1) Simplify: $(3+i)+(9-3i)-2(7+4i)$

A) $-2-10i$ B) $-2+6i$ C) $5-6i$ D) $5+10i$ E) NOTA

2) Simplify: $(3+i)(2-3i)$

A) $3-7i$ B) $9-7i$ C) $6-3i$ D) $6+11i$ E) NOTA

3) Simplify: $\dfrac{3+i}{2-3i}$

A) $\dfrac{9}{13}-\dfrac{7}{13}i$ B) $\dfrac{3}{13}-\dfrac{11}{13}i$ C) $\dfrac{9}{13}+\dfrac{7}{13}i$ D) $\dfrac{3}{13}+\dfrac{11}{13}i$ E) NOTA

4) If $\left(6-6i\sqrt{3}\right)^5 = a+bi$ where a and b are real numbers, then find the ratio $\dfrac{a}{b}$.

A) $-\sqrt{3}$ B) $-\dfrac{\sqrt{3}}{3}$ C) $\dfrac{\sqrt{3}}{3}$ D) $\sqrt{3}$ E) NOTA

5) What is the real part of $\left(\sqrt{2}+2i\right)\left(-i\sqrt{2}+1\right)\left(2\sqrt{2}-i\right)$?

A) $12+2\sqrt{2}$ B) $14-\sqrt{2}$ C) $-3\sqrt{2}$ D) 12 E) NOTA

6) What is the imaginary part of $(1+i)^2 \cdot e^{-i\pi/4}$?

A) $-2\sqrt{2}$ B) $-\sqrt{2}$ C) $\sqrt{2}$ D) $2\sqrt{2}$ E) NOTA

7) Two complex numbers, z_1 and z_2 satisfy the two following properties:
z_1+z_2 is purely imaginary, and ${z_1}^2+{z_2}^2$ is real.
Both z_1 and z_2 have non-zero real and imaginary parts.
For the two properties to hold, which of the following statement(s) MUST be true?
I.) $z_1=\overline{z_2}$
II.) z_1-z_2 is purely real.
III.) z_1 cannot be equal to z_2
IV.) $|z_1|=|z_2|$

A) I. and II. only B) II. and IV. only C) II., III., and IV. D) All are true E) NOTA

8) There are two complex zeros of the function $f(z)=z^2+2z+16$, z_1 and z_2. What is the sum of the squares of z_1 and z_2?

A) –28 B) –15 C) 0 D) 32 E) NOTA

9) Complex numbers can be thought of as vectors in the complex plane. What is the angle that the vector starting at $3-i$ and ending at $-1+3i$ makes with the positive *x*-axis?

A) 45° B) 135° C) 225° D) 315° E) NOTA

10) The sum $1+(1-i)+(1-i)^2+(1-i)^3$ can be represented in the form $a+bi$ where *a* and *b* are real values. Find $|a-b|$.

A) 1 B) 3 C) 5 D) 7 E) NOTA

11) Which of the following is NOT a sixth root of unity?

A) $\frac{1}{2}-\frac{\sqrt{3}}{2}i$ B) $\frac{\sqrt{3}}{2}+\frac{1}{2}i$ C) $-\frac{1}{2}-\frac{\sqrt{3}}{2}i$ D) –1 E) NOTA

12) How many of the following are NOT complex numbers?

I.) 0
II.) $2i-2$
III.) $8i$
IV.) $-\sqrt{2}$

A) 1 B) 2 C) 3 D) 4 E) NOTA

13) Which of the following is NOT a fifth root of $z=16\sqrt{2}+16i\sqrt{2}$?

A) $2\text{cis}(9^\circ)$ B) $2\text{cis}(81^\circ)$ C) $2\text{cis}(189^\circ)$ D) $2\text{cis}(297^\circ)$ E) NOTA

14) Find the value of $f(2+i)$ if $f(z)=iz^3+2z^2-3\bar{z}+2i$.

A) $-11+15i$ B) $-11+9i$ C) $2+18i$ D) $2+24i$ E) NOTA

15) Let the complex number $z_1=a+bi$ where *a* and *b* are positive real numbers.
Let the complex number $z_2=z_1^{\,2}$. Which of the following statement(s) MUST be true?

I.) $|z_2|=|z_1|^2$
II.) The angle that z_1 makes with the positive real axis is half the angle at which z_2 makes with the positive real axis.
III.) If $z_2=c+di$, then both *c* and *d* are positive.
IV.) $\frac{1}{z_2}=\frac{\overline{z_1}}{|z_1|^2}$

A) I. only B) I. and II. only C) I. and IV. only D) All are true E) NOTA

16) Simplify: $\frac{1}{i}+\frac{2}{i^2}+\frac{3}{i^3}+\frac{4}{i^4}$

A) 4 B) $1+i$ C) $2+2i$ D) $4+6i$ E) NOTA

17) What is the norm of the complex number $-6-8i$?

A) –100 B) –10 C) 10 D) 100 E) NOTA

18) Evaluate: $i^6+i^{29}+i^{2006}$

A) $-3i$ B) $-i$ C) $1+2i$ D) $-2+i$ E) NOTA

19) Evaluate: $\prod_{k=0}^{2N} i^k$ where N is an integer. Leave your answer in terms of N.

A) i^{-N} B) $i^{-N/2}$ C) i^N D) i^{2N} E) NOTA

20) Evaluate the sum: $\sum_{k=0}^{2006}(-i)^k$

A) 1 B) i C) $-i$ D) $1-i$ E) NOTA

21) What is the real part of the following product? $(5-6i)(2i+1)$

A) –7 B) –3 C) 4 D) 17 E) NOTA

22) Which of the value(s) for x makes the determinant equal to zero? $\begin{vmatrix} x & -1 & 2 \\ 0 & i & 2 \\ -x & i & 2i \end{vmatrix}$

I.) –1 II.) 0 III.) i IV.) $-i$ V.) 1

A) II. only B) I., II., and V. only C) III. and IV. only D) All of these E) NOTA

23) Dave rips a piece of paper into four identical squares. He then takes the four numbers: $5i$, –2, 300, and $-2006+2007i$, and writes one on each square paper. He puts all four squares of paper into a hat, shuffles them around, and randomly draws 2 squares without replacement. What is the probability that the product of the two numbers he draws is a real number?

A) $\frac{1}{12}$ B) $\frac{1}{6}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$ E) NOTA

24) What is the sum of the complex zeros to the quadratic function $y=x^2-2x+9$?

A) –9 B) –2 C) 2 D) 9 E) NOTA

25) A multiplication by $-i$ in the complex plane does what to a complex number, $z = x + iy$?

A) It rotates it 90° clockwise
B) It rotates it 90° counter-clockwise
C) It flips it across the *y*-axis
D) It flips it across the *x*-axis
E) NOTA

26) Evaluate the sum: $\sum_{n=0}^{5} n \cdot i^n$

A) $2+3i$ B) $3-2i$ C) $-2-3i$ D) $3+2i$ E) NOTA

27) How many of the following statements are true regarding the complex function $f(z)=|z|$?

I.) $f(-z)=f(z)$ II.) $f(\overline{z})=f(z)$ III.) $f(z)$ is always real
IV.) If $f(z)=0$, then *z* can only be equal to 0. V.) $f(z^2)=[f(z)]^2$

A) 1 B) 2 C) 3 D) 4 E) NOTA

28) Two of the roots of a fifth order polynomial with integer coefficients, $P(x)$, are $z_1 = 5-6i$ and $z_2 = 2+3i$. Which of the following statement(s) MUST be true regarding $P(x)$?

I.) $P(x)$ has only 1 real root
II.) $z=-5-6i$ is a root of $P(x)$
III.) $z=2-3i$ is a root of $P(x)$
IV.) The product of all five roots of $P(x)$ is a real number.

A) IV. only B) I. and II. only C) I. and III. only D) I., III., and IV. only E) NOTA

29) Simplify: $\sqrt{-2}\times\sqrt{-8}\times\sqrt{-16}$

A) $-16i$ B) $-8i$ C) $8i$ D) $16i$ E) NOTA

30) What is the solution to the system of linear equations shown below?

$$x - iy + 2iz = -1$$
$$ix + 2y + (2-i)z = 3i$$
$$x + z = 1$$

A) $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -5 \\ 4i \\ 0 \end{bmatrix}$ B) $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 2-i \\ 1 \end{bmatrix}$ C) $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -11+i \\ 1+8i \\ -i \end{bmatrix}$ D) $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1-i \\ -1 \\ i \end{bmatrix}$ E) NOTA