$ D. $\sqrt{38}$
E. NOTA

17. Find $\mathrm{Im}(z)$ where $z = (2 + i)^2 - (i - 3)(4 + 2i)i$
A. $6i$ B. $18i$ C. 4 D. 18
E. NOTA

18. $\frac{4+i}{3i-1}$

A. $\frac{1+13i}{-10}$ B. $\frac{1-13i}{-10}$ C. $\frac{13+i}{10}$ D. $\frac{13-i}{10}$
E. NOTA

19. Which of the following is equivalent to $3i + \sqrt{27}$?
A. $\sqrt{3}\text{cis}(\frac{\pi}{3})$ B. $3\text{cis}(\frac{\pi}{6})$ C. $\text{cis}(\frac{\pi}{6})$ D. $6\text{cis}(\frac{\pi}{6})$
E. NOTA

20. What is the area, in units^2, of the shape formed by the following points in the complex plane?
$3, \quad -2+4i, \quad 3-i, \quad 3+5i$

A. $\frac{25}{2}$ B. 18 C. 15 D. 30
E. NOTA

21. $(\sqrt{3}-i)^7 =?$
A. $1-\sqrt{3}i$ B. $64i-64\sqrt{3}$ C. $\sqrt{3}-1i$ D. $64\sqrt{3}-64i$
E. NOTA

22. Evaluate the sum of the infinite series: $1 + \frac{i}{2} + \frac{i^2}{4} + \frac{i^3}{8} + ...$
A. $1-\frac{i}{2}$ B. $\frac{2i+4}{5}$ C. $2+i$ D. no solution
E. NOTA

23. How many real zeros does the function $f(z) = z^5 - (4-2i)z^4 - (8i-2)z^3 + (4i-8)z^2 - 16iz$ have?
A. 0 B. 1 C. 2 D. 3
E. NOTA

24. If $\sin(x) = \frac{e^{ix}-e^{-ix}}{2i}$, what is $\sin^2 i$?
A. $\frac{1+e^2}{2ie}$ B. $\frac{e^2-1}{2e}$ C. $\frac{1-e^2}{2e}$ D. $\frac{e^2+1}{2ie}$
E. NOTA

25. What is the fifth term in the expansion of $(2+3i)^7$?

A. 13608i B. 13608 C. -22680 D. 22680 E. NOTA

26. Which of the following is true?

A. $\frac{5}{i} = \frac{5}{i^3}$ B. $i^{14} = i^2$ C. $2^i = i^2$ D. $(-1)^3 = (i)^3$
E. NOTA

For the last 4 questions on this test, use Euler's Identity, which states $e^{i\pi} + 1 = 0$.

27. Evaluate: $i^{(\frac{1}{i})}$
A. $e^{\frac{\pi}{2}}$ B. e^{π} C. $e^{-\pi}$ D. $e^{-\frac{\pi}{2}}$
E. NOTA

28. $\ln(\log_i(e^{\frac{\pi}{2}}))$
A. $\frac{3i\pi}{4}$ B. $i\pi$ C. $\frac{3i\pi}{2}$ D. $2\pi i$
E. NOTA

29. Solve for x: $e^{iArcsin(x)} = 1$.
A. 1 B. $\frac{\sqrt{3}}{2}$ C. $-\frac{1}{2}$ D. $\frac{1}{2}$
E. NOTA

30. $e^{\frac{3i\pi}{2}} = ?$
A. i B. $-i$ C. -1 D. 1
E. NOTA